MOLECULAR TERROR: MEDICAL VISION, BIOPOLITICS, AND VISCERAL EFFECTS IN CONTEMPORARY CINEMA

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MOLECULAR TERROR: MEDICAL VISION, BIOPOLITICS, AND VISCERAL EFFECTS IN CONTEMPORARY CINEMA

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Many subfields in the humanities, from biopolitics to queer theory to ecocriticism, converge on the "the molecular" as an important site of subjectivity in the 21st century. Molecularization poses a challenge to traditional molar categories of identity since it fractures the body into internal multitudes that have few socially-recognized markers. Although the turn to the molecular helps articulate the changes in agency and power at the smaller and perhaps more pervasive scale than those found in the realms of work, family, and government, these theories rarely, if ever, accounted for how the molecular is imaged. Such theories take the molecular as a given—as an agreed-upon aesthetic object. Yet the tools we use to see the molecular come to shape our understanding of what constitutes it, whether from microscopy, 3D modeling, or bioanimation. "Molecular Terror" argues that what it means to be a subject in the 21st century requires an exploration of the visual tools that refigure the body at a new molecular scale.

There is an emerging historical parallel between the new visuality of biological science post-2000, with its focus on molecular movement of live-cell imaging with fluorescent markings, and the increased presence of visual effect shots in cinema that go inside the characters' bodies to view moving molecules. I turn to popular culture to understand how the films incorporate these technologies into their narratives to depict how medical tools are interpreted by doctors and patients alike. Though they are not large portions of the film, molecular visions often frame a narrative or appear at a crucial moment of transformation to highlight a sudden shift in a

character's development. Molecular images never just show the inside of the body: they act metaphorically, allegorically, and politically; they visualize an interiority that collapses a character's psychology, identity, and biological make-up into a single image. These images produce paranoid narratives where the very act of rendering the depths of the body accessible makes it more susceptible to mutation and outside influence. This dissertation, therefore, analyzes the pathological emotions produced by medical imaging as much as the pathogens these technologies are designed to combat.

BIOGRAPHICAL SKETCH

Zachary Benjamin Price received his B.A. in Interdisciplinary Humanities with Department Honors from the University of Chicago in June 2012. He worked at Rutgers University Documentary Film Lab and then matriculated to the Ph.D. program in English Language and Literature at Cornell University, from which he received his M.A. in May 2016 and his Ph.D. in May 2019.

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Thank you to Kara Peet and Karen Kudej for the type of guidance that is not acknowledged enough. Kathleen Perry Long, thank you for dropping everything to help me out of a tough spot. To those friends and loved ones who helped me along the way, you know who you are.

English graduate school can be a lonely place, but my four committee members reminded me that I was writing for someone other than myself. They were my most supportive audience. Each conversation I had with Sabine Haenni about my work felt like a minor revelation. She treated me like a future colleague, and she seemed so sure of my eventual success that even I started to believe it. Amy Villarejo saw me not just as a graduate student, but part of the queer community on campus. She taught me that a university's goal should be to build a sense of responsibility between those who make it run. I want to thank her for open arms and willingness to say "welcome" with a full hug. Caetlin Benson-Allott might be a superhero moonlighting as a professor. She accepted my invitation to join my committee when she lived six hours away in Georgetown, and yet she was always around to help talk over my work and give me suggestions about my career. She was an insightful editor of my chapters, which should not surprise anyone, but she was also there for me at conferences and professional gatherings, airport gates and coffee shops, when she did not have to be, appearing out of thin air to lend a helping hand. Finally, my committee chair, Ellis Hanson, imbued in me a sincere belief that art objects can impact one's happiness in a world increasingly dismissive of the humanities. Of all the professors at Cornell, he has known me the longest, and his generosity in his interactions with me and feedback on my writing motivated a great deal of my scholarship. I wanted to explain to *him* something marvelous I uncovered in a film, and that became the genesis of my chapters. Ellis sees the many

ironies in life and is willing to share his laughter with others to help disarm them. He is the best possible mentor. I cannot thank him enough.

TABLE OF CONTENTS

LIST OF FIGURES

Introduction: Molecular Framing

The cell is a site through which all kinds of changing material, semantic, economic, and conceptual relationships are played out: cell to body, cells to one another, scientists to doctors, patients to laboratories. It is a site in which what it is to *be cellular*, in life, death, and disease, is constantly being produced. – Hannah Landecker[1]

What is it to "*be cellular*"? The question moves us from an epistemological understanding of how science examines the body—what tools scientists use to image the cellular—to an ontological question: what forms of embodiments and relations emerge from a shifted sense of the self as cellular? As Eugene Thacker states, "A molecular-genetic knowledge of the body affects how we understand our bodies as part of the processes of embodied subjectivity."[2] "Molecular Terror" argues that what it means to be a subject in the 21st century requires an exploration of the visual tools that refigure the body at a molecular scale.

A wide variety of subfields in the humanities have similarly converged on the molecular as an important site of subjectivity today: in biology, we are said to be entering the age of "molecular vitalism"; in biopolitics, Michel Foucault calls the act of excavating imperceptible institutional actions "molecular history," and Nikolas Rose sees the reimagining of bodily capacities and agency as a "molecularization of vitality"; in queer theory, Jordi Rosenberg locates the limit of ontological discourse in "the molecularization of sexuality"; and in post-structuralism, Gilles Deleuze and Félix Guattari argue that deterritorialization requires "becoming-molecular."[3] In each of these accounts, the small, hard-to-see components that constitute life—the molecular—are acknowledged as influential areas of power and contestation, previously ignored for political struggles over more visible categories of recognition, representation, and identity. The many microscopic particles that move in and out of the body

make any clear delineations between the self and other, human and nature, hard to maintain. As ecocriticism has documented, the various forms of toxic waste we throw out of our homes and ship to other parts of the world inevitably break down into smaller, invisible parts that leak into the water and soil, and make their way back into our bodies.[4] As biopolitics warns, power has seeped into every pore, such that science, medicine, and governments not only discipline and shape bodies to construct the subject as a resource, but that they do so at scales the subject is not yet aware.

Molecularization poses a challenge to traditional molar categories of identity since it fractures the body into internal multitudes that have few socially-recognized markers. For Deleuze and Guattari, the molecular accounts for non-prescriptive and indiscernible forms of becoming that evade identity categories reliant on clear delineations of difference.[5] While the status of the body has understandably been at the forefront of gender and sexuality studies, one critique of the field has been its tendency to construct the body through primarily external and molar markers of identity. Tim Dean argues that cinematic technologies like pornography foreground sexual difference, but also foster a curiosity about the body's interior: "It is certainly the case that bodily interiors pose a greater challenge for cinematic representation."[6] For Dean, since the inside remains invisible, it gives way to fantasies that are not structured by sexual difference. As an example, he points to the practice of HIV transmission as a means of breeding and kinship. Jasbir Puar, in her analysis of the incorporation of transgender subjects into nationalizing discourses, similarly notes how a focus on molar categories of identity—such as the recent political and legal battles over a person's ability to switch between recognizable genders—have allowed for an unchecked form of governmentality to take hold at a molecular and largely invisible level.[7]

Puar and Dean are only partially correct that the internal body remains largely invisible, since they consider visibility only in terms of what a molar eye can see. This perspective ignores much of how we have come to visualize bodies, particularly in medicine and film. In cinema studies, there is considerable scholarship that reveals the co-dependent development of medical imaging and the cinematic apparatus across the last century, going as far back as the overlapping origins of the X-ray and film in 1895 (film quickly incorporated X-ray images into their narratives as special effects, and X-ray practitioners recorded their work on film and sold it as commercial paraphernalia).[8] Part of the question I answer in this dissertation is how the outpouring of media and scientific images of actual molecules influences or challenges theories of subjectivity centered around the molecular. What medical imaging technologies do we use to see the molecular, and how do the movies they inhabit allegorize the act of looking at bodies in different contexts. Although cinema has also always maintained a fascination with the microscopic world of the body, for a few key decades, due to the development of new imaging technologies and the influence of far-reaching geopolitical events, the molecular erupts into public consciousness through the prevalence of molecular images in film and other popular cultural productions.[9]

The first such eruption occurred in the 1910s, as Hannah Landecker and Scott Curtis describe, through public viewings of science films that showed living cells on the screen for the first time.[10] The development of magnification and time-lapse microcinematography allowed the movement of cells, usually too small and too slow to see, to become visible to the audience. These films were so central to cinema's promise of spectatorial attraction, Landecker argues, that they influenced much of the early 20th-century film theory.[11] Such cellular films, called microcinematography, relied on magnification and timelapse, one of which could isolate and

enlarge the cell and the other which could accelerate the cell's movement such that it became visible to human perception. These effects constructed cells in terms of duration and prolific growth/movement. Through cellular film, not only were cells naturalized within a specific medium, but film as a generalized medium developed new narratives and aesthetics based around cellular experiments.[12] One such aesthetic and narrative form, as Yuri Tsivian has documented, was the development of the dissolve and the "penetrative gaze" of the camera in 1910s early Russian film as a filmic technique, one that re-appropriated the conceptual feeling of dissolving bodies from scientific films that used microscopes and X-rays.[13] The camera could remove external barriers, such as clothing, walls, or the face, to reveal naked body parts or a character's inner thoughts. The promise of molecular vision in early science films—to unearth the secret units of "life" through technological mastery—pushed even films for non-scientific audiences to reproduce this desire in their narratives.

The second moment of molecular eruption followed after World War II. With the creation of the World Health Organization in 1948, the US government pushed for mass vaccinations, no longer just targeting troops but also the public (the polio vaccine, for example, was developed and distributed in the 1950s). As Bishnupriya Gosh notes, the government funded a critical mass of public health documentaries at the time that included animated inserts of molecular interiors often taken as documentary evidence of an otherwise invisible-to-the-eye pathogenic invader.[14] These films painted the microbial world inside the body as a continuation of the world war that had just ended. Therefore, America's defense of its borders counterintuitively required expansion of US troops and monitoring of remote locations to prevent disease emergence as the US stepped into a new position as the global police force.[15] Because global health surveillance needed indexical evidence to target and then show the eradication of

potential pathogenic threats, these documentaries and their animated molecular inserts functioned, as Kirsten Ostherr describes, as "inoculations against the continued spread of disease" because they allowed for a seemingly authentic vision of previously invisible diseases, which could now be policed at various borders.[16] Therefore, molecular vision at this time became particularly intertwined and motivated by anxieties of globalization and America's military and financial superiority within a post-World War II order.

While scholars have almost exclusively focused on these two decades—the 1910s and Post-World War II—the ubiquity of molecular vision in the 21st century, from advancements in biological imaging to visual effects in superhero movies, requires another moment of reflection. This new molecular moment is a product of what is called the "post-2000 genomic turn," brought on by a simultaneous development of medical and cinematic technologies: first, the development of live-cell imaging with fluorescent markings, and second, the development of photo-realistic CGI in film.[17] Unlike the push to map the human genome in the 1990s, which largely required computation and a static understanding of the role of different proteins, biology in the post-2000s focused far more on visualizing movement, on how imaging live-cells could elucidate the ways the genetic information discovered a decade earlier effected the mechanism of cellular processes. Biology today—and for the past fifteen years—can be characterized by the ubiquity of live video imaging of cellular movement, such as cell division, regulation, and the movement of protein through and between cells. Though the genome revealed much about the codes of cellular life, the processes and mechanisms that activate or express how a cell develops are context-dependent, tied specifically to certain locations and times in the body. As Hannah Landecker explains, 2000 marked both a conceptual and distinctly visual turn away from the gene in understandings of the molecular body towards what she calls "'Molecular Vitalism': an interest

in all cellular molecules as knitted together in a complex moving net in the time and space of a cell."[18] This focus on seeing the movement of various cellular processes was only made possible through the discovery of fluorescent markers, first discovered in jellyfish, that could then be genetically inserted into another cell's DNA such that the cell would grow its own form of luminosity, a faint light visible to a confocal microscope when exposed to ultraviolet light.[19] This process of genetic engineering reverses our concept that the development of visual tools and greater forms of magnification will allow us to see the molecular more precisely; instead, the molecular proteins found in jellyfish helped to shape and produce a new type of scientific vision. In other words, much of scientific vision not only shows, but is structured by and made possible through the molecular. The discovery of Fluorescent Green Protein (FGP), which earned its team of scientists a Nobel Prize in 2008, produced a "molecular coup" by "depos[ing] DNA as a master molecule whose structure dictated everything that unfolded from it."[20]

Such a discussion of biological imaging would seem overly technical to a media studies audience, and indeed Landecker argues that this aesthetic shift, while crucial, remains largely hidden away from the public eye.[21] However, clips of live-cell imaging not only have a lively existence circulating through social media platforms and internet blogs and memes, which are viewed by nonbiologists as entertaining spectacles, but they have also seeped into popular cultural productions of film and television, music videos, and commercials under the guise of new visual effects that mimic such molecular vision. Since the early 2000s, simultaneous with the rise of live-imaging in science, there has been a significant uptick in films and other media where the camera unexpectedly dives into a character's body to see their molecular insides. A result of the digital revolution in visual effects allowed more precise blending of live-action ("in camera") effects and visual effects added in post-production, which allows for a seamless

transition of scales from the molar to the molecular body. In short, filmmakers can not only reproduce live-cell imaging through visual effects, but they can seamlessly and relatively cheaply incorporate these images into their narratives.

"Molecular Terror" examines a series of films, commercials, and music videos that make up this molecular turn in contemporary cinema and visual culture at large. There are a few films (*Fantastic Voyage* [1966], *Everything You Always Wanted to Know About Sex* [1972], *Innerspace* [1987], and *Osmosis Jones* [2001]) and single-episodes from TV series (*The Magic School Bus*, *Futurama*, *Family Guy*, *The Simpsons*, and *Dr. Who*) that directly center their narratives around journeys inside the body, though almost exclusively at the level of organs and tissues, not cells or molecules.[22] The interior body in popular culture over the last fifty years, however, overwhelmingly appears only in small glimpses, in scenes with microscopes, X-rays, MRIs, or when the camera briefly dives into the body to see the effects of a particular drug or chemical and then zooms back out. As an example, the use of medical imaging has become incredibly popular in TV shows based around hospital dramas, such as *House* (2004–2012) and *Grey's Anatomy* (2005–), or in forensic crime dramas, such as *CSI: Crime Scene Investigation* (2000–2015) and *Bones* (2005–2017). Media scholars have written at length about the prevalence, ideology, and effects of medical images in TV shows and the way such shows use medical images to reflect on bioethical questions.[23] Due, in part, to the development of realistic digital effects, films since the early 2000s from a wide range of genres and budgets have dramatically increased the number of scenes in which the camera unexpectedly dives into characters' bodies to see their molecular insides. Unlike the forensic crime drama, these scenes do not require or foreground the use of a medical tool, but instead use visual effects to imbue the camera with the ability to move inside bodies in a single, unbroken shot, untethered from a

character's perspective or the mediation of a screen. Though they are not large portions of the film, these shots often frame a narrative or appear at a crucial moment of transformation to highlight a sudden shift in a character's development. The films range in genre, including superhero films, such as *Spider-Man* (2002), *The Hulk* (2003), and *Spider-Man: Into the Spider-Verse* (2018); dramas, such as *Enter the Void* (2009), *Cemetery of Splendor* (2016), *BPM* (2017), and *30 Years of Adonis* (2018); comedies, such as *Osmosis Jones* (2001); thrillers, such as *Fight Club* (1999), *The Skin I Live In* (2011), *Limitless* (2011); science fiction, such as *Prometheus* (2012), *Lucy* (2014), *Annihilation* (2018); and horror, such as *The Thing* (2011) and *The Autopsy of Jane Doe* (2016). The molecular vision in these films does not merely show audiences a character's internal infection or the effects of drugs inside their body, they help develop a sense of the interior lives of the characters.

Unlike many accounts of the dramatic paradigm shift to the molecular, popular media since the early 2000s illustrates how the molecular is not simply severed from the molar; rather, they are often depicted as paired, creating complicated visual juxtapositions of molar bodies framed by molecular parts.[24] For example, in superhero films such as *Spider-Man and The Hulk*, a sudden vision of a molecular mutation, caused by a spider bite or experimental injection, frames the molar hero's transformation into a figure of superior ability and bestows upon him a new identity as a city's protector. Similarly, a pharmaceutical commercial for Nexium might momentarily visualize how the drug enters the body to repair the molecular lining of the customer's esophagus, but then transitions into a molar scene of him hiking with his family through a field. The molecular repair of his cell-lining visually frames and physically enables the customer's ability to reconnect with his family and heal the previously frayed relationships caused by his reflux disease.[25] These direct-to-consumer (DTC) prescription drug ads, while

previously prohibited due to concerns over consumer manipulation from pharmaceutical companies, were finally allowed in TV advertisements in 1997 due to a shift in FDA regulation and then another loosening of regulations in 2004, such that advertisements only needed to include “major risks” and “a simplified brief summary” to meet the fair balance requirement of airing such ads.[26] Since these regulatory changes, annual revenue spent on drug advertisements skyrocketed to 5.4 billion by 2006.[27] One very material reason for the dramatic increase in the molecular vision into popular culture would be the introduction and broad dissemination of prescription drug ads at the beginning of the 21st century.

Figure 1.1: Regeneron Poster

Such molecular framings are ubiquitous today, even outside of film and TV. Above is a poster on a bulletin board outside of my office on the Cornell University campus for a recruitment event by a New York-based pharmaceutical company called Regeneron. The company heavily recruits from undergraduates at Cornell, and its sheer prevalence on campus—it even made it to the English building—reflects the company's rapid growth as one of the most sought-after companies on Wall Street due to its exceptional profit margins over a short period of time, with sales of $2.1 billion in 2013 increasing to $5.87 billion by 2017.[28] Marked by horizontal lines, the poster breaks into three separate stories, each of which depicts a different relationship of the molar to the molecular.[29] The second story shows two scientists talking to each other in preparation for an experiment. The molecular image to the left of them displays a ligand-binding signaling schematic, which is a protein that helps with cell-to-cell communication, along with an ambiguous radio- or sound-wave signal emanating outward from one end. The key is in the color of their gloves: each of the scientists has a different color of gloves, pink and blue, that correlate with the colors of the ligand (pink) and the receptor proteins (blue) in the molecular image. The two scientists' interaction mirrors the proteins that must interlock with each other to create a signal. More than just showing that this company will allow employees to work collaboratively, the image suggests that the best form of collaboration is one that replicates the types of protein signaling and molecular processes in the body.

Finally, the third story moves out of the lab to visualize the real-world effect of the drugs the scientists produce. A mother embraces her son with a kiss on the cheek as he smiles. The molecular image to their right, a ligand-induced dimerization, similarly shows proteins twisted in a tight embrace. Although the text claims to "demystify human disease," the image does not show (or demystify) any pathogens, which are instead pushed to the bottom of the poster, almost

out of frame, as if the very molecules the company is paid to combat are only at the margins of an otherwise utopian workspace. Though the company makes drugs for cancer and vaccines for Ebola, neither pathogen is represented, nor are the effects they have on the body. These stories, instead, produce a narrative of female-driven research, first designed through individual innovation and then engineered through collaboration, that leads to the "healthy" interpersonal relationship between mother and son. By mirroring the organic processes within the body, not disrupting or modifying them as surely the company's drugs will do, scientists can ensure the security of the next generation (a pun on the company's name, Regeneron). I take time with this pharmaceutical poster to show the depth of interplays between the molecular and the molar even within promotional material, so common in our day-to-day that we barely take notice. The aesthetics and juxtapositions in this advertisement distill into a single image a much larger trend in how the molecular frames narratives of the molar body. Molecular images never just show the inside of the body: they absorb a variety of meanings; they act metaphorically, allegorically, and politically; they visualize an interiority that collapses a character's psychology, identity, and biological make-up into a single image.

UN-SUTURED BODIES AND THE TERROR OF IMAGING

Two of the main factors that characterize molecular vision are magnification, which removes molar reference points, and camera movement inside the body, which untethers the spectator position within cinematic space from a visible character. Mary Ann Doane, who previously wrote on clinical vision in women's films of the 1940s, argues that magnification can be a grotesque effect because it severs and enlarges specific body parts, making them "larger than life."[30] As Doane notes, early 20th century understandings of scale in visual culture and

architecture used the molar body as reference point, as seen from the writing of artist and architect Le Corbusier: "For his visual measure, he fastened upon the human body as a reference point, citing the age-old tradition of correlating units of measure to parts of the human body—elbow (cubit), finger (digit), thumb (inch), foot, pace etc. Architecture designs a space that a human body must inhabit and for Le Corbusier this demands a resistance to the pure abstraction of the metric scale. Film provides an abstract space inhabited by a virtual body and invites a form of figurative inhabitation by the spectator."[31] As Doane suggests, the molar body—the foot, inch, digit—became the anchoring calibration for a variety of measurements that help navigate space and scale within and beyond the cinema. The goal of such a scale is to make space appear inhabitable from the position of a spectator's own body. In contrast, Doane sees the magnification of the close-up as a way to despatialize the viewer, removing the body from its context through violent abstraction. She ends her analysis of magnification with a suggestion for how our experiences of close-ups may be changing with new cinematic experimentation, and she finds inspiration in the close-ups of Wong Kar Wai's film *In the Mood for Love* (2000):

> What is most striking about the deployment of scale in this film is again an excessive and sustained proximity to bodies, but in this case, the film activates the close-up differently in relation to the body, frequently undermining the expectation that the face is the privileged content of the close-up. The possibility of expressivity and of legibility is shifted from the face to other parts of the body, resituating affect.[32]

Indeed, if close-ups function to resituate affect in *In the Mood of Love*, with its fetishistic shots of hands and backs, what should we make of a molecular vision that not only magnifies the image to its visible limit—the molecular is the smallest unit visible through a microscope—but also dives inside the body, removing any visual signification marked on our external bodies?

Molecular vision in these films is more than thematic in its portrayal of interior multitudes; it is also allegorical in its staging of cinematic spectatorship without the traditional points of reference, such as figures, backgrounds, body parts, and faces. While Yuri Tsivian has argued that medical imaging of the early 1910s, such as the X-ray and microscope, helped to establish the dissolve in film aesthetics at that time, I would add that visual effects and medical tools that plunge inside characters' bodies also effectively dissolve vision—the spectator's point of view and orientation to a particular position in the diegesis is based on molar reference points, without which vision seems untethered from a particular body.

Suture theory initially accounted for a contradiction in the filmic narrative: while the audience only receives fragmented views of the story unfolding before them—that is, he or she cannot see past the limits of the rectangular frames—the formal quality of the film's edits and point of view shots "suture" the viewer within the diegetic action through an identification with an embodied position in the film.[33] Drawing from psychoanalytic models of the wound or cut, this theory of spectatorship relies on the audience's ability to identify with a characters' point of view in order to create a unified and whole imaginary experience. Suture theory has since moved beyond its psychoanalytic roots to a more material history and phenomenological account that encompasses different viewing experiences that are not simply a viewer in a darkened theater watching a feature film, and where identification might not be with a character but a distinct sensual experience in the film, such as a tactile touch or movement as opposed to a recognizable character.[34]

The introduction of digital visual effects in the 1990s has merged discussions of sutured spectatorship with questions of the sublime to account for how the audience may experience perception before or even as a replacement for symbolic representation.[35] Speaking about his

experience of watching technologically groundbreaking films like *Gravity*, Scott C. Richmond argues that cinema is not so much a representational technology as a technology that modulates and manipulates viewers' sensorial capacities—his or her bodily experience as they watch.[36] For Richmond, the "proprioceptive aesthetics" of these films help to orient viewers' experience, but they also "thematize or roughen our perceptual and, thus, embodied involvement with the world unfolding before us onscreen."[37] Molecular vision is another strain of this phenomenological turn since it displays what vision would look like if decoupled from the molar categories of recognition and if spectatorship was shifted away from an embodied position in the diegesis to an assemblage of affects found at the body's microscopic scale. The very medical metaphor of the suture, of stitching up the body to make it whole, reverses in molecular vision when it dissolves the body, making it permeable, its fragments visible, and then plunges the camera inside. Movies like *Gravity*, which try to represent the terror of floating in the void of space, help to show the affective potential of a similar unthetheredness in cinema, though from the loss of visual reference points of earth as opposed to the molar body.

The "unsutured" quality of molecular vision leads to a disorienting and often terrorizing, visceral experience, which can only resolve by returning to a molar and recognizable face or body. Take Björk's song "Hollow" from her 2011 album *Biophilia*, accompanied by a music video created by Drew Berry, a prominent science animator known for creating accurate animated videos of intercellular processes.[38] The music video starts at 1,000x magnification as the camera dives down into skin tissue. As cells rush by, the song's lyrics tell the viewer this disorienting journey has a purpose: "Hollow, I'm falling down the abyss/ Hollow, looking for some answers." Soon viewers come across strains of DNA zipping and unzipping along chromosomes, and the end goal of the journey becomes more clear: whoever is singing,

presumably Björk, is trying to use this internal vision to learn some truth about herself, her ancestry, dispositions, future ailments and current identity, all stored within her DNA. At this scale of the body, however, all the singer can discern of the hectic DNA molecules before her, with their proteins moving along fibers, is that they look like jewelry: "The everlasting necklace/ Jewels after jewels after jewels after/Jewels after jewels." Unable to understand the disorienting narrative of multi-colored geometric shapes moving in mechanical fashion in and out of the frame, the singer becomes stuck on an endless repetition. Finally, after four, long minutes of disorientation, the various strains of DNA twist and turn into a face—Björk's animated face—which then mouths some of the song's lyrics before disassembling into normal cellular processes once again.[39]

Finally, the singer finds something recognizable in the interior spaces of her body, a face which also helps orient viewers to the fact that, indeed, they are watching the right music video and not a mistitled biology assignment. The singer has found her external identity within herself, as if it were always there, in miniature form, built into her very DNA, which finds its external expression in her molar parts: her lips, nose, eyes, cheeks. This internal face is the fantasy of a molecular vision that can solidify identity, telling the singer she is present and coherent even at her smallest unit. The music video ends by rapidly zooming back out from cells to tissues, and out further to the molar face of Björk as she smiles back at the camera in a mirrored version of her molecular face. The last lyrics of the song signify the psychological effects of this molecular vision, "I yearn to belong/ Let me belong/ Let me belong." The song ends with the singer's desire to belong to what she has just seen of herself. The music video "Hollow" shows how digital visual effects untether the molar body as a reference point and plunge the viewer into a chaotic, disorienting, and aesthetically-heightened spectacle. The narrative momentarily

surrenders to bodily sensation, the uncanny mechanical and swirling movement of protein, which are animated by an unknown entity that eventually turns out to be the self, and traumatizes the singer into a repetitious state. However, this terror then resolves with the vision of the molar face. In the end, she recognizes her internal face and desires to become it once again.

This music video, along with the films I analyze in this dissertation, are self-reflexive of how medical imaging encourages specific psychological anxieties around the body and the health profession. They use visual effects to produce a visceral reaction from the characters and audiences, a sudden sense of being "too close" to something dangerous and unrecognizable exactly because it is imagined as coming from inside of them. This visceral quality of molecular vision was present in microcinematography of the early 1910s. Landecker explains, "The experience was supposed to be not just one of seeing living cells but a feeling of unprecedented proximity to life as such."[40] This "proximity to life," while awe-inspiring within microcinematography, produces terror when transplanted into the thriller, science fiction, and horror genres. Molecular vision is used in these genres to fantasize about a sadistic doctor hurting their patient through experimental testing, forced surgeries, and even rape; in the outbreak genre, molecular images of deadly pathogens display the virus's lethality and contagious potential, in zombie films these same viruses cause a painful bodily transformation of the victim into one of the walking dead with a simple bite from a former friend or loved one; and finally, the science fiction genre shows how alien creatures, using far more advanced medical tools, are capable of restructuring a human's DNA and molecular make-up to pacify what they view as a dangerous species—us humans. These genres produce paranoid narratives where the very act of rendering the depths of the body accessible has ramifications: when the body is visible, it becomes more susceptible to mutation and outside influence. Many melodramas stage

a dramatic encounter at a hospital, where a beloved friend is unexpectedly diagnosed with cancer, a story meant to make the audience cry (these medical films are tellingly called "weepies), but the films in this dissertation focus on the visceral and paranoid aspects of a patient's struggle to understand their molecular interior that becomes alien or strange by becoming visible (these films are called "creepies"). Through this generic focus, I analyze the pathological emotions produced by medical imaging as much as the pathological viruses these technologies are designed to combat.[41]

Interpreting the Molecular Gaze

Much medical humanities scholarship on the technological mediation of the body in the 21st century reaffirms what Foucault called the "medical gaze" in the late 18th and early 19th century, a type of look produced by the new technology of the autopsy, which led to the birth of the modern hospital.[42] Previously, doctors would travel to individual patients' homes, but they began to use stationary buildings to care for all of their patients, which also came to serve as sites of medical research. For Foucault, dissecting the body immediately after the patient's death helped structure the role of patients to their doctors. The autopsy allowed doctors to search into the depths of the body for connections between symptoms that occurred while the patient was alive and a specific infected tissue or lesion within the body after death. This dissection was the birth of the objective medical gaze, in which death allowed a disease to become visible outside of the patient's own experience or agency.[43]

Foucault's notion of the medical gaze has only heightened in the 21st century with its vast array of technologies that allow doctors to explore the body. Such tools as X-rays, MRIs, genetic testing, scopes, and ultrasounds allow the doctor to see inside the body at a smaller and more

precise level than before, while keeping the patient alive, and in the hopes of saving them instead of just studying them. As with the dissections, new medical tools naturalize an objective gaze that replaces the patient's perception of his or her illness. As both Jackie Stacey and Amelie Hastie have shown, their doctors trusted their X-ray images over their personal experiences of illness and surgery. For example, Amelie Hastie writes, "At my six-week checkup after my brain surgery, I asked my surgeon how long he thought it would be before my short-term memory and multi-tasking functions would return to normal (or if they ever would). His response (which he repeated relentlessly): 'You've seen the film! There was no brain damage.'"[44] Hastie has to explain to her doctor how the realism of the X-ray might disguise how the film's framing and spatialization of the body influenced what was visible—a far cry from being objective. Since doctors view their patients' experience as subjective, the medical tools became a more reliable form of diagnosis, shifting the perspective of illness completely over to the doctor. To Hastie's point, however, I would add that a patient's experience of his/her body, including his/her symptoms, is also influenced by a variety of other media technologies. For example, just look at WebMD, a website that lists the symptoms of diseases so comprehensively that it causes even the most rational person to think he or she is dying of cancer. Similarly, a person's understanding of their bodily health, not to mention what counts as quality medical care, are often influenced by a variety of popular media—from TV shows to advertisements to newspaper articles—that flood our everyday and make it hard to sift through without medical training. In other words, while doctors do not have direct access to their patients' bodies, neither do patients: both require intermediary tools.[45]

By displacing the patient's perspective, medical imaging falls into the danger of fetishizing of the body. Lisa Cartwright shows how early 20th-century microscopic images,

which focused on the movement of blood through a circulatory system, required scientists to alter test specimens by opening up tissue, reducing oxygen levels, and even sometimes killing the specimen in order to obtain a clear image of blood movement.[46] These techniques, Cartwright argues, fetishize the body by altering the specimen to better isolate the desired region of the body, while purposefully censoring the pain required to make that vision possible.[47] Speaking about the role of endoscopy in TV shows and films such as *Fantastic Voyage*, José van Dijck further explains, "The dominating clinical gaze in these programs is the result of a double mediation: the body is filtered and cleaned up by both the endoscopic camera and the television camera. Surgery becomes a noninvasive, almost aesthetic experience, unadulterated by pain, scarring instruments, or potential complications."[48] For Van Dijck, the result of this sterilized aesthetic experience of peering into the body, seemingly painless to the patient and objective to the surgeon, produces a damaging visual logic around medicine: "The idea that seeing is curing and the idea that peering into the body is an innocent activity, which has no consequences."[49] *Fantastic Voyage* raises what Ellis Hanson calls "the pornographic element of a medicalized vision, where the internal exploration of the patient is purely about pleasure," (and a handsome crew of doctors and assistants that go on an adventure so fun it inspired an Epcot theme-ride) rather than the medical spectacle of the suffering body.[50]

Peering into the body is not always, as van Dijck remarks, an "innocent activity"; however, the critique of the medical gaze, while crucial to the study of medicine, has perhaps had too great an influence on the field, such that it virtually ensures that medical imaging is experienced by the audience as a subtle form of bodily violence. This paranoid response suggests that patients and their bodies are always passive objects of the medical gaze, always violated by the uneven distribution of who is to-be-looked-at. What happens in films when the patients use

these medical tools or look at themselves through it? What happens when medical images of the body are ambiguous or produce multiple and even competing interpretations? While Foucault rightly describes how the medical tool naturalizes bodies that it then adjusts and cuts open to obtain a clearer image, there is another mediating layer to almost every medical technology: the human interface. While studies of medical imaging often isolate the tool to explain its historical development and potential biases, I turn to popular media that incorporate these medical imaging tools into their narratives because of the way these media stage the context of using such tools, the doctor's interpretation, and the patient's reaction to them. Often forgotten in accounts of medical imaging, interpretation of medical images is a large part of the profession. The arduous amount of training required for doctors to learn how to decipher medical images, and the disagreements and second opinions they go through when analyzing these images, suggests that few in the medical profession think, as van Dijck's book title *The Transparent Body: A Cultural Analysis of Medical Imaging* suggests, that medical images are, indeed, transparent.

If medical imaging is a type of media, then the interpretation is a moment of media engagement, complete with all the components of spectator and reception theory. Scott Curtis shows how early medical films in Germany from 1904 to 1914 were significant not only for what they showed, but how they were viewed by different audiences that watched them. Curtis argues that these films helped shape a hierarchy of viewership at the time that established the major difference between scientists or experts and layman. Scientists "observed" films, actively deciphering and interpreting the images before them to keep their minds healthy, while laymen were mere "spectators," almost hypnotized by images they passively consumed.[51] This distinction in early medical film spectatorship helps to show how many popular contemporary films today stage scenes where doctors interpret medical images as a way to train the audience in

how to decipher the images presented to them in the film—in other words, to transform audiences from passive viewers to deciphering experts.

An account of the interpretive elements of medical imaging brings the perspectives of both patient and doctor back into the fold of somatic analysis. Take, for example, the 2016 film *The Autopsy of Jane Doe* about two county coroners, a father (Brian Cox) and his apprentice son (Emile Hirsch), who must investigate a mysterious cadaver discovered at the scene of a gruesome murder. The coroners must answer the question of how the nameless cadaver (Olwen Kelly) died by prying into different parts of her body in search of clues. The beginning of the film literalizes Foucault's notion of the medical gaze created through autopsy. When the son asks his father why someone would do this to her, the father replies that their job is to construct an objective view of what has happened, not answer the questions of subjective experience: "Leave the why to the cops and shrinks. We are just here to find the cause of death, no more, no less." As supernatural events start to happen, however, the father realizes that such an objective gaze is impossible exactly because the psychology of the patient impacts the cause of her death (those who killed her did so with the intent of producing as much psychological suffering as possible). At the culmination of the autopsy, the father and son look at a piece of the cadaver's brain under a microscope, and the scene cuts to an image of red blood cell flowing into the surrounding tissue: she is technically dead at a molar level, but alive at a molecular level. This contradictory and competing result between the molar and molecular complicates the definition of what counts as alive, since the cadaver is in a liminal space between life and death.

The film shows how medical tools alone do not make the body transparent, yet the interpretation of the microscopic image proves to be a central factor in proper medical intervention. Both the father and son give different theories of what could have happened, with

each discarded as too reductive. Eventually, they agree on a complicated story based on evidence they have collected: the cadaver was originally a 16th-century woman in New England, gruesomely tortured and then murdered for being accused of witchcraft by the religious and medical authorities of the time. Although she was innocent, the actions produced the very thing they claimed her to be: a creature dead-set on revenge against the living. Instead of a clear objective gaze, the coroners understand that the gaze itself produces as much as it reveals, and that they are complicit in this act: "Everything they did to her, everything we've done to her, she can feel it." While the microscope does not account for the pain of the patient, while it replaces the patient's own experience with an ambiguous image, the interpretation of this image helps to fold the psychological, historical, and subjective back into the picture.[52] Counter to the visual logic of medical tools, characterized by van Dijck's claim that "peering into the body is an innocent activity, which has no consequences," *The Autopsy of Jane Doe* revises Foucault's account of autopsy to suggest that the medical gaze is dangerous both to the patient and doctor, and only as helpful as its interpretation.[53] In its portrayal of how a father and son learn about each other as they dissect the body of another victim, the film makes a meta-cinematic remark on how the stories that surround medical images tell us about our agency, vision, and bodies better than theories that critique the medical tool in isolation.

Focusing on scenes of interpreting medical images helps to show how films reassess the medical gaze in terms of the spectator's embodied reaction to such medical images. I explore a common trope in 21st-century films that stage scenes of microscopic gazing, what I call the medical primal scene, to highlight the subjective experience and psychological consequences of a molecular vision. Microscopes offer a moment when characters literally self-reflect by looking inside themselves at their blood; however, unlike a mirror that unifies the body into a whole,

looking at their microscopic blood causes the characters in these films to have an identity crisis at the sight of their internal multitudes. Due to the design of the microscope—how in peering into the view-finder, the microscope blocks out other vision and flattens the body viewed—the characters blame the tool itself and fall into a paranoid fantasy of medical malpractice. In each of these scenes, the characters must eventually learn to adjust their interpretation of the microscopic image if they are to regain their sanity. In opposition to a Foucauldian model that sees the subject's perspective removed via medical tools, such molecular visions in these films show how medical tools instead engage and shape the spectatorial experience of the patient.

PSYCHOLOGICAL INTERIORITY

In his analysis of why photography had come to replace painting in the mid-19th century, Walter Benjamin famously argued that there exists an "optical unconscious," since a human observer receives more visual information than he or she can consciously process at one time. For Benjamin, the photograph's ability to magnify and freeze minute actions brings these otherwise unconscious optics into view, imbuing the camera with a special allure that, for the viewer, is experienced as seeing something previously obscured:

> Photography, with its devices of slow motion and enlargement, reveals the secret. It is through photography that we first discover the existence of this optical unconscious, just as we discover the instinctual unconscious through psychoanalysis. Details of structure, cellular tissue, with which technology and medicine are normally concerned—all this is, in its origins, more native to the camera than the atmospheric landscape or the soulful portrait.[54]

Photography brings to light small, previously imperceptible movements, like a psychoanalyst revealing hidden psychological trauma. In a later section, Benjamin expands this psychoanalytic

analogy by comparing how the camera helps discover hidden worlds in everyday life, like a psychoanalyst would discover hidden desires in the nightly act of dreaming: "Photography reveals in this material physiognomic aspects, image worlds, which dwell in the smallest things—meaningful yet covert enough to find a hiding place in waking dreams."[55] But how would an optics—not a person with a psyche—have an unconscious?

While scholarship on Benjamin focuses on understanding the optical unconscious in relation to Freud's theory of the unconscious, Landecker helpfully points out how the "cellular tissue" Benjamin also uses to describe the optical unconscious is either disregarded or almost always taken as a benign metaphor. Though Benjamin gives the "cellular tissue" and "psychoanalysis" equal consideration in describing the optical unconscious, scholars take psychoanalysis as the serious analogy and cellular tissue as a false biologism.[56] In response, Landecker shows how science films of the 1920s influenced Benjamin's film theory. The historical materiality of science films of that time might help us understand Benjamin's "cellular tissue," not just as a metaphor, but as a form of spectatorial experience: "The question is not whether cellular tissue has an unconscious or is conscious but rather how…seeing cells via photography or cinematography would be experienced as seeing the fundamental elements of psychological phenomena."[57] When someone looked into a microscope at the molecular make-up of a specimen, he or she considered that image to be a material representation of the organism's psyche. Landecker highlights the importance of taking the cellular theory of the optical unconscious seriously as grounded in the reception of science films during the time.

In the 21st century, we are experiencing a resurgence of what Landecker notes as an understanding of the unconscious as mapped onto the somatic body, visible in minute details of our cells. While it might have seemed anachronistic to think that cells can reveal psychological

phenomena even thirty years ago, today it is not so far away from how we understand medicine and psychiatry, fields which approach psychological disorders such as anxiety, depression, PTSD, and addiction as chemical imbalances and interruptions of cellular processes. Psychiatry does view psychological experience as fundamentally implicated in, if not largely derived from, cellular mechanism in the brain and increasingly in other parts of the body, where one might least expect. Elizabeth Wilson's *Gut Feminism* notes recent medical studies finding that bacteria and other molecular interactions in the small intestine have as many complex neural connections to the body as the brain, and even help produce chemicals like serotonin, leading Wilson to claim that "the stomach is interior to the mind."[58] Admitting to the molecular origins of psychological states, Wilson argues, requires updating many humanities paradigms, particularly feminist theory, which has largely taken an anti-biologist view in response to essentialist rhetoric that downplays the importance of social construction. For Wilson, this response to biological essentialism has led to a cleaving of the psychological and somatic that is equally problematic. Using the work of Melanie Klein, Wilson accounts for how the psychological effects of biology—"the psychic nature of the organic interior"—might prove reparative for cases of depression, a disorder which disproportionately affects women.[59] Benjamin's cellular understanding of the optical unconscious parallels current biopolitical theories of subjectivity at the end of the 20th century, such as Nikolas Rose's account of the new focus of medicine:

> Over the first sixty years or so of the twentieth century, human beings came to understand themselves as inhabited by a deep interior psychological space, and to evaluate themselves and act upon themselves in terms of this belief (Rose 1989). But over the past half-century, that deep space has begun to flatten out, to be displaced by a direct mapping of personhood, and its ills, upon the body or brain, which then becomes the principle target for ethical work.[60]

Rose notes that a psychological understanding of the body, developed in the first half of the twentieth century, has given way to a modern "flattening" of the body, where the psychological

collapses into the somatic. We can start to see how the flattening microscopic image has affected our understanding of psychological depth with the psyche as largely a process of 2D movement visible in our blood or brain given the right medical tool. This older, scientific mentality that seeing one's molecules might provide insight into psychological phenomena is surprisingly regaining traction with doctors and psychiatrists today whose jobs are increasingly relegated to fixing their patients through molecular interventions.

The flattening of the psychological onto the somatic opens expressive possibilities for cinema, since the camera can generally only hint at the interior psychology of its characters through close-ups of faces or the rupturing of internal fluids (tears, blood, semen) outward into view.[61] The visual effects film, a genre defined by the foregrounding of a film's thousands of visual effect shots, which center narrative action around the film's technical prowess and showcase the latest technological advancement, benefits from reconceptualizing interiority as flatness. Not only can digital visual effects seamlessly plunge into a character's body to see his or her molecular insides, but through spectacular external transformations, visual effects add new layers to the body even as they maintain the entanglement between somatic and psychological. Kristen Whissel has documented spectacular digital effects' ability to enact thematic concerns within a film's narrative, from gravity-defying vertical leaps that visualize class mobility, to digital morphs that visualize the breaking of codes and confines, to 3D that visualizes epistemological discovery and the limits of visibility.[62] In her analysis of *Gravity* (2013), a film about a pair of astronauts trying to return to earth after orbiting debris destroys their space shuttle, she notices how the parallax effect of objects moving from background to foreground within 3D effects represents the internal psychology of the characters: "Digital 3D works similarly in *Gravity* not only to extend the spectator's look into the astonishing depth of outer

space, but also to externalize and render visible internal states that are otherwise inaccessible to vision."[63] For Whissel, psychological interiority represents the limit in cinematic representation, which the film accesses by having "variable depth cues" stage an allegorical coming-into-view of something previously hidden in space.[64] While Whissel examines how 3D effects represent outer space, similar effects that move inside the body work with inverted meaning, where characters peer inside themselves to visualize discrepancies and shifts in their external (visible) identities. This dissertation focuses on how digital effects define molecular vision, but it also documents the way various digital effects accrue meaning within narratives of molecular infection.

"Molecular Terror" investigates how contemporary cinema at the turn of the 21st century, with its pairing of the molar and molecular body, has refigured psychological interiority onto a new molecular scale. While science and technology studies scholars have analyzed the biopolitical consequences of medical imaging, they typically focus on the development and application of these technologies in isolation. I turn to popular culture to understand how the films themselves incorporate these technologies into their narratives to depict how tools are interpreted by doctors and patients alike. Instead of simply removing the patient's experience, a molecular vision mediates that experience. Digital visual effects, such as digital morphs, keyframe animation, CGI, and crowd-simulation software stand in for medical images when accessing the internal or multiplied body, but they also allow the camera to move more effectively through interior spaces. These effects untether molecular vision from the character's perspective, seamlessly merging the molecular and molar to show how a molecular change can alter exterior identity groups and even entire populations. To see molecularly is not to return to a

purely biological register of the body, but rather to account for the technical mastery that makes such vision possible.

Chapter 1, "Microscopy and Medical Paranoia," argues that paranoia has become a common response to new forms of medical imaging that promise to see the internal "truth" of the body, only to produce new bodily secrets from this exposure. The chapter investigates the development of the microscope, which eventually ushered in a new scale of vision that positioned the body in terms of an economy of molecules instead of distinct molar parts, and replaced Michel Foucault's description of the birth of the "clinical gaze" at the beginning of the 19th century.[65] To show the psychological effects of this molecular vision, I analyze scenes from contemporary films in which characters use a microscope to look inside their bodies, only to confirm they are infected with foreign objects implanted by male medical professionals or military agents (*Talk to Her* [2005], *Bug* [2006], and *The Skin I Live In* [2011]). The introduction of the microscopic image into these films acts as a traumatic encounter with the past, forcing the characters to recognize the loss of a discernible identity attached to their molecular makeup. The fear of the microscopic image is displaced onto the user of the tool, generating fantasies of medical malpractice at the hands of their malicious doctors. To heal from this loss of self, characters must learn use "pattern recognition," a way to make sense of large, shifting multitudes.

Chapter 2, entitled "Hypervisibility in *Contagion*: 3D Modeling and Outbreak Narratives," explores the genealogy of outbreak films from the Cold War to the present, focusing on the change in visual effects the films use to depict viruses. *Outbreak* (1995) and *And the Band Played On* (1993) were exemplary films in the 1990s that relied on microscopy as a visual effect to stage an "encounter" between a group of scientists and an imaged virus. Microscopy both

isolates and anthropomorphizes the virus as an antagonistic, foreign invader whom the scientists must combat to save their country. The contemporary outbreak film *Contagion*, however, replaces microscopy with 3D viral modeling and DNA sequencing. These technologies present the virus within an entangled environment, allowing the viewer to see the various ways the virus spatially connects with a host cell. As characters produce the 3D model, the narrative structure of the film starts to shift away from an origin story to instead focus on how various hierarchical medical institutions must integrate with each other to effectively share information about the spread. Through its focus on 3D modeling, the film argues that the virus must not be isolated and excised from the body, but rather smoothly integrated into it for the survival of other vital networks.

Chapter 3, entitled "Animating Infection: Digital Hordes and Risky Mobility," details the development of crowd simulation software in zombie films as it came to signal an internal infection. The same software that filmmakers use to construct armies became a tool that biologists use to animate videos of molecular processes and depict intercellular movement. The digital crowd, developed using software called MASSIVE (Multiple Agent Simulation System in Virtual Environment) and implemented for the first time in the early 2000s in *The Lord of the Rings: The Two Towers*, is now a staple feature in many blockbuster films. Digital crowds, however, have changed since their inception to be far more dynamic in their movement, creating what I call "the digital horde," a fast-moving crowd that is specifically programmed to collide with itself. I claim that the use of the digital horde in films such as *I, Robot* (2004), *I Am Legend* (2007), *World War Z* (2013), *Warm Bodies* (2013), *Dracula Untold* (2014), and *Train to Busan* (2016) project their characters' internal infections onto entire populations. Building on work by Kristen Whissel, I argue that these films exploit the digital horde's internal collisions to

allegorize the excessive mobility that initially caused the outbreaks: migration, class mobility, and unchecked scientific progress. The digital horde acts as an "emblem" of the biopolitical effects of mobility in the 21st century, and it helps visually bridge the extreme difference in scale between molecular and global structures that, in aggregate, determine the health of the body.

Chapter 4, entitled "Digital Transitions and the Micropolitics of Gender," examines how films in the 21st century deploy a series of visual effect technologies—most notably, morphs, keyframe animation, and CGI—to depict smooth transitions into photorealistic bodies. During the Cold War period, a cycle of Hollywood films about the interior motives of visibly loyal citizens clearly separated interior and exterior spaces of the body as visually distinct and narratively difficult to traverse. Digital visual effects, however, have allowed the camera to shift from outside-the-body, live-action shots to inside-the-body, CGI shots within a single take. Notable films that extensively use this transition effect include *Fight Club* (1999), *Enter the Void* (2009), *Prometheus* (2012), *Lucy* (2014), *BPM* (2017), *Annihilation* (2018), and *Spider-Man: Into the Multiverse* (2018). The camera's ability to move fluidly back and forth from the surface to the interior, often multiple times within a single shot, produces a new visual continuity between external and internal depictions of a character's body. Films like *Lucy* and *Annihilation* both rely on visual effects' ability to transition easily inside the body to rethink, at a molecular level, the consequences of gendered identity and violence that hinder their protagonists' lives. In both films, visual effects encode femaleness onto an uncontrollable cell division—a new type of birth for a molecular age that leads to a loss of the characters' self-definition but serves as the only way to outgrow the limitations placed on their gendered positions. This chapter considers the queer possibilities of visual effects that redefine exterior identities through molecular alterations.[66] The molecular in these films offers an origin story for the complex social relations

that plague the films' characters, but such ontological certainty means that molecular change—which is becoming increasingly easy to induce—requires the molar body to keep pace or lose intelligibility altogether.

Molecular vision takes the viewer below the surface of the body and simultaneously beyond most scholarly accounts of cinematic bodies and the spectator's engagement with them. To visualize the interior biological world of a character through visual effects is also to imagine the locus of that character's origins, desires, and inner traumas. Molecular imaging in film, therefore, serves the role of mediating between interior and exterior spaces, showing when and how they connect or clash. It is here, at the molecular image, cinema looks for the various conflicting influences that produce subjectivity in a new age of medical intervention.

Notes

[1] Hannah Landecker, "On Beginning and Ending with Apoptosis: Cell Death and Biomedicine," in *Remaking Life & Death: Toward an Anthropology of the Biosciences*, ed. Sarah Franklin and Margaret M. Lock (Santa Fe: School of American Research Press, 2003), 57.

[2] Eugene Thacker, *Biomedia* (Minneapolis: University of Minnesota Press, 2004), 11.

[3] Hannah Landecker, "The Life of Movement: From Microcinematography to Live-Cell Imaging," *Journal of Visual Culture* 11, no. 3 (2012): 381; Michel Foucault, Patrice Maniglier, and Dork Zabunyan, *Foucault at the Movies*, trans. Clare O'Farrell (New York: Columbia University Press, 2018); Nikolas S Rose, *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century* (Princeton: Princeton University Press, 2007), 13; Jordana [Jordy] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present," *Theory & Event* 17, no. 2 (2014); Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 308.

[4] Rob Nixon, *Slow Violence and The Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2011).

[5] Deleuze and Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, 249.

[6] Tim Dean, *Unlimited Intimacy: Reflections on the Subculture of Barebacking* (Chicago: University of Chicago Press, 2009), 111.

[7] Puar says, "The battle against the extraction and exploitation of bodily capacities and habituations is not going to happen through the terrain of intersectional politics alone, and that in fact biopolitical control societies work insidiously by using disciplinary power to keep or deflect our attention around the subjection of the subject, thus allowing control to manifest unhindered." Jasbir Puar, "Bodies with New Organs: Becoming Trans, Becoming Disabled," *Social Text* 33, no. 3 (124) (September 2015): 58.

[8] Lisa Cartwright, *Screening the Body: Tracing Medicine's Visual Culture* (Minneapolis: University of Minnesota Press, 1995); José van Dijck, *The Transparent Body: A Cultural Analysis of Medical Imaging* (Seattle: University of Washington Press, 2005).

[9] Tom Gunning, "The Horror of Opacity: The Melodrama of Sensation in the Plays of André de Lorde," in *Melodrama: Stage Picture Screen*, ed. Jacky Bratton, Jim Cook, and Christine Gledhill (London: British Film Institute, 1884), 50–81; Scott Curtis, *The Shape of Spectatorship: Art, Science, and Early Cinema in Germany* (New York: Columbia University Press, 2015); Yuri Tsivian, "Media Fantasies and Penetrating Vision: Some Links between X-Rays, the Microscope, and Film," in *Laboratory of Dreams: The Russian Avant-Garde and Cultural Experiment*, ed. John E. Bowlt and Olga Matich (Stanford, California: Stanford University Press, 1996); Hannah Landecker, "Cellular Features: Microcinematography and Film Theory," *Critical Inquiry* 31, no. 4 (Summer 2005): 903–37.

[10] Landecker, "Cellular Features: Microcinematography and Film Theory"; Curtis, *The Shape of Spectatorship: Art, Science, and Early Cinema in Germany*.

[11] Scott Curtis explains that at a similar time in the 1907-1918s, but in Germany, scientists were contending with the development of film, its effects on scientific vision, and vise-versa. From this mixing, film had a tremendous impact on scientific specialization by using films as training tools for scientists and the methods of observation they used. Curtis, *The Shape of Spectatorship: Art, Science, and Early Cinema in Germany*.

[12] Landecker, "Cellular Features: Microcinematography and Film Theory," 913.

[13] Tsivian, "Media Fantasies and Penetrating Vision: Some Links between X-Rays, the Microscope, and Film," 82.

[14] Bishnupriya Ghosh, "Animating Uncommon Life: U.S. Military Malaria Films (1942-1945) and the Pacific Theater," in *Animating Film Theory*, ed. Karen Redrobe Beckman (Durham: Duke University Press, 2014).

[15] Kirsten Ostherr, *Cinematic Prophylaxis: Globalization and Contagion in the Discourse of World Health* (Durham: Duke UP, 2005).

[16] Ostherr, 3.

[17] Landecker, "The Life of Movement: From Microcinematography to Live-Cell Imaging."

[18] Landecker, 378.

[19] In addition to the discovery and development of fluorescent proteins, viewing live cells required advancements in the confocal microscope, particularly advancements made possible through digitalization. I need to do more research on this topic, but live-cell imaging is only possible through the digital revolution.

[20] Landecker, "The Life of Movement: From Microcinematography to Live-Cell Imaging," 381.

[21] Landecker, 379. See Quote: "What does the study of the biological moving image bring to the cluster of humanities disciplines concerned with visuality? This question is particularly puzzling when the visual objects and visual technologies in question have very little public presence, do not function as art, entertainment, advertising or education, and most of the people who make and see these images are research scientists."

[22] Another important exception is the Japanese TV series *Wonder Beat Scramble* (1986), which evenly spent time following the character as he fights villains inside a body and live his day-to-day outside the body.

[23] Michael Allen, ed., *Reading CSI: Crime TV Under the Microscope* (London: I. B. Tauris, 2007); Corinna Kruse, "Forensic Evidence: Materializing Bodies, Materializing Crimes," *European Journal of Women's Studies* 17, no. 4 (2010): 363–77; Michele Byers and Val Marie Johnson, eds., *The CSI Effect: Television, Crime, and Governance* (Lanham: Lexington Books, 2009); Steven Cohan, *CSI: Crime Scene Investigation* (London: Palgrave Macmillan, 2008); Amelie Hastie, "TV on the Brain," *Screen* 50, no. 2 (July 1, 2009): 216–32; Sofia Bull, "A Post-Genomic Forensic Crime Drama: CSI: Crime Scene Investigation as Cultural Forum on Science" (Stockholm University, n.d.).

[24] Rose, *The Politics of Life Itself*; Thacker, *Biomedia*.

[25] elcharrito1, *The Finisher: Nexium Commercial Ad*, accessed January 17, 2019, https://www.youtube.com/watch?v=g0HWjr6eeMo&index=13&list=PLQZTk4BbrTExLq1Lmdj1HqEOZRxv0zbN2.

[26] C. Lee Ventola, "Direct-to-Consumer Pharmaceutical Advertising: Therapeutic or Toxic?," *Pharmacy and Therapeutics* 36, no. 10 (October 2011): 669–84.

[27] Ventola.

[28] Dana Blankenhorn, "The Bull Case for Regeneron Pharma Couldn't Be More Clear," *InvestorPlace* (blog), June 7, 2018, https://investorplace.com/2018/06/the-bull-case-for-regn-stock-couldnt-be-more-clear/.

[29] The first section shows a scientist peering into and pointing at the viewing glass of an unknown machine. The image suggests that she is witnessing, without any visual aid, the digital image hovering to her right called a synapse, a junction between neurons predominantly found in the brain. The poster reads "Innovate," as if the sudden connection between two neurons shown in the CGI sparks the scientist's own thoughtful realization.

[30] Peter Kilroy, Marcel Swiboda, and Mary Ann Doane, "Imaging Contingency: An Interview with Mary Ann Doane," *Parallax* 13, no. 4 (November 2007): 21.

[31] Kilroy, Swiboda, and Ann Doane, 22.

[32] Mary Anne Doane, "Scale and the Negotiation of 'Real' and 'Unreal' Space in Cinema," *NTU Studies in Language and Literature* 20 (December 2008): 20.

[33] Stephen Heath, "Narrative Space," *Screen* 17, no. 3 (October 1, 1976): 68–112.

[34] Jennifer Barker, *The Tactile Eye: Touch and the Cinematic Experience* (Berkeley: University of California Press, 2009); Vivian Carol Sobchack, *Carnal Thoughts : Embodiment and Moving Image Culture* (Berkeley: University of California Press, 2004).

[35] Although many accounts point to the 1990s as the introduction of digital effects on mass into Hollywood Blockbuster films, see Julie Turnock's book *Plastic Reality: Special Effects, Technology, and the Emergence of 1970s Blockbuster Aesthetics* to see how the digital effects of the 1990s grew out of major special effects advancements in the 1970s, with films such as George Lucas's *Star Wars*.

[36] Scott C. Richmond, *Cinema's Bodily Illusions: Flying, Floating, and Hallucinating* (Minneapolis: University of Minnesota Press, 2016).

[37] Richmond, 6.

[38] Björk, "Hollow," accessed April 26, 2019, https://www.youtube.com/watch?v=Wa1A0pPc-ik.

[39] I can't help but think of the ink blot test with this music video as well as other molecular depictions. Since the image is abstract, do the characters just see what they project onto it? Is this the true way of being able to find out about ourselves by looking internally? Or is what we see in our molecules more an account of what we want to be than who we are?

[40] Landecker, "Cellular Features: Microcinematography and Film Theory," 927.

[41] Many thanks to Ellis Hanson for giving me the language to think about how this dissertation is drawn to the particular genres of body horror, science fiction, and medical thrillers as opposed to the variety of hospital dramas. Why this generic difference matters for thinking through medicalized vision is central to my thesis.

[42] Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception*, trans. A. M. Sheridan, 3rd ed. (London and New York: Routledge, 2003).

[43] Much scholarship on Foucault's medical gaze draw out the fetishistic quality of the medicine's peering into the body, but Foucault's account and focus on the death of the patient as central to elucidating bodily secrets is often left behind. The question, then, is how does Foucault's medical gaze function differently outside of the technology of autopsy?

[44] Hastie, "TV on the Brain," 221.

[45]The difference of power between doctors and patients has been a central area of study for biopolitics. In Steven Epstein's book on the politics of AIDS throughout the 1980s and 1990s, he locates the central struggle in modernity around this relationship: "A crucial focus of my study is the relations between professional groups and lay clients, and I take seriously Foucault's suggestion that this is a pivotal arena of struggle in modern societies—that power is manifested in the ability of professionals to label, classify, and condemn, as well as in the capacity of clients to resist the imposition of such meaning." Steven Epstein, *Impure Science: AIDS, Activism, and the Politics of Knowledge* (Berkeley: University of California Press, 1996), 23.

[46] Cartwright, *Screening the Body*, 130.

[47] There are clear parallels between the medical gaze and the male gaze, a paradigm in film theory which argues that the cinematic apparatus, in aligning with gendered looks and the male focal character of a narrative, fetishizes the bodies of women on screen. One critique might be that the medical gaze and the male gaze often align. Indeed, the gender gap in the medical profession, with doctors disproportionately being male, means that the tools were mostly designed with male doctors in mind and mostly men use them to diagnose female patients.

[48] Dijck, *The Transparent Body: A Cultural Analysis of Medical Imaging*, 74.

[49] Dijck, 7.

[50] From conversation with Ellis Hanson.

[51] Curtis, *The Shape of Spectatorship: Art, Science, and Early Cinema in Germany*, 123–35.

[52]Analyzing early science films that used microscopy to image blood flowing through frogs or rabbits, Lisa Cartwright argues "by purging the familiar signifiers of corporeality from the body image, microscopy relieved itself of the need to address issues such as subjectivity, history, and identity" (91). What films like the Autopsy of Jane Doe accomplish is to focus on the scenes of interpreting these microscopy images as a way to fold back into the discussion questions of historicity and subjectivity.

[53] Dijck, *The Transparent Body: A Cultural Analysis of Medical Imaging*, 7.

[54] Walter Benjamin, "Little History of Photography," in *Walter Benjamin: Selected Writings Volume 2 1927-1934*, ed. Michael W. Jennings, Howard Eiland, and Gary Smith, trans. Rodney Livingstone (Cambridge, MA: Harvard University Press, 1999), 510–12.

[55] Benjamin, 512.

[56] Landecker, "Cellular Features: Microcinematography and Film Theory," 930.

[57] Landecker, 930.

[58] Elizabeth A. Wilson, *Gut Feminism* (Durham: Duke University Press, 2015), 14.

[59] Wilson, 43.

[60] Rose, *The Politics of Life Itself*, 26.

[61] Linda Williams, "Film Bodies: Gender, Genre, and Excess," *Film Quarterly* 44, no. 4 (Summer 1991): 2–19; Linda Williams, *Screening Sex* (Durham: Duke University Press, 2008).

[62] Kristen Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema* (Durham: Duke University Press, 2014).

[63] Kristen Whissel, "Parallax Effects: Epistemology, Affect and Digital 3D Cinema," *Journal of Visual Culture* 15, no. 2 (July 2016): 242.

[64] Whissel, 243.

[65] Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (New York: Vintage Books, 1994).

[66] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present"; P. B. Preciado, *Testo Junkie: Sex, Drugs, and Biopolitics in the Pharmacopornographic Era* (New York, NY: The Feminist Press at the City University of New York, 2013).

Chapter 1: Microscopy and Medical Paranoia

Knowledge invents the Secret. – Michel Foucault[1]

I am constantly reminded by my doctors and a variety of newspapers, television shows, and pharmaceutical advertisements that there are secrets within the body that modern medicine is only recently starting to unravel. They often refer to new breakthroughs in mapping the human genome that will allow us to predict future diseases before any symptoms arise, or even damage certain parts of our DNA to prevent those diseases from ever occurring. They also reference recent developments in neuroscience, where scientists are starting to determine what specific genetic and chemical predispositions encourage aggressive behavior or cause depression and anxiety. Renata Salecl, a professor of critical legal studies, points out that neurology and genetic testing have become increasingly prominent in court decisions due to what she describes as the court's desire to know "What is the X in the subject that makes him or her criminal."[2] Since the early 20th century, psychological interiority has been largely understood as located somewhere within the body in a metaphorical sense: an ego/unconscious or a personality. But now, as Salecl points out, it has become literal: subjectivity is something material inside of us, a certain code in our DNA or deficiency in our molecular processes, if only we had the right medical tools to see it.

Access to the body's codes and molecules—in a sense, access to the secret of one's subjectivity—is mediated by a variety of medical tools and gazes. It is no wonder that stories of sickness and medical testing so often revolve around the anxiety inherent in patients' relationships to these tools and the doctors who use them, starting with an understandable skepticism—what if the test is wrong? Or if the doctor made a mistake?—and developing in a

more paranoid direction: “What if the tool is not working, but rather hurting me? What if the doctor is actively negligent, or worse, sadistic?” As most humanities scholarship on medicine will attest, these common anxieties may lead to a biopolitical paranoia, to a larger theory of medicine as a subtle form of population control: “What if medical care is not solely about getting me healthier, but about rerouting authority of my own body to a diagnosis tool, allowing its operator to speak for me?” Although most of these fears move over to a paranoid vision of medicine, accounts of just such medical atrocities and scandals throughout history, however numerous, have served to reinforce future paranoia. In *The Birth of a Clinic*, Michel Foucault sought to confirm these more paranoid narratives when he traced how modern medical science adopted what he called a “medical gaze” around the end of 18th century and into the 19th century.[3] He found that the focus of medicine moved away from seeing the patient as a speaking subject to seeing the patient as the container for a far more interesting and categorizable pathogen. The pathogen, now made visible through optic and surgical technologies, becomes more important than symptomology in diagnosing disease.[4] Having a fever, a bloody cough, and decreased lung capacity, for example, was not enough for a diagnosis of tuberculosis; instead, the doctor was required to search inside the body for the pathogen or infected organ that was the source of the symptoms. Casting the medical profession into the role of a detective, Foucault writes: “The clinic no longer has simply to read the visible; it has to discover its secrets.”[5] Though Foucault famously tries to break from a lineage of psychoanalytic thinkers, his emphasis on the medical gaze as ultimately a form of power that creates secrets in the body, unknown to the patient, works in tandem with such psychoanalytic paradigms of repression and exposure, but through a far more materialist model of pathogen and surgical dissection. The major difference with psychoanalytic theories is how the psychoanalyst relied on the patient’s visible symptoms,

his or her behavior and molar ailments, while medicine sought to remove the patient completely by searching for an internal source. For example, discussing the role of psychoanalysis in medical narratives in the "Woman's Film" of the 1940s, Mary Ann Doane notes that the focus remained on molar bodies, and thus doctors relied on deciphering visible symptoms to diagnose illness: "It is ultimately the symptoms of the female body which 'speak,' while the woman as subject of discourse is absent."[6]

While Foucault names the dissection of cadavers as one of the main causes for this shift to a detective-like medical gaze, I would put forth the microscope as another optical technology, with its delectable promise of seeing a world of secrets invisible to the naked eye[7]. If examining a sample of blood, for example, the microscope could tell the doctor far more about the physical health of the patient than the patient would be able to know about him or herself. As Lisa Cartwright's history of the microscope details, physicians at the beginning of the 20th century, such as Robert Lincoln Watkins in a 1902 publication, saw the microscope as revealing the potential for diagnosis purely based on a deep observation of a drop of blood: "'In the blood lies more disease as well as more premonitory symptoms of disease than can be found in any other part of the body,' he asserted, and 'He is the greatest discoverer who finds the pre-symptom or the symptom of the symptom,' those 'slight and unconscious departures from a normality.'"[8] These pre-symptoms, the pathogens and not the fever, the ones unknown to the patients themselves, come close to describing what Freud would name, at a similar date but in a different field, the unconscious, and what Walter Benjamin would name the optical unconscious.[9] It is through the microscope that medicine developed a visual language for pre-symptoms, an ability to name a body as harboring something dangerous before it felt so, and when the somatic body developed its own "unconscious departures from normality" in the form of microscopic

pathogens.[10] The microscopic view, as a developing medical technology, started to drastically shift the ways of seeing interiority. As scholars have noted, the beginning of the 20th century was a time when a deep sense of psychological interiority was mapped onto and replaced by the body in medical discourse.[11] In other words, the microscope of the early 20th century not only moved from Foucault's idea of symptom to secret pathogen, but ultimately changed the focus of medicine from symptom to pre-symptom, from conscious involvement on the part of the patient to a specialized vision from the microscope that, with its focus on a bodily unconscious, no longer required and sometimes discredited the patient's voice.

With microscope's ability to see pre-symptoms, I am reminded today of how many medical tests are taken as preventative measures, as tests conducted before the appearance of any illness. The routine HIV test or cancer test, for example, is such an affectively charged experience exactly because one's blood is seen to harbor a potential threat that has not yet manifested. Similarly, genetic testing, like the popular *23 and Me*, calculates the risk of developing a potential disease at some undisclosed moment in the future, producing anxiety before the arrival of the actual disease. As such, these tests produce the type of psychological effects of disease on the patient (mental stress, anxiety, and depression) that the medical gaze is no longer interested in documenting. The psychological effects of medical tools are at the heart of surveillance technologies in general that shape the actions of those under observation. As Lisa Cartwright argues, the microscope's gaze, therefore, became a subtle form of governmentality akin to today's video surveillance:

> Long before techniques such as remote sensing or video surveillance were introduced in Western warfare and industry, compound microscopy effectively embodied the optical paradigms that would come to be associated with these late-twentieth-century techniques of discipline and domination. Like these later techniques, microscopy incorporated the individual observer in a decentralized and self-correcting virtual sensory apparatus—an

> apparatus capable of facilitating inspection of visually inaccessible territory with optic precision and detail.[12]

The microscope reimagines the body as circulatory systems and an unknown landscape of hidden tissue, an otherwise invisible world of interconnected bodily spaces that constantly threaten to rupture and reveal something about ourselves that we did not know we had and which we might need to forget in order to carry on living. The search for hidden diseases in our body, as with most attempts to expose secrets, produces counterintuitive results: while we are driven to expose secrets, and haunted by them if we are unable to do so, these secrets, once exposed, never seem to satisfy our curiosity or reduce our anxiety about them. While Foucault claims that "Knowledge invents the Secret," meaning that certain medical fields produced a sense of secrets in the body at the beginning of the nineteenth century, we might also add that bodily secrets invent the paranoid response, a form of psychological illness caused by new medical imaging.[13]

Today, the microscope has changed in type and in power, and with it comes a new visual regime of the body. While the microscope became a tool for scientific use in the nineteenth and twentieth centuries, development of much higher-powered microscopes in the late 20th century, such as the electron microscope, along with the popularity of common commercial microscopes for use by non-scientists and high-school classes have further shifted the effects of the microscope on discourses of the body. In *The Politics of Life Itself*, Nikolas Rose argues that we have finally moved away from Foucault's idea of a medical gaze of body parts to a new molecular gaze. For Rose, we started at what is called a molar level, the level of organs and anatomy dissections, but have now moved to gaze at the molecular level that sees the body in a different, far more magnified scale. This change in magnification of the microscope is nothing

short of a drastic change in how we represent bodies within medical discourse in the twenty-first century:

> Today, however, biomedicine visualizes life at another level—the molecular level. The clinical gaze has been supplemented, if not supplanted, by this molecular gaze, which is itself enmeshed in a "molecular" style of thought about life itself. As even a cursory reading of contemporary biomedical research shows, life is now understood, and acted upon, at the molecular level, in terms of the functional properties of coding sequences of nucleotide bases and their variations, the molecular mechanisms that regulate expression and transcription, the link between the functional properties of proteins and their molecular topography, the formation of particular intracellular elements—ion channels, enzyme activities, transporter genes, membrane potentials—with their particular mechanical and biological properties.[14]

We have a new visual regime and style of the body: images that once focused on the body's skeletal anatomy, its circulatory system, or the health of its organs have within the last twenty-five years been replaced by images of the body as intercellular processes, images of viruses invading a cell, or the replication and dissemination of DNA strands. This molecularization brings with it a different set of relations to our bodies and it opens the body to new forms of power. As Rose later argues, the molecular vision of the body effectively breaks the body into interchangeable parts, which hold no affinity to any given person, and produces a new economy of the body, where molecular units can be exchanged, manipulated by injections and drugs, traded between hospitals and pharmaceutical companies, preserved and commodified. Such a shift in the scale of the medical gaze brings with it other consequences for the terms we use to describe medical intervention. Invasive medical procedures were previously characterized by the amount of incision to the skin or an organ, what is called the level of "trauma to the body," and the size of the tool inserted into the body, all measurements at the molar level. But molecularization requires us to rethink these terms, since small incisions (injections) or no incisions (pills) do not puncture the body at a molar level, but may be far more invasive at a

molecular level, since they have the potential to fundamentally change a cell's function, shape, reproduction, and effectiveness. First ushered in by the optic technology of the microscope, the current age of molecularization produces a new visual regime of the body, and therefore requires us to rethink embodiment, medical care, and bodily trauma through the microscope's new magnified optics.

The shift from a molar to a molecular scale of the body impacted popular film production over the last fifty years. Though medical imaging has changed over that time span, peering inside the body is not new to cinema. One of the most genre-defining Hollywood films to explore the inside of the body through the journey of a group of miniaturized scientists was *Fantastic Voyage* (1966). The promotional material for the film boldly declared itself as entering a "new frontier" of cinema and in the film.[15] The film consciously mimicked science fiction films about space adventure and underwater exploration, and hired production crew members, such as the projection designer and technical adviser, from *20,000 Leagues Under the Sea* (1965).[16] Through its elaborate set designs and special effects, the film presents the body as a place of wonder and artistry, fantastic enough to confirm man's solipsism: one of the crewmembers shouts, "Man is the center of the universe," upon gazing at the intricacies of the human blood cells, which at this scale look like planets in outer space.[17] Though intricately colored and constructed with matte paintings, the sets were always paired with cross cutting to outside the body, or to inside the submarine, where they would be matched with a topographical map to confirm their legibility and position within the body. Besides a single scene where we are shown the many bubble-like cells that make up the blood, the film still focuses exclusively on the molar level of bodies and organs: the narrative is centered around seeing the crew navigating through the patient's circulatory system in a submarine, incinerating a blood clot in networks of the brain, bypassing

the eardrum, and then exiting in a tear drop from the eye. The danger in the film is held to the Cold War threat that one of the crew members is a double agent, who hopes to sabotage the mission and kill the patient at the request of an opposing government. The success of the mission is dependent on the protagonist, agent Charles Grant (Stephen Boyd), figuring out which member of the crew is secretly not who they say they are. Therefore, the film shows that it is ultimately human allegiance and psychology, not the body, which are hard to know—or worse, can be purposefully deceptive. Similarly, the 1987 film *Innerspace* follows a former airplane pilot who accepts a mission to man a submarine that will be miniaturized and injected into a rabbit for scientific research. The mission goes awry when a competing biotech company sabotages the plans, and one of the scientists accidently injects the pilot into another person, a nervous grocery store clerk. Like *Fantastic Voyage*, *Innerspace*'s inside-the-body scenes mirror a space or underwater exploration story, sticking largely to a molar view of organs. The main antagonist of the film remains external to the body, both through the competing biotech corporation and the miniaturized assassin sent inside the body to find and eliminate the pilot.[18]Both *The Fantastic Voyage* and *Innerspace*, though different in many other respects, view the body as a neutral space threatened by an external force as opposed inherently dangerous.

21st-century cinematic journeys inside of the body are generally far more molecular than molar, and far less fantastic, due in part to the way medical imaging of the body, particularly computer modeling, has spread into popular media without need for the same large studio budgets. One example is *Antibody* (2002), a contemporary adaptation of *Fantastic Voyage* about a team of scientists who must miniaturize themselves and then navigate through the body of a terrorist to disarm an implanted microchip with the codes to a nuclear detonation. *Antibody* managed to produce its backgrounds of the body on a shoestring budget of only $3.5 million

dollars, made exclusively for video, without the promotional hype of producing a once-in-a-lifetime spectacle. Instead, *Antibody* transforms the body of the terrorist into unrecognizable assemblages of floating cells and attacking antibodies, now both abject and cyborg, part chip part human, which become the main threat to the mission's success, not a spy or another enemy team. *The Fantastic Voyage*'s deceptive crew members and their hidden threats are here transferred over to the now unknowable and dangerous body of the patient, whom they may never want to save. While *The Fantastic Voyage* separated out the knowable body from unknowable human psychology, today's subsequent journeys inside the body suggest a merging, an unknowable and abject body that produces psychological uncertainty.

To understand the psychological consequences of an internal vision, I examine key examples of 21st-century moments of peering inside the body, where patients traumatically witness, through the microscope, their abject molecular insides for the first time, and become paranoid that they are being used as test subjects by their sadistic doctor. These films ask, what are the psychological effects of this sudden coming-into-view of the molecular body? At this new scale, what are the risks of misrecognition, and what shifts of identity might such a misrecognition of one's body produce? These questions are central to what psychoanalysts refer to as the primal scene, a paradigm for analyzing the misrecognitions produced in traumatic witnessing of gendered body parts. Starting with Sigmund Freud, psychoanalysts use the primal scene to take into account how a childhood misrecognition of gender difference, particularly of one's parents' various gendered organs during sex, produces the violent and paranoid characteristics of desire. The primal scene has a long genealogy in film theory since, in identifying with the point of view of an immobilized witness, the primal scene replicates the position of the cinematic spectator within a movie theater or home entertainment center. In both

the Freudian and cinematic versions, the primal scene also simultaneously produces a paranoid fantasy of accidentally entering the events witnessed, the fear that someone is always watching you watching others, and that the potential violence you see in front of you is already sneaking up behind you, ready to reenact the scene with you occupying various victimized positions within it. In films, this paranoid voyeurism comes across most legibly in scenes of peering into windows, keyholes, or out of bedroom closets, looking in on a scene characters knows they are not supposed to see, so that they are always on their guard against being discovered. Linda Williams's *Screening Sex* is perhaps the most attuned contemporary analysis of the primal scene in cinema as it pertains to sex acts in arthouse films from the 1980s to the 2000s, and the sudden exposure of perverse sexualities they introduced, for the first time, to a shocked American public.[19]

Theories of spectatorship have since evolved to account for the way audiences are no longer immobilized in a darkened theater while watching film. Rather, sitting at a home entertainment system or watching from cell phones and laptops in coffee shops, spectators have the ability to stop, start, and speed up what they are watching with a simple click, and they are increasingly paying attention to other media at the same time. In short, their affective relationship to film has changed. The traumatic and immobilizing witness position of the primal scene seems less and less applicable to the cinematic experience today; however, the primal scene might better explain the position of a patient in the doctor's office, since the various tools used to peer inside the body—the X-ray, the microscope, the ultrasound, etc.—incorporate cinema and its spectatorship, but also serve as precursors to the patient quite literally taking the position of someone to be worked on and often cut open by the doctor. In the primal scene, the viewer first witnesses a sexual scene, but then is implicated in the action once he/she becomes

aware that someone might catch him/her looking. In other words, the patient in the doctor's office, looking at a medical X-ray image and waiting for his or her next medical procedure, enacts a far more Freudian primal scene in its paranoid dimensions than watching a film in one's home. Looking at medical films after 2000, the primal scene is useful to understand how medical imaging technologies are experienced by characters as a traumatic and elicit vision that results in bodily penetration. Similar to the structure of looks in the primal scene, Vivian Sobchack understands cinema as staging what she calls "signifying scenes," where objects in the film look back at the characters "through the hyperbolic excess of ontic presence created by both the camera's close-up framing of them and its hyperempirical detailing of their material presentness."[20] In scenes of microscopic viewing, the molecular insides take on this excessive "presentness" quality since the close-up of the camera reveals the minute materiality of the body. The importance of these scenes, for Sobchack, is evident in how cinema differs from photography: while photography replaces human vision with a mechanical vision, cinema focuses on how mechanical vision sees human vision, an intersubjectivity of vision, crated when the audience watches characters watching something else. The effect is that cinema's "signifying scene" highlights the characters "embodied engagement with the perceptual technologies…and how they have significantly altered both our sense of the world and our sense of ourselves."[21]

While similar in form to the primal scene or signifying scene, the medical primal scene updates the psychoanalytic paradigm to account for a molecular vision, as opposed to Freud's molar account of organs and limbs, and how the viewer comes to understand gender and sexual violence within the body as opposed to simply between bodies. Such traumatic microscopic vision occurs in a series of films from different genres and nationalities over the past fifteen years, such as *Talk to Her* (2002), *Blade: Trinity* (2004), *Bug* (2006), *The Thing* (2011), *The Skin*

I Live In (2011), *Anti-Viral* (2012), *Cemetery of Splendor* (2015), *The Autopsy of Jane Doe* (2016), *Thirty Years of Adonis* (2017), *Sorry to Bother You* (2018) and *Annihilation* (2018). In these films, characters look inside a microscope at their blood, only to misrecognize their molecules as manufactured by external entities or as an approaching threat. Although these scenes depict a crisis of identity at the molecular level, the films ultimately end by suggesting a type of visual interpretation called "pattern recognition"—seeing across images—that might act reparatively to form a coherent sense of self in the wake of medical paranoia. William Friedkin's *Bug* and Pedro Almodóvar's *The Skin I Live In* are both examples of films that examine the effects of the molecular primal scene for subjects in the 21st century, but while medical paranoia in *Bug* leads to a self-annihilation as a psychological defense, *The Skin I Live In* recuperates the possibility of the microscopic vision to restore a subjectivity lost by the molecularization of the body.

THE MEDICAL PRIMAL SCENE: *BUG*

Bug (2006) is William Friedkin's cinematic adaptation of Tracy Letts' off-Broadway play of the same name, where a lone waitress, Agnes White, befriends a runaway soldier, Peter Evans, who eventually convinces her that the government has implanted a colony of bugs in him, and later in her, as a prototype for a much larger operation of civilian population control. Having convinced Agnes of the bugs' reality, Peter decides to save them from the government's further meddling by dousing both of them in fuel and lighting themselves on fire. Making its American theatrical debut in 2000, and adapted into a film in 2006, *Bug* was part of a cycle of feature films about schizophrenic protagonists who are deeply skeptical of the medical treatment that is supposedly there to help them (*Memento*, *A Beautiful Mind*, *Spider*, *The Butterfly Effect*, *Donnie*

Darko, *Vanilla Sky*).[22] Like Friedkin's previous film *The Exorcist*, *Bug* takes place almost exclusively around a bed and explores the themes of possession—in this case, biological possession, not in the grand themes of demonic possession in the heart of a Jesuit university campus. *Bug* understands that narratives about medicalized bodies rely on attention to spatial dimensions and creative set designs, so that the inner body is first made visible through the outwards spaces of the set.

Bug starts with the disembodied voice of a woman answering a telephone call somewhere off-screen, accompanied by a birds-eye-view shot overlooking the Oklahoma flat lands. As her voice answers "Hello?" to no response, the accompanying shot moves forward over the empty landscape, and the faint hum of a helicopter signals that we are looking through the eyes of a mechanical aircraft hovering toward some yet unknown target. As the camera moves onward to a lone motel up ahead in the distance, we start to make out a single person standing on a motel porch, and then continue to move closer until we are at a medium-close shot of a woman, the same woman who answered the phone, standing there visibly agitated that some unseen caller is watching her. In its opening shot, *Bug* questions why such common establishing shots at the beginning of many films, where the camera hovers above a city or town and then zooms in until it reaches the protagonists it will then follow for the rest of the film, should feel so innocuous to viewers when they put us in a point of view that seems to confirm our fantasies of military surveillance. As we glide through the Oklahoma landscape, we may already have some nagging questions: are we in league with the unknown caller? Who sent us? Is this how assassinations progress, with a phone call to confirm the presence of a target and then a precise missile launched by some approaching aircraft? Or are we merely a bug hovering over the landscape drawn towards a lighted hotel sign? *Bug*'s establishing shot is the only such long shot in a film of

otherwise tightly designed spaces. With each subsequent scene in the film, the distance between camera and subject gets closer and closer, so that the entire film is visually structured like one large zoom-in. *Bug*'s strict spatialization insists that some of our most common camera movements, such as the establishing tracking shot, carry with them an inherent point of view whose identity cannot be determined within the diegesis of the film, but whose motivations are nevertheless clearly understood as sinister.[23] Similar to the film's later microscopic vision, the zoom in the opening scene upends traditional notions of suture theory in film spectatorship, since the perspective created through the (lack of) editing place the audience outside of an easy identification with an embodied position in the film.[24] It is this ambiguity of perspective that the microscope, through a similar zoom, will develop into a paranoid narrative.

THROUGH THE LOOKING-GLASS: PARANOID REFLECTIONS

Halfway through the film, Peter quite literally pulls out his insides to see them for himself. To prove his theory that the military experimented on his body, Peter takes out a wrench from a toolbox and, going over to the window to see his reflection, gets a firm hold of his corrupted tooth and pulls. Watching Peter pull himself apart, Agnes clutches her gut in pain, as if Peter were physically extracting something from her body rather than his. The scene is gut-wrenching exactly because she is unable to stop the violence she sees before her, unable to explain the self-harm that is now made explicit. How Peter previously received his wounds were always kept off-screen, with all of his bug bites and bodily wounds simply appearing on his body, their origins unknown to Agnes or the viewer. The entire scene is visualized through reflected glass, at first through the reflection of a window pane in the living room and then through the reflection in a bathroom mirror. The film self-consciously references how mirrors are

commonly the prop used in films of this genre to enact visually the schizophrenic split of a character's personality by literally presenting that character with a mirrored, often more sinister, image of themselves staring back at them.[25] The doubled image makes it hard to distinguish the "real" character from its reflection, and this moment of literal self-reflection highlights how the characters lose their ability to decipher between reality and fantasy. For all the overdetermined signification of mirror as an alternate reality, this is not true for *Bug*. Ironically, the overly speckled and hazy mirrors in this scene help dispel the ambiguities of whether Peter is seeing things and allow Agnes to distance herself, momentarily, from his paranoid fantasy that is slowly taking over her life. The scene focalizes through Agnes's perspective, and as she stares at him through the mirror, she finally recognizes Peter as the agent of his own self-destruction instead of a victim of some unseen force. Here, the mirror functions to see fantasy clearly and therefore disarm it.

No longer able to convince Agnes he is a victim of someone else attacking him, Peter decides to prove he is not crazy by examining his tooth under the microscope. At this moment, Peter seems self-aware that his subjective vision is compromised, so he looks to the microscope for an objective scientific measurement, only to find that it confirms his most paranoid fantasies. First splitting the tooth in half and putting it onto a slide, Peter then looks into the microscope, screams in terror, and then falls back against the wall. A rather shaken Agnes then takes a look, and then mutters a single word: "Millions." After this single utterance, the camera cuts to the view from the microscope: we see a frame with thousands, though certainly not millions, of little red circles surging through a wall of other white circles. In seconds, this microscopic vision then dissolves into a match-cut image of a hive of jittering cockroaches crawling on each other, and the scene abruptly ends. In this visually confusing scene, the microscope facilitates a shift in the

understanding of the term “bugged,” from Peter’s fear of surveillance or wire-tapping (his phone is “bugged” by the government) to an infestation or parasitic inhabitation of his body. The microscopic vision moves from “seeing” to “inhabiting,” as if for Peter, the gaze has materialized and is now physically part of his body.

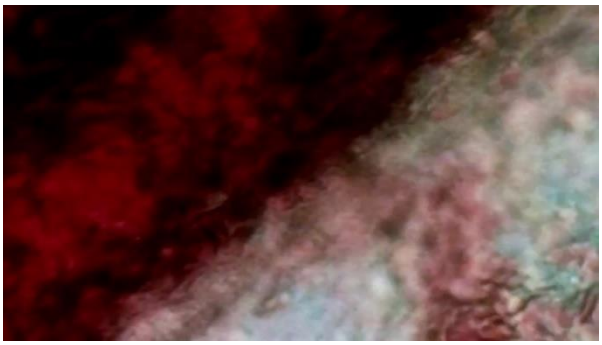

Figure 2.1a and 2.1b: The molecular primal scene in *Bug*

This microscope scene constitutes what I have been calling the molecular primal scene in medical narratives, a staple in the genre, where patients momentarily peer inside the body through the use of a specialized medical optics only to discover a chaotic internal scene, where the body’s processes and detail are exposed but misrecognized. Anyone who has had a medical procedure for a possible illness—be it a cancer screening, ultrasound or X-ray—will know this feeling of uncertainty that marks the image of the inside of the body as something extraordinary, a type of illicit vision that promises both to tell us about ourselves at the deepest molecular level, while often failing to set our anxieties at ease. In *Bug*, this molecular primal scene reenacts a previous and more traditional primal scene, when an unknown third party witnesses Peter and Agnes’s have sexual, and ends with the image of their embrace splitting apart, like a schizophrenic break in the film itself, to reveal a praying mantis head staring back at the viewer.[26] The Praying Mantis is infamous for how the female insect will consume the male during sex if she is malnourished to ensure she has enough energy to produce offspring. In a

buggy version of the Freudian primal scene, not only is the female the one wounding the male, but the head is staring at the viewer, as if we are the witness, now in danger of being consumed.

The medical primal scene hinges on the status of the microscopic image: what do Agnes and Peter see in the microscope? The microscope is meant to gauge Peter's sanity, but the entire scene works to undermine the simplicity of equating seeing or not seeing bugs to either being paranoid or not. If indeed we first see a microscopic image of a human capillary, even before it dissolves into bugs, we do not have a definitive answer as to whether there are bugs visible in the bloodstream. We are forced to wonder, as Agnes and Peter do, what do microscopic bugs in the blood look like? Would we be able to recognize them even if we could see them? Could they be those black splotches on the side there, or have Agnes and Peter simply misread what healthy blood cells look like? We approach the image of the cells and the image of the bugs differently, assuming the latter is fantasy and the other is a record of what is truly there, but why is the microscopic image of flowing red and white circles somehow the empirical and objective image when the bugs are the far more photorealistic and legible? The film's edits suggest that the microscopic image only requires a simple match-on-action cut to move from blood cell to bug, that one is merely the continuation of the other in a different context, but such a cut also relies on the microscopic image as already uncertain, its status as real or fantasy in need of interpretation.

Though the status of the microscopic image remains ambiguous, the scene makes clear that Agnes shares a vision with Peter, and that their vision somehow mixes, like a sexual coupling, in the microscope. If this is Agnes's point of view, why does she see the same vision as Peter, especially if before this moment Peter's vision was understood as compromised? Is the microscope lying to her? Can a fantasy detach itself from one individual psyche and then reattach itself to an optics machine? Even the microscopic image presented in the film could not

have possibly come from the microscope we see in the scene, since it requires a far more advanced microscope to see at this level of detail, and so the microscopic image of cells floats about the scene, with no direct point of view grounded in the film.[27] What is different, therefore, from the Freudian primal scene of a child's traumatic witnessing of his parents' sexual acts, is that the molecular primal scene, because it relies on a mediating specialized tool, has no stable point of view within the child or onlooker. Much like the opening sequence of *Bug*, where the audience flies towards the motel, we do not know whose eyes we are looking from, nor if they are human eyes at all. In the Freudian primal scene, paranoid delusions are quarantined to the embodied position of the witnessing child, and yet in the molecular primal scene, paranoid delusion floats free from a single subject, capable of being shared by a variety of positions (father, mother, and child).

The molecular primal scene shows how patients, upon looking at their ambiguous internal multitudes through a microscope, misrecognize what they see. The vision sparks the return of a traumatic memory. We learn earlier in *Bug* that Agnes had a child, a boy who was abducted in a grocery store when she left him in the cart to grab a bag of onions for dinner. Ever since, Agnes is crippled by her guilt, so when Agnes sees her molecular insides, she recalls the last image she sees before her son's disappearance: a pile of circular red and white onions on the grocery store shelf. The onion image does not flash across; instead, the audience (much like Anges) must remember the visual echo from earlier in the film, such that we see the molecular inside as both familiar but also new. From this recollection, Anges acts as if all of the mysteries of her son's disappearance, all the various parts of her life that do not add up, are now visible in her blood. After this microscopic vision, Agnes develops an intricate connection between Peter's infection and her lost son with blood as the missing piece. She believes the government has taken

her son in order to engineer superbugs that match her DNA, a superbug first implanted into Peter as a test, but ultimately put into her blood for incubation. Paranoia helps to make oneself the center of the universe—everyone, no matter how important, is out to get *you*—thereby building up the ego when faced with something that is radically other: in this case, a new scale to understand the self. It is this radical unintelligibility of the microscopic image—it's otherness that is also supposed to constitute the self—that Agnes defends against by ironically using the image to clarify all the mysteries of her life as centered around her singular importance (to her ex-husband, her doctor, and to larger institutions, such as the military),

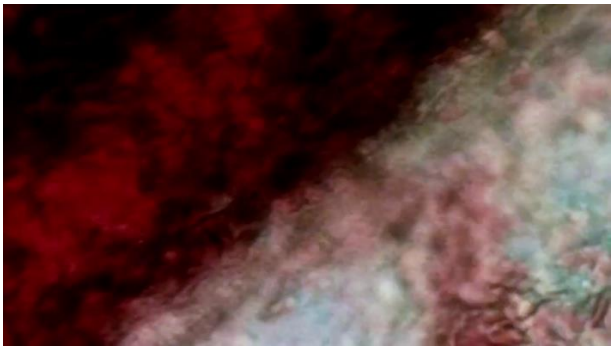

Figure 2.2a and 2.2b: Molecules as traumatic memory in *Bug*

In *Bug*, the more Peter and Agnes trust their microscope to tell them if they have bugs, the less they trust their doctors, either Dr. Sweet, who comes to the hotel to help Peter and is murdered by Peter in return, or the dermatologist, whom Agnes sees about the sores appearing on her body but eventually believes is working for the military. In fact, the microscope allows Peter to assume the role of the doctor in interpreting the images himself, as if the solution to medical experimentation or malpractice were simply to cut out the medical practitioners altogether and have the patients use the tools directly. While they endlessly question the motivation and practices of their doctors, not once do they question whether their microscope is

accurate. Through its extreme paranoia of medical experimentation, *Bug* seems to champion an age when medical care and diagnosis are increasingly shifting responsibility over to the patient, but such a shift relies on the tools, in this case the microscope, to provide a far more transparent image than it does, and to remain itself immune from corruption. The film seems to be paranoid about the microscope's ability to transmit more than an image, but rather one person's vision to another, and an encounter with a traumatic past. *Bug* renders medical imaging ever so seductively close to what it is meant to prevent, namely an unchecked fantasy production and misrecognition of the body. In this way, the film finds that the bodily surveillance used to detect bugs is hypocritically paranoid of its own capability to create them.

In the final moments of the film, Agnes and Peter commit self-immolation to prevent, in their fantasy, the many millions of bugs living inside their body from being extracted and used by the government. The ending dramatizes a defensive response to a new scale of the molar body, now recast as composed of internal multitudes, which Nikolas Rose suggests will be the new unit of biomedical resource extraction in the 21st century.[28] There is certainly a sobering lesson from the neurotic conclusion of *Bug*: either Agnes and Peter are victims of some elaborate plan hatched by the governments, or more likely, they are too easily fooled into self-harm by the tools they use to determine health. Yet, with all this diagnostic paranoia on the examination table, the film still manages to be pleasurable, and far less traumatic, for the audience, a paradox that might make us second guess what the film is up to. The film manages to criticize a certain paranoid medical optics while simultaneously showing us how poetic and thrilling such a paranoid love story might be. Part of this enjoyment might be that, by the end of the film, the paranoia of the image (the ambiguity of the microscope's vision) has resolved itself into just plain fear for the characters themselves. "The thing about *Bug* is that we're not scared for

ourselves so much as for the characters in the movie," one critic rightly points out.[29] The actors are constantly on the brink of what seems like passing out from having to deliver such maniacal and long monologues. By the final climactic scene, as the characters are throwing lighter fuel over themselves, the paranoia becomes sublimated into the prowess of Ashley Judd's and Michael Shannon's performances. Ironically, in a film all about the dangers of getting too close to the image, *Bug* provides the audience a way to distance themselves from the characters' madness by appreciating the spectacle of their physical taxation and triumphant acting. As such, in its final turn toward the theatrical, the film returns focus to the molar level of bloodied limbs, quivering lips, and exhausted bodies, effectively leaving behind the far more neurotic vision of the molecular inside, so that we may leave our screening of *Bug* with a certain sense of satisfaction.

ALMODÓVAR'S MEDICAL FILMS: *TALK TO HER* AND *THE SKIN I LIVE IN*

It's a pity you can't see your whole body. —Doctor to patient, *The Skin I Live In*

The microscope, as *Bug* shows us, leads to a sense of paranoid disorientation rather than a clearer understanding of what we are looking at. The danger, then, is that doctors take this tool as a transparent recording of our insides. To counter this medical gaze, feminist scholars have argued that patients, especially female patients vulnerable to being deemed hysterical, should supplement a doctor's diagnosis with stories of their struggle with medical procedures. "Illnesses become narratives very quickly," Jackie Stacey writes in the opening chapter of her book *Teratologies: A Cultural Study of Cancer* about her experience with breast cancer, and how bodily fragility might form the ground for an artistic practice of storytelling.[30] Stacey's *Teratologies*, Vivian Sobchack's *Carnal Thoughts*, and Amelie Hastie's "TV on the Brain" are

all examples of reparative "working throughs" that try to address what it means to be positioned as a patient in an increasingly technologically saturated world of medicine, where the patient's voice is being largely replaced by increasingly advanced optical tools.[31] To add subjectivity to the diagnosis of the medical tests, they give the perspective of the patient to tell us what it means to experience disease and the politics of care as opposed to simply categorizing the pathogen that is making them sick. In other words, what is crucial to these women's health is to tell a far more embodied story than the ones given to them by their doctors. These strategies have been lifesaving; however, merely flipping who is in control of the narrative, from doctor to patient, has other obstacles. What if, for example, one is paralyzed, amnesic, or simply too exhausted to speak (all conditions for the women in Almodóvar's medical films)? How does the body, however fetishized by the microscope, push back against such a medical gaze? And what if patients are prone to paranoia or misrecgonition, such that their stories are just as riddled with bias?

Pedro Almodóvar addresses these questions in a series of films about extreme examples of hospital malpractice. We learn about the lives of female patients only through their doctors, who narrate their story and who, the audience eventually learns, have either abducted or raped their patients. Almodóvar takes some female patient's most paranoid fantasies of a doctors' sadism and literalizes it. In *Talk to Her/ Hable con ella*, the plot centers around a nurse named Benigno (Javier Cámara), who takes care of a paralyzed patient, Alicia (Leonor Watling), whom he was stalking before a car hit her. While he gives her excellent medical care, as the other nurses admit, audiences learn much later in the film, after we have already begun to sympathize with him, that he has raped the comatose Alicia—and she is now pregnant. Benigno is sent to jail and commits suicide, but unbeknownst to him, the comatose Alicia awakens during childbirth

(the child is lost) and the film ends with her returning to her life. In *The Skin I Live In/ La Piel Que Habito*, we follow a doctor named Robert (Antonio Banderas), who seems to be caring for a suicidal female patient, Vera (Elena Anaya). We see him trying to produce a genetically impenetrable skin to put on Vera to protect her from harm, and Vera tries to commit suicide multiple times in the first half of the film, so while the doctor is illegally experimenting on his patient, his actions seem to come from a potentially ethical place. Then the doctor's estranged brother comes to the house and, believing the patient is his former lover, rapes her. At this point, the diegetic narrative unravels, and the audience receives a series of flashbacks in which we find out Vera was previously a male clothing designer, Vicente, whom the doctor kidnapped and conducted a forced sex-change operation on as revenge. The film ends with Vera killing the doctor and escaping back to his previous life.[32] *Talk to Her* and *The Skin I Live In* have similar structures: in both, the audience learns much later on in the film, as a sort of betrayal to the audience's trust, that the medical professionals are committing sexual crimes on their patients, who are largely unable to protest.

It is this sexual betrayal that Linda Williams argues situates Almodóvar into the group of directors, along with Ang Lee and David Lynch, who in their films continually restage Freud's primal scene, in which audience members are consciously positioned to misrecognize the sex acts presented to them on screen. In a silent film inserted within *Talk to Her*, Benigno describes his account of watching this silent film, *The Shrinking Lover*, to the comatose Alicia. In the film, a man accidentally shrinks from taking an experimental nutrient potion his chemist girlfriend made. In his final act, the man—now only a few inches—climbs into his girlfriend's vagina, bringing her to orgasm, while staying "inside her forever." Only after multiple scenes, do viewers realize Benigno raped Alicia at the moment we were watching the man climb into her

vagina. Linda Williams writes how the scene "both reveals in explicit detail a phallic act of vaginal penetration while also screening out the violent and graphic coercion of rape that lies behind it."[33] The effect of this betrayal for Williams has the horrendous consequences of making the audience misrecognize a rape as consensual: "Almodóvar's portrayal of rape, to the contrary, *does* ask me, insidiously, without my even quite knowing it, to adopt a rapist's point of view."[34] The primal scene in *Talk to Her* thus generates paranoia for the audience precisely in the director's ability to trick the audience, insidiously, into accepting and even applauding sexual violence. The primal scene produces a visual logic: the male gaze of the medical professional, Benigno, literally materializes into a penetrating and violent act for his female patient.

For a scene described by Williams as the primal scene par excellence, it manages to confuse the audience's vision a second time. This is a scene, as in *Bug*, where the Freudian primal scene suddenly transforms halfway through into a molecular primal scene by adopting a specialized vision to look inside of the body. The screened-out rape does not occur during Benigno's retelling of the silent film, but rather in the shot afterward, when the camera cuts to a close-up of a lava lamp. In this shot, we are forced to watch as the red liquid of a lava lamp stretches outward against a yellow background, and having extended too far, then breaks apart into separate, smaller circles, only to fall back down in slow motion and recombine with the blog below. Why this long, contemplative shot of a lava lamp? The image of the lava lamp, unlike the silent film of Alfred entering his girlfriend, is far harder to read, far more ambiguous since it focuses on the movement of vibrantly colored circles, floating about in liquid in what looks like the images of our molecular insides. If this is a molecular vision—a representation of internal fertilization, the merging of a sperm cell and egg—then we are, like the engulfed Alfred, suddenly inside Alicia. If we follow the logic of the cuts, from Benigno looking intently at

Alicia, to the comatose Alicia's face, to the lava lamp, then whose point of view is the audience looking through when they stare at the lava lamp? Is this Alicia's internal vision, which Almodóvar claimed he tried to convey obliquely in the film?[35] The cut to the lava lamp brilliantly turns this Freudian primal scene of concealed rape and comical body parts into a far more ambiguous molecular primal scene of cellular division and then reattachment. The paranoia generated in this scene, therefore, is not about being fooled by the director into sympathizing with a rapist so much as it is about how, if at all, we are supposed to understand the status of these images that appear to represent something happening inside us, an internal vision that is different in identification and legibility from Benigno's molar gaze. Regardless of which image obfuscates the rape, the violence of the act certainly still stands, and the film purposefully elicits this feeling of betrayal; however, the move to the lava lamp—to Alicia's internal molecular vision—might be a moment when the audience can see outside of Benigno's totalizing vision. In a film where looks produce violence, Alicia's internal look serves as an acknowledgment that Alicia is in the act of self-repair (a splitting but then healing) even during her most vulnerable moments.

Almodóvar's *The Skin I Live In* restages the molecular primal scene of *Talk to Her* through the medical act of stripping a body of its identity and then rebuilding it, through molecular manipulation, into someone new. *The Skin I Live In* opens with a series of establishing shots, first of the town of Toledo, then of Robert's house, and finally the image of an unknown woman seen through the house's windows. Each of these shots is accompanied by an opening credit, which appears small on the screen but then grows in size, as if magnified by some unseen tool, until the letters are large enough to fill the width of the screen. The title of the film appears just below the woman as she stretches into a plank over her couch, her body fitted with a skin-

tight and skin-colored suit. The title's letters appear in blood-red ink surrounded by a white outline, what can only be described as the letter's outer skin, which holds together its liquidy, red interior. In this establishing sequence, the film spells out the aesthetic relationship of exposed and rigid bodies to a magnified vision. *The Skin I Live In* dramatizes the tension inherent in microscopic vision, what I have been calling in this chapter a medical primal scene, to name the aesthetic encounter one has with a previously hidden interiority, an encounter which is misrecognized as sexual violence.

The tension between molar and microscopic vision is not only metaphorically established in the opening title sequence but enacted in the following scene when Robert secures a package of blood from a maternity hospital and examines it, not coincidentally, under a microscope. Robert's lab is an architectural wonder of glass and brick. Like the tools in this lab—the beakers, petri dishes, syringes, and bottles—the walls are all transparent, supporting the principle of scientific transparency, of a complete openness to empirical vision that constantly spills into obsessive voyeurism. Looking into the black viewfinder, Robert then projects an image of the interior blood cells onto a video screen next to him. The film reproduces the visual structure of this examination each time Robert looks at Vera. Later, he will use this same method to keep Vera under surveillance, with a circular black camera installed on her wall that then projects her image onto a flat screen television in his room. In a scene that repeats the examination of Vera's blood, Robert watches Vera sleeping on a wall-sized screen in his room. With a TV remote, he adjusts the surveillance camera and zooms in and out over sections of her naked body, collapsing the distinction between camera and microscope. The empirical examination reveals a voyeuristic imperative of medicine that views the body fetishistically. Most of *The Skin I Live In* consists of

fetishistic close-up shots of the patient Vera's naked body, either lying in his room, practicing yoga, or displayed on an operating table.

Figure 2.3a and 2.3b: Microscopic vision in *The Skin I Live In*

The voyeuristic vision of the doctor, in effect, reduces the patient to a body with no vision. In her analysis of medical TV shows like *House, M.D.*, Amelie Hastie argues that the patient's vision and experience are displaced by the doctor's optic technology, be it an X-ray or MRI scan. In her own experience after undergoing surgery for a brain tumor, Hastie realized that the doctor trusted his imaging, which revealed no damage of her brain, over her experience of short-term memory loss: "Without others being able to see what I felt and knew, my own perception (in fact, my perception of myself, of the way my mind was working—in other words, my perception of my own ability to perceive) was challenged at multiple levels."[36] *The Skin I Live In* literalizes Hastie's experience of a censored self-perception by presenting most scenes of Vera with his head cropped out of the shot, severed by the frame.

Identical to the angle at which Robert stared down at the blood specimen in the microscope, the angle of these shots consists of an overhead first-person point of view, from the perspective of the doctor, staring down with his hands reaching out from the bottom of the screen. It is worth noting how this microscopic vision already embodies a certain structure of

seeing, in which Vera's body is more visible to Robert than to himself. Similarly, Robert is careful to remove all the mirrors from the house so that Vera is never able to see a full view of his transformation. Standing over his naked body, Robert sarcastically laments, "It's a pity you can't see your whole body." Vera expresses her frustration at being unable to see himself in his many drawings across his bedroom wall. The drawings are recreations of Louise Bourgeois's *Femme Maison* (1947) series, which depicts in minimalist ink and pencil drawings a woman's naked body with a house for a head.[37] Like the film's many mannequins, whose bodies are naked but missing heads, the naked bodies in Vera's drawings are exposed to the world but unable to see themselves. Vera's drawings express a sense of violation in that his body is more accessible to outsiders, more intimately known to Robert than to himself. The effect of this off-screen, voyeuristic medical gaze, therefore, is to produce its opposite: a patient that is all body and no vision.[38]

THE NEW FACE OF MEDICINE

While the doctor's voyeuristic vision blocks the patient's vision, new medical interventions make legibility of the body continually harder, even for Robert. In a lecture at his hospital, Robert explains the importance of face-transplants for patients who have suffered extreme burns and no longer can be recognized: "Our face identifies us," Robert explains about those who suffer from extreme disfigurement: "For burn victims, saving their lives is not enough. They need to have a face even if it is from a corpse. A face with features so they can gesticulate." Indeed, Robert is also referring to his past wife, Gal, who survived a disfiguring car accident but eventually killed herself after looking at her unrecognizable and scarred face in the mirror. We cannot live without some form of recognition, Robert reminds us, but his medical technologies

that restore this lost identity marker simultaneously suggest that we can never trust a face as a valid indicator of identity (faces are now transferable). In one scene, Robert's brother Zeca returns to his house after being caught on camera stealing jewelry at a store and hopes to kidnap Vera in hopes of having Robert give him a face transplant to avoid identification by the police. In a later scene, Robert himself dons a skin mask when he abducts Vicente in order to evade any witnesses who might recognize him. Through Robert's extreme skin transplants, he can fool recognition even by other senses besides vision, such as smell and touch. Robert's new skin, because it smells different from human skin, is unrecognizable to mosquitos, he explains at a science gathering, and therefore prevents all mosquito bites, thereby diseases like malaria.

In a subtle move, Robert shifts from championing transplants for those who have damaged faces to performing transplants on those who are completely healthy, all under the claim of preventing future diseases. However, Robert seems to forget his own lesson. When he encounters a scene of sexual violence between Vera and Zeca, he misrecognizes her for his wife Gal, whose face he has transplanted onto Vera. When Zeca returns to Robert's house in a tiger costume and rapes Vera, the whole scene is watched by Marilia, the housemaid, and then later by Robert on a screen similar to the one he used to view her blood in the lab. In an almost campy and yet violent version of the microscopic examination of red and blue blood cells, Zeca rapes Vera in a room strewn with red and blue yoga balls. Robert's previously privileged position as the agent of surveillance rebounds as a threat to his vision. He is not only forced to watch something he does not want to see (the masochistic consequence of a desire for complete surveillance), but he is still, despite all his technological vision, unable to recognize who is fucking whom in this scene (and who is to blame for it). Vera's physical resemblance to Robert's

wife forces him to relive his wife's previous affair with Zeca. Consequently, he finds himself aiming a gun at Vera, and not Zeca, when he goes to interrupt the rape.

In this moment, Robert is forced to confront an image he cannot decipher due to his extreme medical transplants and surveillance technologies: is this Vera or Gal, and since Gal had previously had an affair with Zeca, is it her desire or is she a victim of a violent rape? *The Skin I Live In* asks the same question of identity and desire that *Bug*'s Agnes asks about parasites in her bloodstream: now that everything is exposed due to new optic technologies, how will we recognize what we are seeing? In other words, exposure does not guarantee legibility, a point the film enacts with all its various backstories that might turn out to be possible fantasies. While the film's plot depicts Vicente forced into surgery by Robert, the narrative form throws this history into question. Vicente's abduction and surgery are presented as a flashback when Vera lies sleeping in bed, but what if this flashback is, as its origins suggest, just a dream? What if Vera fantasizes about previously being Vicente in order to justify her lack of sexual desire towards men? Up until the flashback sequence, Vera is a depressed and suicidal patient, whom Robert loves. Within the flashback sequence, however, we learn that Vicente is attracted to his female friend, Cristina, who informs him she is only interested in women (Vicente: "You're mistaken Cristina." Cristina: "Because I don't like men?" Vicente: "Because you don't like me"). At the end of the film, when Vera returns to Cristina in a now female body, there is a sense that they can finally be romantically together, suggesting that, if this is a dream sequence, Vera imagines a scenario in which she justifies her dislike of Robert, kills him, and then runs off to be with the women she desires. This reading would require that the audience see the film itself as unreliable, itself a paranoid narrative, and the exposure of Vera's backstory as potentially fabricated, not redeeming as we want it to believe. The film leaves open the question of Vera's consent by

presenting the abduction as a dream sequence with no way of verifying its authenticity. Therefore, audiences are left uncertain whether to view Vicente's bodily transformations as forced violence or as wish fulfillment.

The possibility that Vera's backstory may be a fantasy of sadistic medical figures and a forced gender swap, recreates Freud's famous case of Dr. Schreber, who produced a similar fantasy that his doctor (and then God) was trying to violate him, and then he realization that he would rather like to succumb to them as if he were a woman. From this case, Freud created his most influential theory of paranoia about, among other things, sadistic father figures who threaten castration, and the child (as in Schreber), who might seek it out: a type of repressed homosexuality that cannot be acknowledged, so it returns to the narcissistic child as the world conspiring against him or her.[39] Almodóvar restages this case study as a story of abduction and forced sex-change operation, but proffers a repressed transgenderism rather than homosexuality.[40] Robert's vision, like the film's dream sequences, may therefore expose various parts of Vera, but it runs the great risk of not knowing what it sees (or worse deceiving the viewer). As in Schreber's case study, the film's paranoia might be a product of this radical misrecognition of the difference between wish fulfillment and abduction, desire and victimhood.

The possibility of misrecognitions proliferates at the molecular level, as do the consequences of such a misrecognition. In many of the long lab scenes, we see Robert take the blood of a pig, separate its various components, including its DNA, and then combine them with human blood to create Vera's new, impenetrable skin: what Robert calls transgenesis, a process strictly forbidden by the medical community for ethical reasons, which he is clear to point out hamper the development of undoubtedly life-saving medical care. Through the microscopic image of her blood, we are given perhaps the most intimate image of Vera, and yet even at this

level we cannot ascertain which individual red blood cells are his or which have been mutated into pig cells, similar to the question of whether or not we can recognize microscopic bugs in Peter's blood. The molecular level erases the individual markers of identity from the body, and so this unrecognizable image of red blood cells, which look identical in human and pig species, opens the body to radical forms of exchange and transformation. Nikolas Rose sees the switch in medicine toward a molecular view as a successful effort to place the body into a new market economy:

> Molecularization strips tissues, proteins, molecules, and drugs of their specific affinities—to a disease, to an organ, to an individual, to a species—and enables them to be regarded, in many respects, as manipulable and transferable elements or units, which can be delocalized—moved from place to place, from organism to organism, from disease to disease, from person to person.[41]

With this new vision, bodies can take on different capabilities and uses. Robert can steal blood from both a maternity hospital and from a farm and mix them to create what many of the film's critics call Almodóvar's take on a modern-day Frankenstein.[42] *The Skin I Live In* portrays Rose's fear of a body exposed to the whims of the market with its twisted narrative of abduction, identity swapping, black market medical care, and genetic splicing. The radical instability of identity appears at the level of both diegetic story and formal framing since Robert psychologically substitutes Vicente for Gal, then Norma, and finally Vera, all revealed to the audience through flashbacks in reverse chronology, like the peeling back of various layers of skin.

If we do read the film, not as a modern-day Frankenstein, but a modern-day Schreber, in which Robert's plastic surgery would allow Schreber's fantasy of gender transformation to be realized, then such an opening up of the body to the market, with all its potential for exchange

and manipulation, might allow for a more personalized gender expression. At an extravagant wedding in the film, one of Robert's former patients approaches him with real praise: "Thank you. I owe this wedding to you," she says, and though Robert responds that regardless of the surgery her husband would still adore her, she admits, "Without your help, he'd adore me less." Molecularizaton, therefore, has the potential for an erasure of identity, but such erasure might, in effect, be freeing. In his essay "The Biopolitics of Pleasure," Tim Dean sees this molecularization of the body as an important moment to critique the reliance on a stable identarian politics:

> The fiction of our bodies as self-contained unities, marked by sexual division but nonetheless individually bounded, is particularly intransigent because it grounds all other identitarian illusions (this is the point of the Lacanian mirror stage)….Rather, it is a matter of recognizing—in the face of that most elementary self-recognition—how each and every ostensibly discrete human body contains multitudes or, put better, is multitudinous. The counter-recognition of radical bodily porousness, by registering our commonality and perpetual contact with others, enables vastly expanded possibilities for politics and for pleasure.[43]

Dean takes heart in exactly what Rose is most skeptical of: the loss of "specific affinities." Dean suggests that recognition, the scene of Lacanian understanding of the self, needs to be reworked through a microscope and not a mirror, where one can acknowledge one's multitudes on a petri dish as opposed to a singular, bounded form in the mirror. In other words, Dean sees the radical unrecognition of molecular vision as a way to open the body to more pleasures, not mutually exclusive with the new forms of governmentality. His conclusion, however, entails an almost impossible task: if our insides are unrecognizable, what part is recognized? His language of molecular looking is hypocritically filled with moments of recognition ("The counter-recognition of radical bodily porousness"). In addition, unlike his emphasis on the possible pleasures of this

new inside, the film shows us that seeing internally may be an almost exclusively painful and even self-destructive process.

What both Dean and Rose need to acknowledge are the formal, aesthetic, and cinematic qualities that allow us to see our multitudinous insides. They assume the microscope is a transparent record to molecular jouissnace, as opposed to a technology that frames the molecular through a particular lens. Dean's sense of the new "porousness" of the body highlights how the film juxtaposes the porous internal body, the ease for which Robert can mix Vera's cells, with Vera's smooth and poreless external skin, created through digital visual effects. As Carla Marcantonio explains when speaking of the scene where Vera's face is projected onto Robert's large TV screen, "No human face could elegantly withstand the high-definition close-up that Vera's countenance does, which betrays not the slightest imperfection....Anaya/Vera's skin, digitally enhanced during the postproduction process, is the result of a second transgenesis, an extratextual one overlaid on the first."[44] I would add, however, that the scene only starts at this molar level of the face but zooms closer to the TV screen to eventually show how Vera's smooth skin is still made of multiple, tiny pixels. In the scene, Robert does not just zoom his surveillance camera onto Vera's face, but also physically steps mere inches from the screen, breaking apart the cinematic allusion to reveal the technology of flashing dots. At this distance, Vera's face seems to crawl with pixels as if bugs were jittering under her skin. The effect of looking too closely, even at digital visual effects and seemingly smooth screens, breaks the image apart into tiny multitudes and give the skin a unique type of texture and pattern.[45]

PATTERN RECOGNITION: TACTILE EMBODIMENT

Returning to the microscope scene in *The Skin I Live In*, the process Robert uses to examine Vera's blood tells us how to read the film's other images. From an overhead shot, Robert pushes a solid, red liquid from a syringe onto a glass slide. Then, in a ground-level, medium shot, we see Robert viewing the slide in a microscope, and finally a close-up shot of a screen, where a flattened image from the slide projects a cluster of red circles amidst a blue and off-white background. The film associates the overhead-view shot of Robert looking down on a patient from an operating table with the microscopic image projected onto the screen, both of which flatten the image and remove depth. In *Screening the Body*, Lisa Cartwright describes how the microscope, from its early development, gives bodies a flattened aesthetic to provide clarity of vision. For Cartwright, this flattening aesthetic distances the microscopist from the subjective experience of the bodies they view:

> Placing a specimen on the instrument's stage and closing one eye to peer through the viewfinder, the microscopist sees the body in a manner that effectively distances the observer from the subjective experience of the body imaged. Excised from the body, stained, blown up, resolved, pierced by a penetrating light, and perceived by a single squinting eye, the microscopic specimen is apparently stripped of its corporeality, its function, and its history even as it serves as a final proof of the health, pathology, or sexuality of the subject whose body it represents.[46]

In this account, the microscopist sounds rather like the sadistic Robert, who "strips," "perceives," "penetrates," and "resolves" the body of Vera under the guise of making him more healthy or impenetrable to some future disease. Indeed, Robert's continual surgeries on Vera, while in the name of making Vera's skin more impenetrable, are a way for Robert to inflict daily pain on Vera as punishment for his potential rape of Robert's daughter, Norma. In short, the development of a new healing skin masks the motivation of inflicting pain. For Cartwright, the removal of physical depth in the image becomes metaphorical for the removal of history,

subjectivity and identity from the object imaged. It is not hard to see how Cartwright's critique of the flattening microscopic image adopts into the scientific register theories of visual fetishism, the ways women, as Cartwright specifically focuses on in her book, are presented as to-be-looked-at under new scientific optics, immobilized and turned into flattened and abstracted symbols. As fetishized objects, these specimens can then placate the doctor's anxiety, which in *The Skin I Live In* consists of Robert's dead ex-wife, who cheated on him with his brother. The fetishized object screens out the violence of this transformation, much like how the smooth dissolve of an editing effect depicts Vicente's transformation into Vera (the two actors who play Vera/Vicente, switch at the moment of this editing trick).[47] The danger of this transformation is clear in Cartwright's understanding of a flat aesthetic as an "obliteration of bodily presence and the signifiers of pain," and therefore the removal of depth as an ethical lapse in the viewer.[48] The logic of this visual fetishization suggests that without seeing pain, the viewer does not consider it, and therefore the effective solution to visual fetishization becomes purely a task of exposure.

Against the imperative to expose pain as the solution to holding Robert accountable, the camera's molecular vision questions how, if at all, audiences will recognize pain or violence when they do finally see it? What if, as we find out, Vera is rather good at faking both pleasure and pain? Instead, the film shows how exposure of depth does not lead to a clarity of vision and clear ethical critiques. Indeed, in one scene, Robert's fellow surgeon has figured out that Robert has abducted Vicente and conducted a forced sex-change operation on him. Vera walks into the room, and in a moment when he might have affirmed the surgeon's story and tried to escape, he instead comes out as a woman (disingenuously, we assume) using what is now the vocabulary for transgender self-definition: "If you're talking about me, Dr. Robert didn't kidnap me… I'm here because of my own will. And my name isn't Vicente, it's Vera. Vera Cruz. And I was

always a woman."[49] The name complicates Vera's affirmation of identity, since Vera means "truth" and Cruz means "cross," but put together they suggest a truth that is at odds with itself. The scene is devastating not just for how close Vera gets to freedom and then how purposefully he dispelled any possibility of doing so, but for the way it makes the audience question how self-identification and "coming-out," the language itself implying exposure, might be another form of lying. For Hastie and Cartwright, who both rightfully criticize the ways the microscope removes the patient's perspective, the solution may not be privileging the sudden exposure of hidden depth as inherently beneficial or healing for the patient.

The Skin I Live In offers a reparative way forward from the flattening aesthetic of the microscope that does not merely try to return depth to the subject under focus, but importantly supplements this flatness with a new emphasis on texture and patterns. The same structure of seeing as described by Cartwright—where a three-dimensional object is flattened by either an overhead view or a screen—continues throughout the film, even in scenes that have nothing to do with looking inside the body. In what might be the film's signature editing style, the film first starts with a ground-level shot of a character or space, and then cuts to an overhead shot of that same object but from a point of view that removes depth. As with the rape, originally seen on Robert's surveillance screen, the film also produces the flattening affect of the microscope by having Robert continually interact with a screened body, one turned from flesh into a flat surface to be gazed upon. In each of these scenes of overhead or screened bodies, the film shifts focus towards a sustained attention to texture and patterns that make up the objects and image in the frame. In the moment after Robert has killed Vera's rapist, the housemaid, Marilia, admits that Robert and Zeca were secretly brothers and she was also secretly both of their mothers: "I've got insanity in my entrails," she tells Vera. As is common in the film, the conversation starts with a

ground-level view of Marilia on the bloodied bed, only to then cut to an overhead shot that flattens the image into a shallow depth. However, this flattening allows the camera to focus and linger on the otherwise unseen texture and patterns in the frame, a red blanket, previously seen as solid red, but now visualized as patterned with many red subunits (Marilia is also cleaning up blood from the bed as if to further support the visual connection between the camera's downward gaze of objects and Robert's gaze at Vera's blood in the microscope). In the following scene, Marilia and Vera are conversing around a fire pit about Robert's ex-wife, Gal, who killed herself. The scene once again starts at a ground-level with the flames licking the bottom of the screen, but cuts to an overhead shot from what must be an omniscient point of view. The effect of the angle change is to move attention away from the Vera and Marilia towards the cobble-stone driveway, and see how it is made up of smaller subunits, providing a bumpy texture and a dotted pattern to the scene. The change in shot, from the viewer staring head-on at bodies foregrounded in the frame to the viewer staring downwards at bodies flattened into backgrounds, moves the scene from a molar to a molecular view, from the identities of the characters visible in the foreground to the patterns that form in the background.

Figure 2.4a and 2.4b: Flattened aesthetic in *The Skin I Live In*

Gal's death is similarly depicted in this dynamic: Gal's daughter, Norma, is seen at a ground-level view playing with a doll and kitchen set. The film never captures Gal's suicide via

jumping out the window, but it cuts to an overhead shot of Gal flattened by the ground that met her fall. The shallow depth of the overhead shot draws our attention to the patterned sheet, whose purplish gray and red design matches the bruised and bleeding skin of the dead woman. The fibrous grass mimics Gal's wrinkled and patch-work burn scars. Finally, towards the end of the film, Vera enacts her revenge on Robert by stealing Robert's gun under the guise of trying to find lubricant. After shooting Robert, Vera then kills Marilia who enters the room to find out what has caused the gunshots. The ground-level point of view of the scene then shifts to another overhead shot that flattens the bodies but emphasizes the patterns of the rugs, which were previously hidden behind the bed or below the screen. As with all the patterns and textures in the film, audiences are made aware of the smaller subunits—rectangles, circles, and lines—that make up the seemingly smooth object until they are appear up close. The overhead shot similarly reduces the two dead bodies of Robert and Marilia into a gravity-less dimension where they seem to float and circle about as if part of the rug's design. Through the focus on texture and patterns, the bodies in the frame become incorporated into a much larger and more elaborate pattern in the background: they dissolve the clear delineation of individuals to background within the frame, enacting Dean's molecular encounter in which the individual must learn to decenter their molar bodies from a sense of self by accepting their porousness to other people and objects around them.

In these shots of bodies transforming into patterns, the edits take on the structure of the microscope scene, and yet, the flattened image does not serve to "decorporalize" the body, as Cartwright suggests, but rather helps magnify the textures and patterns that make them up. With its emphasis on texture, the overhead shot gives us a far more tactile experience of bodies, fabrics, and backgrounds than the ground-level point of views, which focuses more on

conversation, facial emotion, and action, and are all focalized on a character (what is traditionally seen as giving "depth" to a character). The paranoid understanding of the medical gaze argues that the doctor's looks constitute a form of violent touching; by flattening out the patient, the microscopic image—as seen in *Bug* and *Talk to Her*—inevitably leads to the patient's physical penetration and suffering, which is then covered up (bug infestation in the guise of normal blood cells or rape in the guise of a silent film). *The Skin I Live In* initially starts with this paranoid narrative, in which Robert's microscopic vision of Vera's blood cells inevitably leads him to violently disassemble and restructure her cells and—as if to make the connection between doctor's vision and bodily violence even clearer, he pressures her to have sex with him. Later in the film, however, the microscopic vision becomes a reparative tool for Vera by showing how a focus on texture and pattern, two forms of vision that focus on "touch," produce a sense of embodied memory she can use for her escape. In her book *The Skin of the Film*, Laura Marks argues that film can capture other senses beyond the audio/visual by initially refusing to make a shot intelligible so that audiences respond through the other senses triggered by a haptic vision. For example, she sees a breakdown of the representation of a character in the film *Sniff* through a "tactical close-up" of the character's individual hairs on his scalp. This image, for Marks, requires the audience to respond in a far more embodied capacity than if they were to see him at a more recognizable scale: "Cinema itself appeals to contact—to embodied knowledge, and to the sense of touch in particular—in order to recreate memories."[50] Vivian Sobchack similarly explains that cinema is a technology that expands the audience's sensual engagement with an image in addition to giving that image a narrative meaning: "Meaning is not solely communicated through signs but experienced in the body. The phenomenological model of subjectivity posits a mutual permeability and mutual creation of the self and other."[51] As if

drawing from both Marks's and Sobchack's theories of embodied spectatorship, *The Skin I Live In* uses pattern and texture to dissolve the molar body and engage the audience in a tactile relationship with the image, returning the character's physical embodiment to an otherwise flattened image. To summarize, the molecular view gives up molar identification for a molecular embodiment. Therefore, instead of "distanc[ing] the observer from the subjective experience of the body imaged," as Cartwright writes, the microscopic vision in *The Skin I Live In*, as in *Bug*, is felt.[52] For this reason may be why both films center on their characters' fleshly sensations and the embodiment of their skin: in *Bug*, that uncanny feeling of bugs crawling under one's skin, or in *The Skin I Live In*, that feeling of being constrained, even imprisoned, by the thickness of one's skin.

The move from the individual identity of characters to the minute elements of texture and pattern leaves open the possibility of recognition across the bodies Vera has inhabited, as opposed to the singular body Robert has grafted onto her. I would call this "pattern recognition" for the ways it can make sense of large, shifting multitudes, not through individual identification, but by connecting patterns across them. This type of recognition is expressed most clearly in the final scene of the film, when after killing Robert and escaping from the house, Vera returns home to his friend and mother, finally having attained his freedom. Unfortunately, because Vera looks completely different, they do not recognize him. There is a heartbreaking moment when Vera, after five years of being away and imprisoned, finally sees his mother, but she stares blankly at him and then returns to her work. Vera realizes that no matter what story he tells them it will not be believable without more proof. In other words, his self-proclaimed identity is rendered useless at this moment because of Robert's extreme physical meddling. In what would otherwise be yet another moment of misrecognition in a film full of them, Vera is finally able to convince his

assistant, Cristina, of his past life based on, not coincidentally, his dress and its unique pattern: "Look, do you remember this dress? Before Casilda's wedding, six years ago, I said I'd give it to you just to see how it looked. You said if I liked it so much, I should wear it myself. At that moment we were alone, remember?" Cristina remembers, and calls over Vera's mother to tell her, both of whom have taken to solid color clothing since Vincente's disappearance, much like the shop, which is now adorned mostly in monochromatic dresses. Here, loss and memory are embodied as fabrics without patterns, a sort of emptying out of detail from the visual field resulting in a homogenous, opaque appearance. As Marks explains of cinema's ability maintain forgotten or "minority" cultures, the haptic vision of Vera's dress contains within it an embodied memory he can use to reassert a sense of self within a world where molar identity is either untrustworthy or unintelligible.

Figure 2.5: A blood-patterned dress in *The Skin I Live In*

Fittingly, Vicente's body appears as a floral dress, a material remnant from his former life, while his actual body has changed. This added textile is part of what the microscopic image brings into focus: a life teeming within what was previously a solid color. Once again, Vera's dress mirrors the microscopic blood examination scene when he approaches the store in the final

scene. As Vera enters the store his body is caught by the reflection on the shop window such that the flattened image of him in a floral dress is superimposed onto an all-red dress on display in the window. As in all the previous microscopic shots and overhead points of view, Vera's body is flattened and projected onto a glass surface; however, his flattened image quite literally adds another layer of texture and pattern (many circular flowers) to a dress that otherwise appears, with the naked eye, as purely, blood red. Recognition, in this scene, is about remembering a pattern as opposed to a molar body. The dress provides something of the embodied memory of the subject that Cartwright argued the microscope and Robert's surgeries should have removed by grafting over Vera's skin. It is Vera's/Vicente's embodiment at different stages in his life, represented by a variety of shifting fabrics and patterns, that produce his sense of self and not, as the title suggests, his singular skin. It is not about one skin breaking free of its entanglement form others. As I have argued elsewhere, while Vera is alienated from her skin, "audiences are forced to recognize these multiple overlapping layers as crucial to understanding Vicente's identity, not to separate out the 'I' from the skin, but to map the 'I's journey through different forms of embodiment."[53]Vera learns to see herself as the movement between skins, the similarities and patterns that connect different skins, not anyone skin itself: she ends with a molecular sense of multitudinous selves over a molar sense of a singular identity.

While *Bug* might be a horror version of Dean's molecular encounter—where both Peter's paranoia and molecular bugs infect her, causing her to commit suicide—*The Skin I Live In* might be a reparative version, since Vera, even after mixing with the identity of others, eventually learns to secure a sense of self through tactile embodiment. Though *The Skin I Live In* fades to black with a possible form of recognition and a reunion of Vicente/Vera with his family, there are still the end credits. Like the opening title sequence, the end credits highlight the film's

aesthetic interests in microscopes and the molecular inside, but provide one last twist, in a film full of them, by zooming in closer from blood cell to DNA. As the final scene fades to black, a spiraling DNA strand takes over the screen, constantly changing color as it twists, with the names of the cast and crew appearing over it. Is this vision paranoid or reparative? The twisting and then untwisting DNA strand in the credits embody the film's narrative twist, told from the perspective of the doctor, only to flashback to the beginning and tell the same story from the perspective of the patient, with each turn providing a different side on the same story.

21st-century films about medical paranoia make audiences consider the form and aesthetic of the microscopes, which characters use as a form of self-reflection on the power of the medical gaze, what I have been calling an updated version of Freud's primal scene for a molecular age. However, the microscope, which promises to tell us something about ourselves, to reveal our body's greatest secrets, instead shatter our sense of identity by showing how we are constructed of chaotic multitudes, an ambiguous image. Misrecognizing what these multitudes mean, characters project the image's violence onto the doctor who uses these tools, spawning narratives where a doctor's look materializes into bodily penetration and experimentation. The ubiquity of these scenes in contemporary cinema might signal that culture is trying to understand and respond to the aesthetic and formal fact that medicine largely sees and intervenes in the body at a new molecular level: molecules can be detached from a body, manipulated, and swapped into another without a clear indication of its effects on molar identity. It is enough to make one paranoid. In *Bug*, the only sense of peace comes with suicide, but as *The Skin I Live* shows, the solution to this new radical uncertainty of identity can come through interpretive practices of media, such as learning to see patterns across multitudes.

Notes

[1] Foucault, *The Birth of the Clinic*, 163.

[2] Renata Salecl, "Secrets in the Body: The Fantasy Structure of Genes and Brains" (School of Criticism and Theory, Cornell University, 2016).

[3] Foucault, *The Birth of the Clinic*, 135. See quote: "The medical gaze must therefore travel along a path that had not so far been opened to it: vertically from the symptomatic surface to the tissual surface; in depth, plunging from the manifest to the hidden; and in both directions, as it must continuously travel if one wishes to define, from one end to the other, the network of essential necessities."

[4] Foucault, 122. See quote: "Clinical experience sees a new space opening up before it: the tangible space of the body, which at the same time is that opaque mass in which secrets, invisible legions, and the very mystery of origins lie hidden. The medicine of symptoms will gradually recede, until it finally disappears before the medicine of organs, sites, causes, before a clinic wholly ordered in accordance with pathological anatomy. The age of Bichat has arrived."

[5] Foucault, 120.

[6] Mary Anne Doane, "The Clinical Eye: Medical Discourses in the 'Woman's Film' of the 1940s," *Poetics Today* 6, no. 1/2 (1985): 224.

[7] The microscope has a long and entangled history with cinematic and photographic technologies. Walter Benjamin credited photography as a technology capable of capturing minute details our naked eyes otherwise fail to consciously grasp: he called this the optical unconscious. Lisa Cartwright and Hannah Landecker both discuss the use of microscopes in early cinema of the 1910-20s, and I will turn to each of their observations later in the chapter to discuss how the formal qualities and promises of the microscope are not identically replicated in films that incorporate microscopic images. Similarly, in his chapter "Media Fantasies and Penetrating Vision: Some Links Between X-Rays, the Microscope, and Film," Yuri Tsivian examines the use of microscopes in earlier Russian cinema. This is an important history I hope to keep in the background of the chapter. "Media Fantasies and Penetrating Vision: Some Links Between X-Rays, the Microscope, and Film," in *Laboratory of Dreams: The Russian Avant-Garde and Cultural Experiment*. Stanford University Press: 1996.

[8] Cartwright, *Screening the Body*, 81.

[9] Benjamin, "Little History of Photography," 510–12. There is a lot more work to be done here in terms of understanding the role of how medical tools brought to visibility things that remained invisible, and therefore changed the patient's relation to the unconscious. For example, in his essay *Bareback Time*, Tim Dean discusses how there was a great deal of trauma when HIV first broke out, but the eventual diagnosis and imaging of HIV by medical science helped to mediate this previously unknown threat: "Biomedical technology's capacity to identify particular blood-borne viral antibodies offers a means of naming—and hence for bringing into

the realm of the knowable—what otherwise remains disquietingly mysterious" (91). "Bareback Time," *Queer Times, Queer Becomings*. SUNY Press: 2011, pp. 75-99.

[10] Cartwright, *Screening the Body*, 81.

[11] Rose, *The Politics of Life Itself*, 26.

[12] Cartwright, *Screening the Body*, 86.

[13] Foucault, *The Birth of the Clinic*, 163.

[14] Rose, *The Politics of Life Itself*, 12.

[15] *Fantastic Voyage*, Trailer (20th Century FOX, 2015), https://www.youtube.com/.

[16] Alberto Brodesco, "I've Got You Under My Skin: Narratives of the Inner Body in Cinema and Television," *Nuncius* 26, no. 1 (July 1, 2011): 206.

[17] To read more about sublimated inner space in *Fantastic Voyage* read Kim Sawchuk's "Biotourism, Fantastic Voyage, and Sublime Inner Space", in *Wild Science: Reading Feminism, Medicine and the Media*, edited by Janine Marchessault and Kim Sawchuk (London: Routledge, 2000), pp. 9-23.

[18] The solution is once again psychological, since the pilot learns to survive by helping build the confidence of the clerk. The clerk is then able to escape his capture and help the pilot escape his body before it is too late.

[19] Williams, *Screening Sex*, 224. See quote: "What they saw, I want to argue, amounted to an American primal scene in which a dark and nasty side of sex, a side long screened out of American movies, erupted into consciousness as the innocuous lyrics of a fifties love song about a girl's dress were transformed—in a way that only Lynch could do—into a sinister fetish."

[20] Sobchack, *Carnal Thoughts*, 75.

[21] Sobchack, 13. To show the intersubjective potential of film, Sobchack uses the example of *Bladerunner*, where an android says, "If you can only see what I have seen with your eyes" (120).

[22] In *A Beautiful Mind* and *Memento*, the characters are explicitly diagnosed; however, in *The Butterfly Effect*, *Spider*, *Donnie Darko*, and *Vanilla Sky*, the characters are undiagnosed, and the characters themselves seem unaware of what the audience is eventually meant to recognize as hallucination caused by schizophrenia. In all of these films, the characters weave paranoid stories of medical malpractice or underground conspiracies to prove they are not sick, but merely too close to the truth.

[23] This has been a common establishing shot at least since the 1960s. As one example, the 2005 film *Charlie and the Chocolate Factory*, which came out the same year as *Bug*, opened with a

similar establishing shot where the camera starts high up in the clouds and then drifts down through a factory, finally landing on the protagonist, Charlie, whom it will then follow for the rest of the film.

[24] Heath, "Narrative Space."

[25] See films like *Vanilla Sky*, *The Shinning*, *Black Swan*, *Split*. All of them have a key mirror scene where the character looks into the mirror and his or her reflection reveals their alter-ego.

[26] Multiple images in the film shake, duplicate, and then dissolve into bugs. In this case, the bug is a praying mantis, infamous for how the female praying mantis will consume the male during sex if she is malnourished to ensure she has enough nutrients to produce offspring.

[27] The low-quality microscope presented in the movie would never be able to see the image of blood cells, suggesting that the production team instead used a stock footage from another, much higher-powered microscope, to put in this scene.

[28] Rose, *The Politics of Life Itself*.

[29] Roger Ebert, *Roger Ebert's Movie Yearbook 2009* (Kansas City: Andrews McMeel Publishing, 2009), 85.

[30] Jackie Stacey, *Teratologies: A Cultural Study of Cancer* (New York: Routledge, 1997), 5.

[31] Hastie, "TV on the Brain," 219.

[32] From here on, I will be using the male pronoun to refer to Vera and Vicente.

[33] Williams, *Screening Sex*, 217. This film within a film, *Shrinking Lover*, where Alfred is miniaturized and then dives into his lover's vagina, is another instantiation of the recasting of *Fantastic Voyage* film into abject terms instead of sublimated wonder.

[34] Williams, 218.

[35] Pedro Almodóvar, *Talk to Her*, DVD (Culver City, CA: Sony Pictures Classics, 2002).

[36] Hastie, "TV on the Brain," 221.

[37] Louise Bourgeois, *Femme Maison*, 1947, ink on paper, 1947, New York: Solomon R. Guggenheim Museum, Art Tattler.

[38] Zachary Price, "Skin Gazing: Queer Bodies in Almodovar's The Skin I Live In," *Horror Studies* 6, no. 2 (2015): 305–16.

[39] Sigmund Freud, *The Schreber Case*, trans. Andrew Webber (New York: Penguin Books, 2003), 62. For a more comprehensible reading of Freud's use of Schreber to explain paranoid delusions, see Ellis Hanson's "Technology, Paranoia and the Queer Voice." *Screen* 34, no. 2 (July 1, 1993): 137–61.

[40] In his analysis, Freud's accounted for Schreber's transgenderism, not just homosexuality, since he acknowledged that Schreber wanted to succumb to them as if he were a woman. Similarly, in reading Freud, Lacan called the Scheber case a moment of "transsexual jouissance"; however, neither readings seem to fully account for Schreber as someone who is transgender the way *The Skin I Live In* makes it explicit, partly perhaps because the language and understanding of transgenderism today would be anachronistically applied to Freud's time. In *The Skin I Live In*, Vera's possible desire to fabricate a story of a forced sex change operation (and drafted skin) could displace any of the concerns and questions of transgenderism onto others another person.

[41] Rose, *The Politics of Life Itself*, 15.

[42] Alessandra Lemma, "A Perfectly Modern Frankenstein: Almodovar's The Skin I Live In (2011, Sony Pictures Classics)," *The International Journal of Psychoanalysis* 93 (2012): 1291–1313.

[43] Tim Dean, "The Biopolitics of Pleasure," *South Atlantic Quarterly* 111, no. 3 (June 20, 2012): 490.

[44] Carla Marcantonio, "Cinema, Transgenesis, and History in The Skin I Live In," *Social Text* 33, no. 1 (March 2015): 49–50.

[45] Carla Marcantonio argues that the construction of identity through transgenesis shifts how audiences must think about molar identities: "Identity, along with biopower, recedes into territories that evade visual representation and whose mechanisms are increasingly understood as atomized—thus the recent interest in affect and temporality as modes of addressing new formations of identity, one that depends as much on relationality as on a bounded individuality" (52).

[46] Cartwright, *Screening the Body*, 83.

[47] Almodovar's use of two separate actors to play Vicente and Vera suggest that, for however good digital visual effect might be for making Vera's skin look smooth, they can only do so much to account for gender. If digital visual effects could transform the body completely, then why wouldn't the film stick to one actor (as an example of a film that does this, perhaps unsuccessfully, look at *The Curious Case of Benjamin Button*)?

[48] Cartwright, *Screening the Body*, 93.

[50] Laura U. Marks, *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses* (Durham: Duke University Press, 2000), 129.

[51] Marks, 149.

[52] Cartwright, *Screening the Body*, 83.

[53] Price, "Skin Gazing: Queer Bodies in Almodovar's The Skin I Live In," 315.

Chapter 2: Hypervisibility in *Contagion*: 3D Modeling and Outbreak Narratives

Outbreak narratives center around two crucial arrivals: the arrival of a deadly pathogen into an unsuspecting population, followed by the arrival of an image of that pathogen as a means to combat it. As many of the characters in these outbreak films will claim, the first step in finding a vaccine is to isolate and then image the virus. Two-thirds into the film *And the Band Played On* (1993), many people had already died from what would be called the AIDs virus; communities had gathered in public meetings but were now resting in their homes; friends and loved ones had learned to mourn; and health officials had closed down bathhouses. The science researchers had made little progress on an anti-viral drug, since the virus was still not imaged—until a group of scientists in a French lab finally captured a photograph of one. Staring over a microscope, one of the researches proclaimed, "Here it is…Your virus. What you have found is a new retrovirus!" Soon after, the film's narrative assumes momentum again, as if the discovery of the image had, in effect, moved the characters out of a stupor. The film cuts to news reels of protesters putting pressure on Congress for more research funding, and then to the Secretary of Health and Human Services promising that "within six months a blood test will be available." In short, the image itself was a type of cure. This scene of visual emergence remains a popular trope in outbreak films, and it highlights the stake film in general has in making the molecular body visible. Steven Soderbergh's 2011 film *Contagion* is a bold reimaging of the imperative to make things visible in outbreak films. Counter to the microscope, which isolates the pathogen and creates a visual encounter between scientist and pathogen as seen in *And the Band Played On*, the 3D modeling used to image the virus in *Contagion* focuses on the points of connection and integration

between pathogen and the host cells, making it hard for scientists to see the virus as a separate entity. The inability of the 3D model to isolate the virus from the cellular networks of the body mirrors the film's structure—called a "network narrative"—which is composed on many storylines of characters that overlap and connect at different moments (in *Contagion*, there are eleven main characters and ninety-seven scenes, with an average length of a minute per scene). By focusing on points of connection and integration, the film bypasses a sense of paranoia generated in the search for the virus's singular origins; however, the film ends by acknowledging how the viral, in its integration with the lives of the characters, has become an essential component to the revival of other networks (health institutions, commerce, and media).[1]

Since outbreak films often center their narratives around making molecular threats visible, the tools or visual effects these films use to portray the molecular comes under intense scrutiny by the characters and audiences alike. How can audiences trust an image that cannot be verified with their naked eye? In other words, because the virus is too small to be seen without magnification, how do we know what is artificial and what is accurate? Such indexical uncertainty is at the center of outbreak movies. In her book *Cinematic Prophylaxis*, Kristen Ostherr confirms this observation by noting how the outbreak film works by oscillating between indexical (microscopy) and artificial (maps, animations) modes of representation to capture the spread of contagion.[2] She looks at two types of outbreak narrative: public health films and popular post-WWII Hollywood productions, which promise visibility (what she calls "total health surveillance") in order to shore up national borders: "the same anxiety that drives health surveillance organizations in their frustrated attempts to represent contagious disease is reproduced in the organizations' privileging of film as the medium whose unique ability to capture 'the real' will enable the elusive invisible to be visualized."[3] Ostherr shows how instead

of seeing an indexical image of a virus, the audience is presented with an artificial stand-in, like the trope of a large map with multiplying red dots, which acts to increase the paranoia of disease spread without actually visualizing viral transmission. Such artificial stand-ins are dangerous because, while the virus stays invisible, its damaging effects are projected onto far more visible agents, usually racial and sexual minorities, immigrants, or, in the case of the Cold War, potential communists hiding in America.

Why does Ostherr see the sexualized or racialized bodies in the films as indexical and not the images of the virus, what she calls the "indexical representation of the body and the impossibility of visualizing potential threats to that body's integrity"?[4] In the book's analysis of the 1995 film *Outbreak*, in a scene where virologists analyze an electron microscope image of the Ebola virus, she argues that the key distinction is what is visible "to the naked eye":

> The notion that the location of the virus can be pinpointed with electron microscopic precision—as it is in *Outbreak*—would seem to fulfill the world health fantasy of total surveillance, and yet, the virus remains invisible to the naked eye. From this perspective, digital imaging is merely another technology of representation, like cinema, that can temporarily enhance the visual field but cannot fundamentally alter perception.[5]

Ostherr makes a strong case for how digital imaging reinforces indexical questions by offer to fulfill the fantasy of "total surveillance"; however, the emphasis on the "the naked eye" might be problematic. If the naked eye is the standard, does it matter that there is such a wide range of vision between people? In addition, the standard of the naked eye would also characterize most vision as suspicious considering the ubiquity of everyday artificial enhancements and magnifications, such as glasses, contact lenses, artificial lighting, magnifying glasses, binoculars, telescopes, cameras, and screens. Ostherr ends by equating digital imaging of the virus to the effects of cinema at large—both are enhancements to the visual field. I agree, but such an

argument would then question her previous distinction between the visual effects of viruses and the indexical "realness" of bodies as fundamentally different in their cinematic representations.

As Ostherr suggests, advancements in digital visual effects might only serve to reinforce a fantasy of total vision. Addressing digital imaging at the turn of the 21st century, Caetlin Benson-Allott describes a shift in what cinema can now make visible: "Advancements in CGI enable convincing depictions of things impossible to see in everyday life: dinosaurs, hobbits, viruses. It has become necessary to speak of 'hypervisibility' to describe the way movies can realistically render such previously hard-to-envision phenomena."[6] She is talking about Steven Soderbergh's 2011 film *Contagion*, which realistically displays the outbreak of a fictional pandemic by incorporating computer-animated images of the virus's structure and digital surveillance footage of its transmission. While hypervisibility speaks to a larger trend in contemporary filmmaking, where movies have increasingly relied on computer-generated images to bring to life previously unseen phenomena, hypervisibility plays a specific role in the outbreak genre, since capturing the virus on screen is akin to halting its movement and solving its mysteries. In accounting for the narrative drive to discover an image, Priscilla Wald points to the way outbreak narratives, across the 20th century, use the structure of detective fiction, where a heroic scientist must first reveal the image of a hidden virus in order to unravel its insidious crime.[7]

Such hypervisibility promises viewers the ability to see viral transmission from two previously impossible scales: both the molecular scale of viral invasion into cells, and the global scale of viral transmission across large populations. The use of CGI to image large-scale transmission will be the subject of my next chapter on digital zombie hordes, but this chapter will look at outbreak films that focus, even if for just one scene, on imaging small-scale viruses.

Contagion, perhaps more than any other film, embraces digital medical image to provide a unique degree of hypervisibility, not simply making previously-hidden microbes visible, but showing audiences the virus from all angles. Not satisfied with merely providing a CGI image of a virus, *Contagion* gives us a 3D model that is made to withstand intense visual scrutiny and examination. Such promises of hypervisibility, however, have produced an equally strong backlash in academic scholarship about the limitations of vision in outbreak narratives. Scholars aim to unpack the ways these films fail to live up to their promises, or worse, purposely try to manipulate images of viruses for ideological purposes. *Contagion*, in particular, has become a petri dish for testing out such challenges to hypervisibility.[8]

There is a scene early in *Contagion* that consciously stages the potential of hypervisibility to produce such visual limitations. We follow Dr. Sussman, a San Francisco virologist, as he goes to a bar for some food, only to find himself disturbed enough to return back to his lab. In the bar, he hears a cough somewhere in the room and looks around for the culprit: a woman desperately grabs a cup of water; a bartender yawns into his hands and returns to wiping dishes; a mother feeds potato chips into her daughter's mouth and then touches her own glass. These quick cuts are accompanied by an eerie soundtrack of string instruments. In the absence of a magnified vision, Dr. Sussman sees transmission everywhere, in every touch, on every glass. This is the paranoia produced by seeing what one of the characters in the movie describes as "fomites," the surfaces pathogens require to transfer from one person to the other. Since the virus is left off screen, everything, even innocuous exchanges, becomes tainted with its invisible possibility.

In her article "Out of Sight," Caetlin Benson-Allott reads this scene as displaying the limits of visibility for both Dr. Sussman and the audience. The article distills the second

challenge to hypervisibility. Benson-Allott articulates a strong critique of the movie's obsession with digital imaging, and the way such a focus belies other factors now relegated off-screen: "However hard they look, their screens reveal only biological explanations for the epidemic. They inevitably exclude macroeconomic and social forces, which are even harder to picture than the microscopic disease but causally every bit as important."[9] Benson-Allott's critique draws from a Marxist reading of object fetishism: the spectacular and vibrantly colored digital images of the virus conceal the social and economic components that allowed the virus to emerge into the human population. What this visual sleight of hand produces is a spectatorial experience of always searching for the real culprit somewhere off screen, just out of sight, a paranoid relation to viewing that outbreak narratives cultivate in their audiences. Brent Bellamy, citing Benson-Allott, reiterates this point using the language of a tug-of-war game between the visible and invisible: "If the world is now a fully global one, then *Contagion* reminds us that it is a fully capitalist one, too, but in such a way that implies we look to the absences for explanation, rather than what is made entirely, accurately visible."[10] While they rightly detail the dangers of using a single image to explain a complex phenomenon, these readings simultaneously reduce the visible to mere visual trickery, which the audience must then discard for other invisible factors. These arguments might adopt Dr. Sussman's paranoid searching as he sits in the bar, but for the movie tries to overcome these visual limitations.

Let us return to the scene with Dr. Sussman: his inability to see the virus did produce a paranoid searching, a frantic zooming in on the empty spaces and shared objects that could harbor invisible pathogens. But in the very next scene, motivated to resolve this paranoia, he successfully images the virus he was previously unable to see with his naked eyes. The key, we learn, was a fetal bat cell lung that could survive the virus's growth long enough to image the

virus's full life cycle. The image he produced, now shown on multiple screens, is the first major breakthrough towards developing a vaccine. After this point in the movie, once the virus has been imaged, paranoia is no longer the predominant affect, and Dr. Sussman drops out of the narrative completely. There are no more shots from the camera looking closely at surfaces or objects to imply possible fomites; instead, the movie shifts focus to how the emergence of the image of the virus produces new social and economic questions: who should see it? Who gets credit for the image? How are they compensated? Who will use it productively? How much money and time will be needed to translate the image into a viable vaccine? After seeing Dr. Sussman's image, Dr. Ellis Cheever, the director of the CDC (Center for Disease Control), lists these concerns about distribution, credit, and compensation. Snapping his fingers, he asks,

> Dr. Cheever: He's gonna publish. Shit. What does he want?
> Dr. Hextall: Ehhh, a box of cigars. He had a choice Ellis. He could have gone into business for himself. There is no doubt he was approached, but he gave it to us.
> Dr. Cheever: Are we supposed to trust him?
> Dr. Hextall: We don't have a choice.

For the rest of the movie, *Contagion* illustrates how these images circulate through private and public institutions, how they are interpreted, used, and abused by different viewers. After Dr. Sussman shares the image of the virus, the movie gives a montage of the various different people and institutions who will now use it: pharmaceutical companies, government officials, health agencies, news stations, and other labs.

While the digital imaging of the virus conceals other socio-economic factors, *Contagion* dramatizes how the creation of the image itself produces an entirely new set of socio-economic factors that are just as important. Instead tracking the spread of the virus, the film switches to tracking how the image of the virus spreads, and we soon learn that these digital images travel through communication networks in uneven and socially determined routes. Instead of

generating an image of the virus that reveals the socio-economic components of the virus's origins, *Contagion* shows how the image of the virus, like the virus itself, is more impactful in how it travels through and across places and, in this case, screens. In its focus on the sharing of the image, the film views not just the virus, but the scientific methods of fighting it, in terms of networks.

EMERGING IMAGES

Outbreak narratives address how medical images of viruses and bacteria, usually relegated to scientific discourse, emerge into public consciousness and engender new social anxieties. The invention of the compound microscope in the 17th century launched the field of microbiology, but as I will detail in the next chapter, it had the effect of shifting the focus of medicine a decade later from diagnosing symptoms to examining the microscopic pathogens that caused them. This shift from patient to pathogen had a psychological effect on how patients viewed their bodies and the doctors who treated them. In the late 19th and early 20th century, though decades of improvements allowed compound microscopes to increase in resolution, they were limited by their use of light, as outlined in Abbe's formula, which barred them from seeing structures of less than half a micrometer.[11] A new tool, the electron microscope, surpassed this limitation. First developed in the 1930s, though only put into production after World War II, the electron microscope provided a higher resolution image than the light microscope by using a beam of electrons guided by magnetic lenses. The electron microscope not only allowed biologists to see smaller structures, to the level of 1 nanometer resolution by the 1940s, it also endowed previously imaged organisms with a new level of texture and shape.

The electron microscope's ability to visualize texture and shape proved a crucial turning point in outbreak narratives that used these images to instill a specific affective relationship between the virus and the audience. In one scene in *Outbreak,* which *Contagion* will restage sixteen years later, characters use an electron microscope to image an Ebola-type virus that has just emerged in Zaire, Africa, and which will eventually reappear, to the military's horror, within a small California town called Cedar Creek. As Major Salt scrolls through images captured on the electron microscope, the camera zooms in on the computer screen he is looking at, until the image fills up the entire frame:

> Salt: K Sir, here we go. Now we see them individually, searching for their next victim until there is nothing left to kill.
> Casey: Mark this day, Salt. We could spend our whole careers waiting to see a new virus.
> Salt: Sirs, Mr. Motaba up close and personal.
> Casey: I hate this bug.
> Sam: Come on Casey, you have to love its simplicity. It's one billionth our size and it's beating us.
> Casey: What, do you want to take it to dinner?
> Sam: No.
> Casey: What then?
> Sam: Kill it.

Figure 3.1a and 3.1b: A pathological encounter in *Outbreak*

As Major Salt explained in his remark that "now we see them individually," the electron microscope is particularly good at isolating an individual pathogen from the infected tissue. Through this individuation, the scene of looking is staged as a meeting between a single virus

and the team of scientists, who marvel at the virus's danger and simplicity, and even joke about it as a deadly lover. This "meeting" presents the virus as in the room with them, as equally indexical to that time and place as the scientists staring back at it. The reverse shot parallels their composition, with the scientists in all-white robes, heavily contoured by a side light that outlines their bodies in black shadow, similar to the white interior of Mr. Motaba and his shadowy outer protein layer. This very first visibility of the virus allows the movie to characterize the virus as a foe of equivalent strength as the team of scientists. However, the electron microscope's individuating image simultaneously makes the virus vulnerable to a variety of personifications, of both racialized and gendered bodies, which the movie mobilizes to show how the scientists must (and will) overcome this new threat for the benefit of a fundamentally discriminatory concept of American safety. As Kristen Ostherr notes, this scene personifies the virus as a racialized phallic image that embodies the anxieties of both an African and homosexual penetration into the American West.[12] As Major Salt explains as he goes through the slides, the virus penetrates the cell: "one goes in, millions come out." The same process finds its visual parallel in the narrative when a single African Capuchin monkey illegally enters a small town in California through a naïve American worker, and threatens to cripple the nation from the inside.[13] Like the electron microscope, the solution is similarly to isolate the virus: the army can quarantine the small town and then bomb it to ensure the health of the rest of the country, as if it were amputating a diseased limb.

In restaging *Outbreak*'s famous "meeting" scene between scientist and virus, *Contagion* shows how a change in imaging produces a different affective relationship to the virus. *Contagion* does use the electron microscope for one image of the Mev-1 virus, created by Dr. Sussman. However, the electron microscope is not even given a full screen image in

Contagion—it is relegated to smaller screens, to laptops, to sides of the frame during conference calls. We can barely make out this image, and unlike *Outbreak*, the movie never zooms in on an isolated strand. Instead, *Contagion*'s main examination of the virus comes from Dr. Hextall and Dr. Cheever using DNA sequencing and protein modeling, two new imaging techniques that have revolutionized microbiology to the same extent that the electron microscope did. In their CDC office, the two scientists discuss the images of the Mev-1 virus.

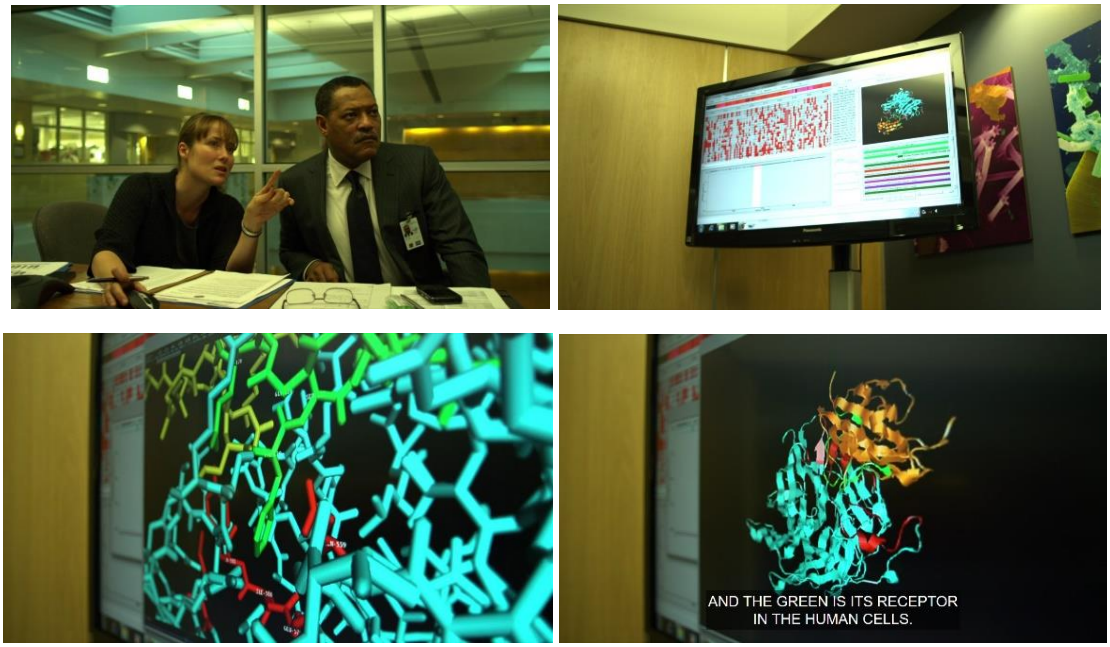

Figure 3.2a-d: A networked vision in *Contagion*

Different from Major Salt encounter with a static, microscopy image in *Outbreak*, Dr. Hextall interacts with a three-dimensional model of the Mev-1 virus by rotating it in different direction, so as to show Dr. Cheever all the various "receptors" the virus uses to attach itself to the cells of the human host.

> **Dr. Hextall:** Here is a model of the virus and how it attaches to its host. The blue is virus, the gold is human, and the red is the viral attachment protein. The green is its receptors in the human cell. These receptors are found in the cell of both the respiratory track and the central nervous system. The virus attaches to the cell like a key slipping into a lock.

What a surprising word—*slips*—as if the virus's primary goal, instead of attacking the host, was to initiate a well-lubricated and painless intercourse with it. Dr. Hextall uses a similarly phallic metaphor as Salt's penetrating Mr. Motaba, but the metaphor here is not one of destruction, but of seamless connection. Dr. Hextall never says the word "kill" as either the goal of the virus or the virologists fighting it, and her extensive listing of colored links in the model's network shows that the main challenge of this virus is in trying to differentiate it from the human host with which it integrates. Protein modeling, with its unique ability to visualize connections, as opposed to isolated strands, therefore encourages a different affective understanding of the virus. The body is now portrayed as a network the virus has "slipped" into and become inseparable from.

As we will see later in the movie, if the body is now networked, the danger is when the virus interrupts its different connections, what is thematized in the body as the breakdown of communication between body parts, and then paralleled at a global scale with the breakdown of communication between different health agencies and the public. In this scene, the movie gives us a model of hypervisibility, what I associate in this movie with a specialized 3D vision in which all angles are examined. By seeing the invisible microbes from all angles, however, the effect is not always a clearer understanding of them; rather it confuses our ability to differentiate between organisms, to delineate and separate out, in this case, virus from body. The viral is a threat to vision, not in its sudden dangerous visibility, as previous scholars have claimed make the virus seem like an invading threat, but in its ability to integrate, to become indistinguishable, to create visual confusion by erasing autonomy. This change in viewing the virus from killing to integrating, from an isolated agent to series of links in a larger network, shifts how the CDC must approach defeating it. *Outbreak* is clear in its military analogy of seek and destroy: the goal is to "kill it." But in *Contagion*, Dr. Hextall must take a different approach, which she explains to

another government official: “Until we can grow it, and a great deal of it, we can’t experiment with it.” The very solution to the virus is, ironically, to figure out how to grow it, and then further integrate it into the system, so it infects the host without getting them too sick—what the movie will describe as the process of live attenuated vaccination. The solution is therefore not a removal but a more thorough integration that smooths out any of the interruptions the virus may cause to the system.

The emergence of these new forms of medical imaging in *Contagion* support the movie’s claim to scientific accuracy. The question of the movie’s accuracy is intertwined with the realism of the image, and yet these images are only half accurate: they are obviously inaccurate in their color and geometric shape to what a virus would look like through an electron microscope, but this exaggerated appearance helps Dr. Hextall accurately depict how the virus requires a connection with a certain part of the cell before it becomes pathogenic. The change in viral imaging as presented by *Contagion* raises the question as to whether, if at all, audiences should place these images under the category of realism. In all its promotional material and in all its reviews, *Contagion* was singled out and praised for its realism, its sheer scientific cool-headedness in depicting a viral outbreak as it would play out in the models epidemiologists (in particular, Dr. Lipkin, a scientists at Columbia University) and other health officials have constructed.[14] The *British Medical Journal* even reviewed the movie in an article titled “An Outbreak of Scientific Accuracy,” where the authors congratulate Soderbergh on directing the only outbreak movie to get it right: “A film about an outbreak of a new infectious disease pleasantly surprises Gavin Yamey and Jimee Hwang: it’s one that finally gets the science.”[15] The authors’ pleasurable surprise at watching the movie quickly gives way to the overall “power” of the film to stimulate a far more valuable response: “Above all, *Contagion* is a powerful reminder

of the importance of sustaining public health investments."[16] In fact, many high school and university classes on public health have screened *Contagion* to think through what a contemporary outbreak would look like and how best to respond to it.[17] Scientists, including those hired as consultants to the film, see *Contagion* as a necessary public health announcement to stimulate reinvestment in the CDC (the CDC did receive an uptick in donations after the movie exhibited in theaters). Because of the film's realistic depiction of a modern-day outbreak, *Contagion* shifted in function for many viewers from being a type of entertainment to serving as an almost public health documentary. In one of the press conferences after the movie's screening at the Venice Film Festival, Soderbergh discussed his first initial meeting about *Contagion* with scriptwriter Scott Burns in this vein: "All of the science had to be accurate. All of the scenes in which the virus was discussed, was shown visually, had to be absolutely realistic and plausible, otherwise we felt we weren't advancing our ideas very well or contributing to this genre very well."[18] Soderbergh's own investment in the realism of *Contagion* shows how he uses scientific accuracy to differentiate the movie from others in its genre. By advertising the movie's heavy-handed use of scientific imaging, Soderbergh asks audiences to develop a different relationship to this outbreak narrative—not one of fantastical embellishments about the potential for viral transmission to lead to an apocalyptic future, but as a simulation of what could happen today.

Instead of simply showing us what is "absolutely realistic" and discarding all fantastical embellishments, the movie pulls off a difficult feat that more public health-focused productions often fail to do, which is to bring such fluorescent models of the body into the register of realism. There is an inherent visual disconnection between Dr. Hextall's protein models and the bodies visualized on camera. The movie works to connect them by creating a continuity between the

aesthetics of the computer models and the far more "realistic" images of faces and sickly bodies that we are used to identifying with on screen.

In the movie, humans, once infected, take on fluorescent and abstracted shapes, are kept in a shallow depth of field, and are shot from a variety of angles, as if they now functioned like the 3D protein models framed by an empty background. During her first days of infection at the casino, Beth Emhoff looks as if her head is one link in a chain of fluorescent nucleic acids forming a DNA strand above her; as John Neil leaves the bus, the background turns florescent blue and his darkened form makes him look trapezoidal; the unnamed Ukranian model in the opening scene dies in her hotel room, and suddenly we see her face sandwiched between two florescent, yellow blocks, with her reflection on the tile floor producing an image of a doubled head, as if seeing her face from two angles in one shot; once dead, Dr. Mears is wrapped in a florescent blue body bag and the close-up shot again reduces her body to an abstract shape against a shallow and solid background. To put it simply, in *Contagion*, acquiring the virus makes one become infected by the aesthetics of the fluorescent viral models that seem plucked from one of Dr. Hextall's conference presentations.

Scholars have named this unusual aesthetic in *Contagion* "digital realism" for the way Soderbergh visualizes the world using the unique effects of the digital Red One camera. Without being corrected in post-production, images from these cameras show a natural lighting that through the camera looks overexposure, which nonetheless might better resemble how we see the world today through our phones, computers, and other digital technologies:

> Prominent in recent Soderbergh films shot with the Red camera is what Hunt calls "a harsh florescent hue . . . with blurred indistinct images, brimming with the lifelessness of digital processing." This look is created by Soderbergh's use of natural light, which paradoxically "emits an unnatural glow most directors would remedy [in postproduction] as to give their film a more 'realistic' look." Hunt calls this unaltered image "a new sort of realism, one that strives to depict the world as captured by the Red One."[19]

While Soderbergh creates this aesthetic in many of his later films, his use of it in *Contagion* amplifies the effect when juxtaposed with the scientific images he wants to render, as he claims, "absolutely realistic." Soderbergh's digital realism explains why images of the virus are all quarantined to digital screens or monitors in the movie.[20] Unlike other outbreak narratives, there is no moment when the camera suddenly zooms in between characters and magically sees a viral transfer (i.e. *Outbreak*). In restricting this impulse, the movie maintains a realism in that it sees only what its characters can see. All images of the virus must be viewed in line with the scientists' vision—on a computer screen. Yet, this does not dismiss such fluorescent images as purely detached from the characters' world; instead, through an aesthetic leakage, the movie bridges these fluorescent models with those bodies outside of the screen. The leakage works both ways: the movie's own frames are so saturated with monitors and screens, sometimes with three or more in a single shot, that they do not quarantine the digital images as much as show how such images start to constitute what it means to see in a modern setting saturated with technological assistance. Therefore, realism in the digital age may require us to accept a rather fluorescent aesthetic. Throughout its narrative, *Contagion* eases the audience into accepting these computer models, with their fluorescent colors and geometric shapes, as accurately representative of their insides.[21]

If the accuracy of the protein model is based on its ability to highlight the areas of connection between the virus and its host cell, then Dr. Hextall's second form of imaging, DNA sequencing, characterizes these connections by their particular order. As Dr. Hextall tells Dr. Cheever that they are dealing with a novel virus, one never before seen, she shows how it was created through a unique sequence of mixed DNA:

> **Dr. Hextall:** We've sequenced the virus and modeled the way it enters the cells of the lung and the brain. And the virus contains both bat and pig sequences in the bottom right. See the dark green is pig and the light green is bat, and here you can see the cross-over event: pig, bat, bat, and pig, bat.
>
> **Dr. Hextall:** Somewhere in the world, the wrong pig met up with the wrong bat.

The image emphasizes an order: pig-bat-bat-pig-bat, or A-B-B-A-B. Though Dr. Hextall has seen the individual DNA before in different permutations, the uniqueness of the sequence produces a pandemic. From such sequencing techniques, what is important is no longer the isolated image, but how it connects to others, its sequence, its order, its pattern. *Contagion* takes seriously how, in an age when genetics increasingly determines how we conceptualize our bodies, we must rethink health in terms of sequence. One may look at Tom Six's 2009 film *The Human Centipede (First Sequence)* as another example of a film that tries to understand its characters in terms of abstract sequences. The movie is a horror story, as explained by Eugenie Brinkema, about the violence of "enchainment in a specific sequence."[22] *Contagion* looks at the transformation of the body into sequences, but instead of enchainment to such sequences, it emphasizes how the addition of new links in the sequence produce a whole different than the sum of its individual parts.

Like the movie's aesthetic parallels between its 3D models and its infected characters, the movie similarly parallels the DNA sequence with the sequence in which characters appear and interact with each other in the movie. *Contagion* can be read as one large exercise in sequence editing, moving back-and-forth between ten main characters, all while maintaining a single narrative arc. The generative qualities of sequencing have cinematic equivalents in classical montage theory and the much-cited Kuleshov effect, where a specific sequence of images produces a unique effect in the viewer that would change if the images were ordered differently.

In *Contagion*, sequencing is used to link characters' individual storylines together to produce an overall image of how viruses function relationally.[23] *Contagion*'s theatrical promotional poster is a good distillation of this effect. The poster consists of six individual close-up images of characters, all attached to a central yellow bar that divides the images into two groups, a top and a bottom. Through this sequence of faces, the poster advertises the movie's ensemble cast, a selling point for the movie and often cited as the reason for the Soderbergh's commercial success. Ensemble casts draw on the moviegoer's desire to see how so many different celebrities will interact with one another. It is no wonder that other Soderbergh movies with ensemble casts fall under the genre of the heist movie, where audiences can delight in watching how each celebrity fits into an elaborately choreographed plan to successfully pull off "the job."

Figure 3.3: *Contagion* poster

In a clever reversal of fortunes, the *Contagion* poster portrays this interconnectedness as the means for viral transmission. All the faces seem to be looking at something off-screen, but their placement makes them appear as if they are looking terrified of *each other*. The order of their heads matters: each one of the characters on the top bar is paired with their opposite on the

bottom (this is an image of a DNA strand with its opposite base pairs). Dr. Cheever (top left) is linked to his rival Alan Krumweide (bottom left): the two will battle it out on live television, where they will accuse each other of fabricating the truth, leading Alan to be arrested for fraud and Dr. Cheever to be investigated by Congress for conspiracy. Both are eventually punished for trying to inform the public of the dangers of the virus. Dr. Orantes (top middle) is linked to Dr. Mears (bottom middle): the two initially hold opposing jobs, since Dr. Mears is tasked with tracking the spread of the virus, while Dr. Orantes is tasked with tracing the virus back to its origins. Both, however, will be defeated in their search, since one is killed after becoming infected and the other is abducted for a chance at the vaccine. Mitch Emhoff (top right) is linked to his wife, Beth Emhoff (bottom right): he is a loyal husband and immune to the virus, while she has an affair and is the virus's first victim. They both end up in similar positions, however, when in the final scenes of the movie, Mitch holds up the camera in an identical fashion to the way Beth does in the photos he is looking at. These separate storylines diverge from each other at the diegetic level, but their juxtaposition, their very position next to each other in a sequence, helps the audience see a larger pattern of how seemingly opposite characters act similarly. The DNA sequencing pushes audiences to see how the development of the virus—pig-bat-bat-pig-bat—mirrors the way the movie produces a sequence of characters to combat it. Both the 3D protein model and the genetic sequencing shift the representation of outbreaks away from an isolated image of the virus to the types of connections it makes visible.

NETWORK NARRATIVES

Hypervisibility promises to represent previously impossible-to-see actants through convincing digital images. As described by its critics, hypervisibility is dangerous because it leads audiences to a false sense of seeing the "totality" of a situation, be it biological, social, or economic. When applied to outbreaks, this potential danger is heightened, since outbreaks spread much faster across the globe, affect billions of people, and rely on with vast and complex systems. These outbreak narratives, therefore, must find a way to represent globalism (and global capital) in addition to microscopic organisms. Bridging the local (or microscopic) with the global is exactly what Frederic Jameson contends is impossible to do with our current representational capabilities. Jameson calls this our inability to create a "cognitive map" in a globalized world.[24]

Using the work of urban planner Kevin Lynch, who saw that landmarks help orient inhabitants to their position within a city, Jameson applies a similar model to the subject and his or her orientation to other social systems. Before late capitalism, he argues, orienting oneself was possible because the directness of causes and effects in an isolated space allowed the subject to bridge the gap between his or her local experience and "the economic structure that determined it."[25] However, with the rise of globalization, the subject loses this ability, and thus becomes increasingly susceptible to conspiracy theories that promise to flatten out the complex cause-and-effect systems into single actors who are "behind it all."[26]

In the 2000s, media theorists saw a possible solution to Jameson's cognitive mapping with the advent of new "technology which has allowed humans to extend their cognitive and practical capacities in such a way that complex global systems become intelligible."[27] They point to computer simulations that chart flows of global finance, and software programs that diagram complex climate change in an accessible way for both scientists and the public. I would add to

that list computer simulations and networks of real-time monitoring that help epidemiologists track and predict disease spread, that make such large calculations intelligible to scientists who can then use this data to eventually eradicate certain diseases from the earth (for example, look at the technical achievements required for the largely successful elimination of rubella, polio, and smallpox). *Contagion* does not incorporate that technology, but it provides another solution to the challenge of cognitive mapping through narrative experimentation and a focus on the networks that enmesh subjects across vast geographic space. The movie accomplishes this task by moving away from the standard outbreak narrative of finding a single origin of the virus, towards a focus on the distribution, speed, and safety of communications between initially unconnected people.

Contagion follows ten characters as they either fall prey to or try to combat the recent outbreak. These interspersed storylines overlap at various points in the narrative, sometimes through chance, but often through their shared interaction with larger institutions, like the WHO, the Department of Homeland Security (DHS), and the CDC, which require their employees to synchronize their efforts and work globally. *Contagion* is not the first to deploy this sort of narrative structure—filmmakers have increasingly use network narratives over the past twenty years. As Vivien Silvey has argued, network narratives have increased in popularity since the 1990s "with ensemble casts and jumbled chronology, but also 'scenes in cross-reference with each other,' in which digital-communication technologies and jet travel 'have perforated the boundaries of distance and time.'"[28] Such movies as *Short Cuts* (1993), *Magnolia* (1999), *21 Grams* (2003), *Babel* (2006), and *The Edge of Heaven* (2007) excavate the invisible connections between disparate people, often between citizens in "the West" and "the East," where a local event leads to the unraveling of larger national relations. Neil Nadine, in a similar lexicon, calls

these “Global Network Films,” which he dates from the 2000s onwards. Focusing on Soderbergh’s earlier film *Traffic*, he argues, “Their stories can be understood to challenge the meta-discourses of transnational flows, connectedness, and harmonious networked relations by embracing these logics in order to examine the trauma, impotence, misscommunication, and alienation that networks can produce.”[29] *Contagion* embraces the structure of the network narrative by showing how such global connections might be made visible and indeed materialized with the emergence of a disease, though unlike most network narratives, the movie does not take a purely negative view of such networks, since it ends by showing how they are necessary to also producing and distributing vaccines.

Though critics universally place *Contagion* among this emerging genre of network narrative, the movie differentiates between two types of network narratives within its diegesis: one that tries to capture the effects of viral transmission, and another that tries to remedy it. The opening ten minutes starts with a viral network, where four characters of different nationalities board various transit industries and travel across the globe, one in London, Hong Kong, Japan, and the United States, and then all proceed to die in identical fashion, unbeknownst to each other, but in a repeated pattern. The cuts between the four characters are fast, allotting only twenty to forty seconds between each one. A woman pays for her drink before she boards a plane to Minneapolis; a man, visibly pale and sweaty, takes a ferry to his apartment complex in Macau, China; a Ukrainian model cancels her photoshoot and takes a cab to her hotel room in London. In the next cut, we find the Ukrainian model dead on the hotel bathroom floor, foaming at the mouth. We then return to the woman in Minneapolis as she comes home and hugs her son and husband. A fourth character is added: a man, also visibly pale and sweaty, leaves the bathroom compartment on a plane. He takes the train home to Tokyo, when suddenly, he collapses on the

floor and foams at the mouth like the Ukranian model, as fellow travelers watch in horror. In the last minutes of this opening sequence, we return to man in Macau as he leaves his apartment into a crowded food street market, collapses into a busy highway, and dies on impact. Two scenes later, we watch as the last surviving person, the Minnesota woman who started off the sequence, similarly collapses, foams at the mouth, and is taken to the hospital, where she dies. The movie cuts back and forth between these four characters, creating a visual connection based on their repeated actions, as if all other characters are eventually doomed to repeat the action of the character that preceded them. All of them go through identical stages of dizziness, sweaty faces, collapsing, and then foaming at the mouth, eventually leading to death. What we get in the opening scene, then, is a stripped-down version of a network narrative. A physical connection is made visible between four geographically separate individuals, but these individuals are never named, nor do we learn much about their lives outside of their current health crisis; instead, personal difference is reduced through visual repetition of motion and gesture. The pattern of their deterioration conceals their differences. The virus, therefore, has a democratizing effect in its ability to restructure the daily rhythms of four different individuals (of different races, genders, classes, and nationalities) to look the same.

The opening viral network does not provide audiences with any of the immersive qualities promised by network narratives. In fact, if the opening were supposed to document the outbreak of a new virus in four different locations, Soderbergh would be guilty of lumping all these geographies into one hazy and claustrophobic landscape. The global world depicted by this network seems unusually flat, and instead of grounding the audience in a specificity of place, as other network narratives aim to accomplish, here space is largely transitory if not literally blurred from the lack of camera focus, due either to the character's dizziness or the speed of the

character's transit. The movie further abstracts the four characters' experiences by providing no diegetic sound outside the initial phone conversation with the woman in the airport. There is no ambient noise from any of the cities, no hum of the airplane engine, or chatter of nearby passengers; there is no difference in language or other aural signs that we are inhabiting different spaces. Such a lack of diegetic sound makes these characters seem to move through the landscape as if disembodied from their surroundings. Yet in opposition to this muted diegetic landscape, the movie provides a prominent soundtrack, with a song titled "They're Calling My Flight," which drowns out all other noise and plays across all four story-lines. There are no lyrics to the music, just a pulsating, electronic beat that starts as a low hum, and crescendos higher and higher, until finally hitting a piercing note. The song then recedes back down to start the build-up all over again. Through this cycle of build-up and then explosion, the music sonically illustrates the incubation period of the virus as it multiplies inside the cell and then ruptures to infect others. It is this rhythm that most closely choreographs the various edits of the opening scenes. To acquire the virus, it seems, is to fall prey to this universalizing rhythm, which detaches one from their landscape, and dictates the characters' movements.[30] In trying to capture viral transmission through network narratives, the movie produces an unforeseen side effect: juxtaposing four characters with quick cuts shows a clear connection between them, but forces the audience to focus on what is constant between frames, on a shared pattern, reducing the characters to only their similarities.

In the movie, this viral rhythm is initially mistaken for jet lag, revealing how the movie overlaps speed of global transit with speed of cinematic transitions. Asked if she is feeling okay, the woman in the airport, who will be the only one of the four to get a back story, casually replies, "Yeah I'm just jet lagged." The movie thematizes jet lag as a precursor to getting sick: to

constantly travel across the globe is to lose one's attachment to a certain location and the daily rhythms that characterize it, making one vulnerable to assimilation. Losing one's attachment to location is also a dangerous side effect for *Contagion*, whose structure requires it to shift quickly across space and characters in order to show contagion at a global level. This effect of jet lag, the movie argues, is what the virus induces in its hosts through infection and what the movie itself might fall prey to in trying to visualize the global transmission of the virus. In the opening sequence, Beth is late to a flight, so she leaves the man she was just having an affair with without saying goodbye—he calls her asking what happened—creating a sense of disorientation that the movie repeats once again during her death at the hospital. Mitch follows her into the emergency room, but a nurse quickly pushes him away once she starts to seizure. The nurse draws a bed curtain around Beth, effectively shutting Mitch (and the audience) out of what happens next. Like an editing wipe, the pulled curtain acts as a transition between cuts, and we see Mitch standing in the waiting room some time later, listening to a doctor explain that his wife was unresponsive to treatment and has unfortunately died. Narratively, the time between Beth coming home and her death is brief, and the censorship of Beth's actual death adds to Mitch's inability to process what has happened. Angry at the doctor, Mitch shouts, "I mean I just saw her. We were just home. We had dinner. We had pizza. She said she was jet-lagged." The speed of Beth's illness is reproduced through the movie's rapid edits, which push Beth's death somewhere in between scenes, causing Mitch to feel he has missed time, that somehow he is not in sync with his surroundings. The opening sequence of *Contagion*, therefore, showcases one type of network narrative gone wrong. To capture the spread of a fast-moving virus over the globe, the movie strictly limits scenes to no longer than thirty seconds each, and cuts so quickly between them that it produces a sense of jet lag similar to the damaging effects of the virus itself. The danger of

using a network narrative to portray a viral outbreak is that the speed of the virus disrupts the promise of what network narratives can offer. In trying to capture the speed of viral transmission, the movie opens with a sequence that removes the local experience of characters for a shared connection between them.

Contagion poses the dangers of the viral for network narratives in its opening sequence in order to suggest a remedy in the rest of the narrative. While first portraying the threat of imaging viral spread as a disorientation to space, the movie then proposes a fix to this initial viral network with a shift to outlining the networks of health official who will counter the outbreak. In their book *The Exploits*, Eugene Thacker and Alexander R. Galloway argue that modern threats such as computer and biological viruses exploit and spread through our preexisting social networks, and therefore our most effective means to combat such a wide spread must be to produce a counter-network:

> Consider the 'good virus' model applied to the outbreak of an emerging infectious disease: an epidemic is identified, and owing to its networked nature, a counter-network deploys to confront it…Paradoxically, the good virus will succeed in administering the vaccine only if its rate of infection surpasses that of the bad virus. This nexus of disease, medical delivery, and military logistics is what we can expect in future evolutions of warfare. (120)

Contagion follows the logic of medicinal counter-networks in its eventual shift to the networked response of various governments, pharmaceutical companies, and world health organizations, who must all collaborate to find a vaccine for the virus. In other words, the second network narrative in the movie stops following the disease spread and starts following the response to finding a cure, a shift in focus from viral transmission to networks of health institutions. The ten main characters in the movie are linked to similar institutions, but inhabit different levels of employment within them, from director to researcher to janitor. To get a sense of the variety of their institutional positions, here are the ten major characters the movie follows: Dr. Ellis

Cheever (CDC director), Roger (CDC janitor), Dr. Erin Mears (CDC field worker), Dr. Ally Hextall (CDC virologist), Admiral Lyle Haggerty (Homeland Security), Alan Krumwiede (journalist/blogger), Mitch Emhoff (husband of patient zero), Beth Emhoff (AIMM CEO and patient zero), Dr. Leonora Orantes (WHO epidemiologist), and Dr. Ian Sussman (San Francisco virologist).

This counter-network of mostly health officials remedies exactly what the opening network disrupts, namely the subject's temporal and geographic specificity. After its opening viral network, where all infected characters are synced up to a universal rhythm, the rest of *Contagion* magnifies the way that characters, as part of larger institutions, are often out of sync with each other. A character's unique position within an institution limits how he or she acts. In one scene, Dr. Hextall must follow the orders of the director and shut down all research of the Mev-1 virus outside of a strictly controlled set of labs with level 4 biosafety regulations. In arguing against this decision, Dr. Sussman begs, "I think that's a mistake. We are making progress. You limit this to government run BSL-4 and it'll take forever. I can do this." In reply, Dr. Hextall sympathetically remarks, "Cook your samples. Destroy everything. We can't risk it. I'm sorry." Both Dr. Hextall and Dr. Sussman think such government protocols will limit the speed of developing a vaccine, but they are stuck. In other words, though their agencies work globally, these characters are hampered by their location, be it in an abstract chain of command or a literal restriction on laboratory space. While capturing viral spread assimilates difference to ensure speed, the movie shows that the response to the virus must have the opposite effect: a grounded perspective in institutions that unequally hamper movement.

The movie lingers on the mundane tasks and set backs of daily work as a virologist, government official, or field epidemiologist, which break up seemingly monolithic institutions

into their messy and different components. Scientists and agency directors often disregard each other and weave personal goals into their agendas. In one scene, officials helping the WHO in Hong Kong kidnap a representative in order to ensure that their family's village will be moved to the front of the queue for a vaccine; in another, a scientist disregards a biosafety procedure by self-injecting a potential vaccine in order to bypass the time of human trials. These conflicts not only show global institutions as hierarchical and decentralized networks, but they allow *Contagion* to break from the outbreak genre's more conventional understanding of who is ultimately responsible for the emergence of the disease in the first place. Most outbreak movies entertain the fantasy of corrupt military generals who have secretly financed labs to engineer or harbor deadly viruses for use as biological weapons, which either through negligence or as a test, are released into civilian territories. There is often a virologist who identifies so strongly with the logic of survival of the fittest that he or she (though almost always male) wishes to curb human population by either personally releasing the virus or refusing to develop a vaccine, as in *12 Monkeys* (1995). The second type is a military official who sees disease as the ultimate efficient weapon that must be harbored to ensure the dominance of a certain nation (see *Outbreak* (1995)). This military official may be so manipulative that he or she is entirely absent from the narrative, only implied as an omnipotent "watcher" through a cut to someone in the shadows watching surveillance footage of the outbreak unfold, as in the 2010 remake of *The Crazies* or the 2002 film *Resident Evil*. Sometimes, as in *Doosmday*, both the military figure and the scientist figure are present in the same movie, and sometimes the two figures are combined into one. In these movies, the curing of the virus is only the first step towards solving the crisis; only once these corrupt officials are removed from power can society be safe from further outbreaks. This trend in outbreak movies is so common, its repetition so automatic, that it might serve as a defense

against the rather unnerving reality that the military and scientific community, even if led by the most compassionate people, might not be effective in protecting its citizens against naturally occurring outbreak.

In *Contagion*, there is no single villain character or even cluster of characters who, if not for them, the disaster could have been averted. This is particularly striking in a time when viruses have become synonymous with bioterrorism. In one scene, an official in Homeland Security asks Dr. Cheever whether the current outbreak could be the product of a highly sophisticated terrorist plot, and for a moment, the movie teeters on whether it might follow the generic convention.

> Government Official: If you were going to plan it, I can't think of a better time.
> Dr. Cheever: Plan what?
> Government Official: An attack. Is there any way someone could weaponize the bird flu?
> Dr. Cheever: Someone doesn't have to weaponize the bird flu. The birds are doing that.

The term weaponize implies an agent that constructs something with the purpose of causing destruction. Counter to this, the movie shows that there need not be an agent in the literal sense for a virus to decimate the world. The danger is not that there is a mastermind criminal or biological weapon in the hands of a terrorist, but that our response teams and safeguards will be ineffective. *Contagion*'s corruptions are smaller and more site-specific: Dr. Cheevers tells his fiancé to leave Chicago before the border closing is officially announced; the government is unable to fly a CDC officer out of Minneapolis because the plane is given instead to a sick senator; the WHO is willing to exchange placebo vaccines to free an abducted agent; Alan Krumweide endorses an unproven homeopathic remedy for potential monetary gain. These are all small corruptions, based in human interactions with institutions and not criminal conspiracies. Instead of showing the viral outbreak as caused by a single "evil" individual, *Contagion* argues that characters are symptoms of their positions within larger institutions.

SECURE TRANSMISSION

Through *Contagion*'s attention to the creation and vulnerability of networks, it allows us to rethink contemporary theories of virality through a narrative of an actual viral outbreak. Where does the metaphor of virality begin and end? What is the relationship of the viral to the network it passes through? In the 1990s and 2000s, as capitalism moved into its later stages, theories of insular networks failed to account for the way networks were now leaving themselves open ended, with the goal of absorbing other networks. In their book *Empire*, Michael Hardt and Antonio Negri characterized this late capitalist impulse to absorb as "contagion," and linked it to the virus, a biological and increasingly digital threat that requires a response from nations in the form of biopower: "Hardt and Negri emphasize in *Empire* how science, communication and language are incorporated as production powers of the Empire leading to a new biopolitical or biopower agenda of capitalism."[31]

The rise of viral marketing in the late 1990s further suggested an adjustment in capitalist production, where companies could convince consumers to do part of their labor of advertising for them by supplying the consumer with free media sharing networks, such as email.[32] Ralph Wilson, one of the pioneers of internet marketing, wrote a popular article on the subject, titled "The Six Simple Principles of Viral Marketing," where he describes the principles that allow this virality to run unhindered: "1. Gives away products or services; 2. Provides for effortless transfer to others; 3. Scales easily from small to very large; 4. Exploits common motivations and behaviors; 5. Utilizes existing communication networks; 6. Takes advantage of others' resources."[33] Like the open-ended network, viral marketing absorbs the customer's own friendship networks and exploits them to sell products.

Counter to viral marketing, *Contagion* presents virality as predominantly a threat to communication networks, especially those which are necessary to coordinate an effective response to outbreaks. If *Contagion* is a hypervisible outbreak narrative, meaning the movie relies on the emergence of an image of the virus, then the question remains how these images transmit to different organization in order to be an effective defense against the virus. In the opening shot, Beth Emhoff answers a call on her cell phone. John Neil is on the line, and he jokingly criticizes her for running off after having sex with him and not saying goodbye; however, she quickly confirms that she simply did not want to miss her flight. The call ends with them figuring out how to communicate with each other without raising the suspicion of their respective partners: "Listen, use the other e-mail I gave you," John Neil hesitantly reassures her, "because that's the only secure one." In a movie where viral transmission equals death, what does it mean to have a secure transmission? Is such security possible? A secure transmission is one that stops others from hearing one's private conversations, or a transmission that can authenticate who is on the other side. In our increasingly online world, secure transmission also refers to defending against unwanted computer viruses or other forms of malware that prey on such communication networks, sometimes just to monitor their users' actions and collect data, but other times to produce more invasive interruptions like slowing down computer processing or even disabling hardware. In other words, communication transmissions are prone to infection. When these communication networks are vital for coordinating different agencies and field workers to work together, securing such transmissions becomes synonymous with successfully creating and distributing a vaccine.

Similarly, if we are to visualize the biological body as a network, then the ultimate danger to this body is when its links are stressed, overloaded, or completely interrupted. As

Donna Haraway argues in "A Cyborg Manifesto," the new type of pathology for the networked cyborg is a communications breakdown.[34] As *Contagion* delves into the different positions of its ten main characters, it ultimately examines the different forms of communication that connect them together. Through telephone calls, emails, webcams, and conference calls, which establish links between scientists, then through government associations, and finally even larger global agencies, the movie shows how a robust information network must be built and then guarded to effectively relay information quickly enough to develop a vaccine: "An information network is used to combat a biological network."[35] The movie depicts the characters as connected to each other in obscure ways: one WHO employee tracks the movement of another character through surveillance cameras as she transmits the virus; another journalist follows the social media posts of a CDC worker's fiancée to get damning evidence of the CDC's private ethical lapses. The various connections between characters, therefore, do not form through a viral exchange—no main characters get another sick—but rather through communication technologies that hope to confirm information about the virus's spread. Each character in the movie is associated with a type of technological communication that either allows him or her to thrive or leads to their death: Mitch Emhoff (Matt Damon) and Dr. Mears (Kate Winslet) both are associated with the telephone, Dr. Cheever (Laurance Fishbourne) with the television broadcast, Alan Krumweide (Jude Law) with online blogging, and Dr. Hextall (Jennifer Ehle) with conference calls. Each one of these communication technologies comes under threat at one point or another in the movie, often from other forms of communication, and each character has to find a solution to such exploits.

The first major danger is when a communication system is so overloaded that messages stop going through. In one scene, when the epidemic is at its worst, Mitch hears a gunshot and

peers out of his window to see two gunmen in ski masks shooting his neighbors and stealing goods from their house. As the soundtrack music starts, Mitch picks up his phone and calls 911, but is met with a busy signal: “Because of the high volume of 911 calls, please use the following directory...” and a long list of possible options, none of which will provide immediate assistance, while the gunmen have already come and gone. In this scene, simply the lack of ability to call law enforcement provides the tipping point when social order breaks down. The use of the song titled “They Are Calling My Flight” to signal viral spread, as I have argued regarding the opening minutes, works similarly to Mitch’s busy 911 call, since it blocks out diegetic sound and forces the audience into a state of being detached from their surroundings.

Like Mitch’s busy signal, Dr. Erin Mears’ (Kate Winslet) reliance on the cell phone as a means of support is similarly blocked by the introduction of the virus. As a CDC field worker, she is dispatched to Minneapolis, the first known site of the outbreak. Before she leaves, Dr. Cheever tells her to stay in constant communication, both for logistical purposes of tracking the virus and to provide her with support in such a challenging situation: “As of this moment, you and I are attached at the cell phone. If you need resources, call me. If you get into a political dogfight, call me. If you find yourself wide awake, staring at the walls at 3 a.m. wondering why you took the job, call me.” About halfway through the movie, Dr. Mears suddenly wakes up in a dark hotel room with a hoarse cough. Since it is completely dark, all we hear is her voice, but it is enough to know she has been infected by the virus. The scene is a repetition of the opening scene of the movie when we first hear Beth cough behind a black screen, though at the time the audience does not understand the significance; now, the sign is clear. Mears’s first action is to call the hotel staff and ask them to contact everyone who has serviced her room to warn them of a possible infection: “I need all of their numbers. Home, cell, everything, yes,” Mears urges to

the receptionist, as if collecting phone numbers were a form of prophylaxis against further transmission. The movie suggests as much, since up until this moment, the telephone was used as a preventative tool to inform potential patients, but most importantly to locate people across geographic space so they can send help. In an earlier scene, Dr. Mears used her cell phone to locate Aaron Barnes, who had given Beth Emhoff a ride home from the airport a few nights ago, and was late to work. After calling Mr. Barnes, Dr. Mears was able to find his location, convince him to get off the bus, and wait for a car to pick him up: "Don't talk to anyone, don't touch anyone. That's the most important thing. I'm on my way to you now, Aaron." Counter-intuitively, the phone helps to inform the patient that he should isolate himself and stop talking to other people, but it simultaneously promises that someone is on their way: isolation is easier to deal with knowing someone will find you. Therefore, when Dr. Mears finds herself sick in her hotel room, she calls Dr. Cheever, who similarly tells her to stay in place while he gets someone to pick her up. The phone call necessitates a chain of other phone calls, and now Dr. Cheever must make a call to Admiral Haggerty of Homeland Security to authorize the resources necessary to evacuate Dr. Mears.

A few scenes later, though, the movie returns to Dr. Mears huddled on a cot in one of the make-shift, emergency health facility she helped set up in a hockey rink. Dr. Cheever's phone calls clearly have not worked, since Dr. Mears is still in Minneapolis looking rather close to death. A Minneapolis health official comes over and explains the situation: "Dr. Cheever called again. We are just having a hard time with the logistics of evacuating you, finding a plane and all. I got your phone. Dr. Cheever asked you to call if you feel up to it." The health official opens her hands and tries to stick the phone in it. Dr. Mears, physically unable to call, looks perplexed by the offer. Her phone, now in a clear hazard bag, is useless if not a false hope. A few scenes

later, having died from the virus, Dr. Mears will be wrapped in a similar plastic bag, due to a shortage of normal body bags. We later learn that the isolation pod, which would have picked up Dr. Mears and brought her to Atlanta, was already booked by a sick senator from Illinois. Dr. Cheever had needed to call Admiral Haggerty earlier as the senator would be the last before they shut down the airports and quarantine Minnesota. Though Dr. Mears' phone calls are not put on hold, as in Mitch's 911 call, the delayed response and the inability of Dr. Cheever's own calls to convince Homeland Security to evacuate Mears effectively amounts to the same thing: when the telephone communication system is overloaded, people die.

The CDC starts to rely on television, a one-directional form of communication, to broadcast a single message to large numbers of people. In *Contagion*, the television proves the most effective platform through which the CDC and the government placate growing public concern over the outbreak and disseminate information downward to them. Other forms of news have failed: as one character proclaims, "print media is dead"—the virus has killed it—due to its inefficiency and slow speed, but also, as we see through shots of abandoned streets and office buildings, because it requires too many people to be in close contact to produce and distribute (workers at a TV studios would also pose a danger, but the film shows just how few people are needed to send broadcast out to millions of watchers). After the outbreak, consumers no longer accept objects into their homes someone else has touched; everything must be distributed to the home directly and consumed without passing through too many hands. Therefore, television, with its relatively small production crews, allows viewers to watch from the safety of their homes—to see what is going on outside without having to put their bodies in physical danger.

For the movie, television becomes a way of safely transitioning between spaces. In the movie, television acts as a technological link that allows scenes to transition smoothly between

spaces without getting a sense of spatial disorientation. In one scene, Alan is at a laundromat in San Francisco, watching a TV broadcast of Dr. Cheever, when the movie transitions to Dr. Cheever by cutting to an image of the camera and crewmembers filming the broadcast. In the next shot, we are now looking from the eyes of one of the lab scientists down at Dr. Cheever. In this cutting between TV viewer, film crew, and scientist, we move from San Francisco to Georgia. and the movie has successfully completed one of its many dramatic cuts—across people and places—while maintaining a sense of continuity in narrative. The audience knows where they are because the television has shown where they are going before the cut. Another example happens later in the movie, when Admiral Haggerty draws from a lottery bowl to see who gets the vaccine first during a live television broadcast. The camera starts by standing next to Admiral Haggerty in the CDC headquarters in Atlanta as if we are one of the news reporters in the room, to Dr. Cheever looking down at him from one of the labs on the second floor, and then finally to Mitch watching the broadcast on his TV at home with his daughter in Minneapolis, where they are hoping to get a low number in the lottery. All three characters are watching the lottery from different spaces, and the camera is able to map out the location of each look. In a movie that is so spatially disjointed, and with scenes that last on average only one minute, the television broadcast creates a shared visual point between storylines, which allows the movie to transition between these spaces without the viewer becoming disoriented. These televisual transitions are always between the CDC and the public, and show one of the few stable communication systems in the movie. In a similar way, the television broadcast maintains a continuity of message about the virus to the public. Dr. Cheever, who is the one most often in front of the camera, explains that the benefit of television is that it gives a “single overriding communications objective” to the public, a vetted and unified approach to the virus, by directly dispersing it to their homes.

The introduction of Alan Krumweide, an influential blogger and journalist, who is granted an interview with Dr. Cheever on live television, threatens the directness and continuity of the television broadcasting in the movie. In the interview, Dr. Cheever is tasked with once again relying on a single message, shifting focus away from questions of how many people have died from the virus to date to the topic of how social distancing and staying calm is the greatest form of protection citizens have.[36] Alan tries to undermine the "single overriding communications objective" Dr. Cheever is in charge of delivering by stressing how such a single message obscures the other sides of the story. The goal for Alan is to have the public question the validity of television by introducing other forms of news media that run counter to such a tightly curated platform: "If you check on Facebook, you'll find a communique attributed to Dr. Cheever by Elizabeth Nygaard about the quarantine of Chicago hours before it was announced to the public. That's why I think [Dr. Cheever] is a bit disingenuous when he says equal care for all and not just his friends." Facebook, with its remarkable ability to broadcast the intimate lives of its users, allows Alan to track Dr. Cheever and his fiancée in ways that would have been impossible through television. The interviewer then turns to Dr. Cheever and asks, "Can you tell us what communication appeared and when?" Dr. Cheever replies that he is unaware of anything on social media attributed to him. If system overload is one form of communication breakdown in the movie, then the other is the "appearance" of new communications, which the television's singular focus cannot address and therefore fails to defend against. After the interview, many people gather in social spaces against the CDC's recommendation to try and acquire the drug, Forsythia, even though they are unsure whether it is helpful or not. These gatherings inevitably lead to rioting, where physical prowess and horde mentality determines who lives and who dies. If television's strength in the movie is its ability to provide a single, vetted message, then it fails

exactly in its lack of breadth and inability to incorporate other messages.

By using social media to undermine the stability of the televisual message, Alan is calling for hypervisibility in communication networks as a way to bring transparency to institutions. Traditional television interviews are set up to reduce visual confusion, as if audiences are made to feel like they are looking in on two motionless people in the middle of a conversation. The setup is so ubiquitous it is easy to picture it without much help: two people, usually an interviewer and an interviewee, sit across the table from each other, angled slightly towards the camera positioned at the centered point in front of them. The only other shots come from two separate cameras on either side. The conversation stays continuous by providing matching close-ups on each individual face as the person talks. In a movie that prides itself as realistic, *Contagion*'s greatest visual experimentation comes in this TV interview by refuses to follow the conventional shots and edits of news television. Not once do we look through the cameras we can see set up to broadcast this interview; instead, we start with a wide shot from behind the stage that reveals all the components of the interview—lights, cameras, crew, background sets, and intermediary screens—that produce the singular image that appears on home viewers' TV screens. The camera also does not always visually follow who is talking, breaking another rule of interview cinematography. For example, in the middle of Dr. Cheever answering a question, we cut to a screen where Alan is preparing to go on air by doing a few vocal warm-ups. Instead of the head-on camera angle of traditional news broadcasts, the camera in the scene circles around the interviewees, often from odd angles, either below a table or the chair they are sitting on, sometimes off too far to the right, exposing the backstage, or from behind the two interviewers so that we are viewing the interview backwards, at the cameras and crew members that are recording them. The camera even breaks the obligatory 180 rule by circling around Alan and Dr.

Cheever in sections that, if pieced together, would form a 360-degree image. As the camera circles, Alan tells the interviewer that Dr. Cheever will not admit to the public how many people have died exactly because it would reveal how the CDC does not have control of the situation, though they maintain a calm façade: “You think you’ve got it in front of you, but next it’s 256, and then it’s 65,000, and it's behind you, above you, and all around you. In 30 steps, it’s a billion sick.” Although Alan is talking about the virus, he might as well be describing what the camera is doing.

Figure 3.4a-l: 360-degree interview in *Contagion*

"You think you got it in front of you, but…It's behind you, above you, and all around you"—it is as if the scene enacts the dangers of a multiplying virus by similarly multiplying the angles from which we see the object seemingly "in front of you." Like Dr. Hextall's rotation of the 3D virus model seen earlier in the film, the camera rotates around the different speakers to give us a 3D model of their bodies and the television screens that connect them. In doing so, the movie gives us a sense of what hyper-visibility would be like in the news room, a multiplicity of visions that leaves no part of the interviewer uncovered.

However, hypervisibility does not produce the type of progressive political change Alan had hoped for. Though we see Dr. Cheever in a variety of bad angles in his interview, there is no clear action to take against him. Dr. Cheever was not immediately replaced until after the vaccine was developed, and by the end of the movie, we are made to believe that he will be punished unfairly by a drawn-out Senate investigation as a scapegoat for public frustration at the CDC. Not only is Dr. Cheever's ethical lapse rather minor—it would be hard to find anyone who would not do the same—but he admits that after thinking it through, he would do it again if given the chance. Dr. Cheever's exposure instead feels like a hollow form of made-for-television politics in that it reveals, through a dramatic performance, the special treatment CDC members give their spouses: "It puts its faith in the power of exposing an insidious social force that we already know about and often happily engage in ourselves."[37] Later in the movie, away from the gaze of cameras, Dr. Cheever willingly gives up his dose of the vaccine to Roger's (the janitor's) son as a sign of good faith. Putting himself at great risk of being infected, Dr. Cheever leaves by shaking their hands: "You offered your empty right hand to show that you meant no harm," he explains. As in the television interview, hyper-visibility—understood as the act of making all

aspects of a character's actions visible, no matter how mundane or incriminating—challenges the causal assumption that exposure leads to clarity.

In another scene, Mitch finds out from a health official tracking the initial spread of the virus that his wife, Beth, had cheated on him with a former partner on her layover in Chicago. Through this reveal, some reviewers understandably read *Contagion* as punishing unfaithful women, but the movie continually underplays this possibility: Beth is described as making a "mistake" by her mother, and that she still "loved [Mitch] very much." Mitch similarly seems to have forgiven her affair, especially in the final scenes of the movie, when scanning through photos of her smiling, he breaks down crying at the realization of his loss. At the Venice Film Festival, when asked about the connection between Beth's death and her affair, Gweneth Paltrow, who plays Beth, admits that she never made this causal connection: "I think if death by virus was a punishment for extra marital affairs, there would be like three dudes left in this room...I didn't make that connection…we are all fallible"[38] Paltrow may be wrong or purposefully confrontational, but it is true that regardless of her affair, the virus would still have spread to her family and eventually across the US. Like Beth's extra-marital affair that was exposed through a medical exam, Alan is eventually arrested and his blood tested to reveal that he had made up his own miraculous recovery from the virus to help sell Forsythia, a homeopathic treatment he profited millions on. Court documents exposed his crime, but regardless, his followers helped pay his $10 million bail, and Alan ends the movie continuing his journalistic goal of exposing government corruption from the dispersal of the vaccine. In showing viewers the daily lives of ten people fighting a deadly virus, the movie provides a level of hypervisibility (a full picture of a character's good and bad actions) that only the most three-dimensional examination of characters makes possible, but at the same time, such a complete

vision refuses to provide the moral clarity or obvious political action that, in other films, would act as narrative closure. For all of *Contagion*'s hypervisibility, it remains difficult to distinguish between the good and bad players.

The most significant moment of exposure arrives in the final scene, since after an hour and a half of following people's responses to an outbreak, the movie returns to a time before its first scene takes place, and like a returned traumatic memory, reveals the creation of the virus and first day it emerged into the human population. In a Rube Goldberg-esque chain of events, the final sequence starts with an AIMM Anderson owned bulldozer displacing a colony of bats from their habitat deep in the forest into a human-inhabited pig farm.[39] Through a shared bite of banana, the virus passes from bat to pig, and mixes into a novel virus. Then the pig is picked up and brought to a Hong Kong casino, where a chef, having prepared the pig for dinner, shakes hands with the AIMM Anderson CEO, Beth, without washing his hands. In red ink, the words "Day 1" are time stamped onto this last image before the movie cuts to black and the credits roll. Like many outbreak narratives, the end sequence provides a story of nature's revenge, in which one of the heads of AIMM is killed by the hubris of her own company's deforestation project. Up until this scene, the movie had maintained a strict visual coherence where all shots were grounded in a character's point of view and in linear chronologicy, but this end sequence breaks this cohesion and gives us a third person, omnipotent vision filled with long shots deep in the forest that no character could possibly have seen, all before the events of the first scene take place. Contagion seems so invested in showing the audience every component of the virus's story—all angles of how the virus developed and spread—that it is incapable of following its own strict form. It is this exposure of origins in the final moments that both disproves criticism of the movie's visual obsession with computer-generated images and provides fodder for

critiques of its narrow focus on certain American companies. Like the other scenes of exposure in the movie, this one has led a few scholars to equate hypervisibility with easy culpability. In "Going Viral in a World Gone Global," Dahlia Schweitzer reads the last scene as showing that "the worst villains are the greedy corporations," and the pandemic's "'root' cause can be traced to the action of an American company and its transmission to none other than the company's Global Operations Manager"[40] For seeing AIMM Anderson as the "worst villain," I am struct by how the movie shows the company in complete compliance with the authorities during the outbreak. In fact, as I hope to have shown, the movie is quite successful at breaking apart anything as monolithic as an "American company" by showing how such institutions are constructed of conflicting individual actors, most of which are not so easily categorized as simply greedy or villainous.

Against Schweitzer's generalization of "greedy corporations," Brent Bellamy argues that the final scene loses its potential critique of the socioeconomic catalysts for the pandemic because it is too specific in blaming AIMM Anderson.[41] Caetlin Benson-Allott articulates this critique through the language exposure and invisibility:

> Soderbergh's visual details particularize the global forces they invoke, ironically rendering such forces invisible again. Because it must find a way to represent transnational capital, Soderbergh's final sequence participates in a logic of visible evidence that only leads to certain kinds of culprits—those which can be seen and identified—such as Beth Emhoff's company, AIMM Anderson.[42]

In identifying a "culprit," itself a strange task, critics suggest I should search for an even earlier origin than the one provided by the movie, one before AIMM Anderson started its bulldozers, back to something more structural, I assume, like the creation of international trade agreements between the US and China that supersede local governance, or to the development of large corporate lobbying groups to dissolve environmental regulation or outsource resource extraction

to areas without them. Though the origin could go back even further, to the baby boomer generation and its large consumer demand for cheap wood products, or the defunding of global healthcare agencies after the economic collapse in 2008. There are many possibilities for this fictional disease. Finding the origins outside of a clear transfer of the virus from one organism to the other would have to "represent transnational capital" in its entirety, what seems like an impossible standard for any movie, and one audience's might not even want. It seems unavoidable, however, that searching for a definitive origin leads to an endless peeling-away of earlier and earlier culprits along this chain of events. The outcome of searching for an origin generates two opposing readings: the exposure of the virus's origin is either a clear condemnation of the villainous company responsible, or it is an exposure that conceals a far more insidious network of transnational capital that is left off screen by AIMM's visibility. The logic goes like this: the danger of "visible evidence" is that it inevitably elides other factors not in focus, and while the movie points its cinematic finger at something specific, it lets off the hook other factors connected to it, especially ones harder to capture on camera. In this logic, I am caught by a certain paranoid suspicion of visibility, in which visual evidence, regardless of its accuracy or social benefits, becomes just another means of mystification, or worse, manipulation. Especially in a movie that provides more hypervisibility than any other outbreak narrative before it, a movie that tries to show pandemics from all angles, and in doing so risks losing its narrative arc and even character identification, the critique of *Contagion* as hiding insidious actors rings as automatic more than accurate.

The critiques imply that by making visible those invisible actors, by blaming the right groups, we could accurately identify transgressors in the future. To point to the final scene in particular, which stands in sharp contrast to the rest of the film, is to equate finding the origin of

the virus with curing it. However, in its refusal to link exposure with clarity, *Contagion* moves away from such conventional outbreak narratives where discovering a virus's origin is necessary to produce a vaccine. At the beginning of the movie, a series of CDC officials inform us that to develop a vaccine they need to first find the origins of the virus. In a news station interview, Dr. Cheever explains, "Hard to know what it is without knowing where it came from. Our first job with these things is to find ground zero. Figure out how it jumped into the population." In accordance with this logic, the CDC sent Dr. Mears to Minneapolis to track who had been in contact with Beth Emhoff, to find out where and how she might have spread it. Similarly, the WHO dispatched Dr. Leonora Orantes to Hong Kong to trace where the spread might have started and find patient zero. As the virus spreads to infect one out of twelve people on the planet, these missions start to feel irrelevant to the current crisis. At one moment, Dr. Orantes asks for more surveillance footage to help her track the movement of Beth Emhoff in a casino when she notices two people on her team looking rather agitated. She asks the Hong Kong assistant, Sun Feng, "Is there a problem?" and he tells her that the outbreak has reached their village, and that his own mother is showing symptoms. With a biting remark, he continues, "I'll get you the footage you require." Halfway through the movie, both efforts of Dr. Mears and Dr. Orantes to find the origins are interrupted in back-to-back scenes. Dr. Mears suddenly acquires the virus and eventually dies, leaving her work unfinished, and Dr. Orantes is kidnapped on her way to the airport and brought to the distressed village as a political bargaining chip. Though their unexpected removals would seem disastrous to the operations of the CDC and WHO, they have little to no impact. Despite the CDC not knowing patient zero, they still develop a vaccine.

Counter to tracking the virus backwards to its origin, Dr. Hextall is tasked with growing the virus and purposefully spreading it to laboratory monkeys. She injects a damaged version of

the virus into the body just enough for the monkey's immune system to recognize it while also keeping the host alive. In other words, her job is to produce a safe transmission of the virus. In a movie about dangerous forms of connections and the failure of communications to supplement them, Dr. Hextall bravely embraces these connections by willingly injecting herself with a potential vaccine and testing it out by purposefully acquiring the virus from her ailing father through a goodbye kiss. For a secure transmission to be established, someone must first risk being injured by it. This is the lesson that Dr. Hextall learns in the hospital room with her father before he dies, when she acknowledges that he would meet patients when other doctors refused to risk it: "You took that chance. You took that chance every day." The gamble pays off and the vaccine is discovered. We see how the very act of spreading the virus proves most helpful in curing it. Dr. Hextall's character shows how transmission and dispersal are ultimately the keys to fighting the virus, not finding an elusive origin. Before Admiral Haggerty starts the vaccine lottery, he explains: "We may never know where this disease came from, but we do know that this vaccine is the result of the courage and perseverance of a remarkable few." The final exposure scene in the movie, therefore, comes only after the vaccine has already been discovered and distributed to the population. The scene is unique in that it is detached from any character's perspective, and so the origin of the virus is concealed from any character who would then be able to use it to later inform the health officials how the virus first emerged. Against the conventional privileging of origin, *Contagion* emphasizes transmission and dispersal as the means for curing the virus and dealing with future outbreaks.

By focusing on dispersal over origin, we might better understand the movie's critique of the type of transnational capitalism that was missing from the final scene, yet present in the second half of the movie as the world starts to return to "normal." The discovery of the cure to

the pandemic leads to another set of questions about circulation, distribution, and networks: although we have found the cure, can we efficiently develop and disperse a vaccine to reach billions of people, and if so, who gets it first? Immediately following Dr. Hextall's discovery of the vaccine, an unseen newscaster talks about the accelerated production of the vaccine from the Food and Drug Administration, as B-roll footage moves between manufacturing facilities that fill and then package thousands of vaccines, to forms of transportation (trucks, boats, and airplanes) that deliver them across the globe. The images of transportation networks visually repeat the opening scenes of the spread of the virus and its dispersal through boats, cars, and planes—now, however, with the dispersal of the cure. Counter to the multi-sited ethnographic sections that shows the internal conflicts of institutions, these images of factories and transportation networks all run smoothly, a shock considering the state of the world. No one is fighting, as we have seen previously with grocery stores and pharmacies struck by riots. Nor in the transportation networks do we see the type of quarantine and barred access like in previous shots of deserted airports, city curfews, and militarized state lines. Overnight, it seems, the discovery of the vaccine has cured the ills of industry and returned them to normal a speed of production, if not accelerated.

In one shot, the narrator informs us that the vaccine is being developed in "five undisclosed locations," and we are presented with a time-lapse long shot (one of the few in the movie) of a factory, with cars and trucks speeding in and out. The sides are all blurry, presumably to protect viewers (it is not clear if we are in a news shot) from identifying the location. If the characters viewing this broadcast could identify the locations, the factories would be vulnerable to raids. With this scene's quick cuts back and forth between various locations, its focus on the dispersal of objects through highly efficient transportation networks, and the effects of disengagement from a specific location ("five undisclosed locations"), the discovery of the

vaccine in effect returns the movie to the same viral rhythms and spatial disorientation as the opening scene of viral spread. What we see is that the dispersal of the vaccine mirrors the spread of the disease, as if the way to fight the virus is to mimic its spread.

The return of the viral rhythm during the time of vaccination dispersal signals the movie's stance on transnational capitalism and its relation to viral outbreaks. Deadly pandemics are not a recent phenomenon and have existed long before global capitalism, mass deforestation, and high-speed travel allowed viruses to spread quickly. In opposition to the vague corporate origins of the virus, the movie displays in detail how today's behemoth pharmaceutical companies, in partnership with global health organizations, are largely effective at addressing pandemics through their unique capacity to mass-produce vaccines and disseminate them to billions of people across the globe within a short time frame. While in the 21st century viruses can spread faster than ever before, they can be cured faster than ever before. The insight the movie suggests through its repetition of viral rhythms in these final scenes is that healthy dissemination must mirror viral spread if it is to be effective. In other words, the relationship between the virus and transnational capitalism is not merely antagonistic, in which the viral disrupts networks of information and commodity distribution, but rather that the viral is incorporated into them. The clue to the virus's relationship to transnational capitalism was in the biological 3D protein model after all, since it showed how the virus integrated into, not disrupted, the cellular system. While Dr. Hextall previously tracked the spread of the virus before she discovered the vaccine, in a later scene, she now sits at a computer "tracking vaccine batch numbers"—the object being tracked has changed from virus to vaccine, but the process remains identical. This is where the movie makes its critique of transnational capitalism: not in capital's unintended consequences to create outbreaks, such as in AIMM's dislocation of an

infected bat population, but in other companies' integration of the efficiencies of viral dispersal into their own marketplace. At the end of the movie, one way the audience is told the threat has subsided is that Mitch goes shopping, in person, at an actual mall, for his daughter's prom dress. His vaccine bracelet is scanned at the door, and there are people in hazard suits scrubbing down food court benches, but besides these visual reminders, the department stores are neat and well-stocked, and Mitch can buy something without fear of possible infection. This orderly shopping experience is in sharp contrast to the disheveled grocery store earlier in the movie, a set piece in outbreak narratives because it dramatizes the breakdown of infrastructure that has become so naturalized in our lives that it seems invisible except in its destruction. If the outbreak initially caused a disruption of these large consumer sites, then a return to normalcy entails a reinvestment and rebuilding of them.[43] The vaccine itself has shifted in how it is sold, what Jussi Parikka calls a shift from Post-Fordist models of production and consumption to a viral or contagious consumption: "Now, the fact that consumer production is intimately tied to the circulation of objects is nothing new. Instead, what is interesting is the emergence of what could be called 'contagious modes of circulation' where objects cling to and seek their consumers."[44] The movie dramatizes this shift clearly. Instead of selling the vaccine at certain locations, and having consumers come purchase them if they want, the government assigns one to each American, who is given a lottery number that will determine when, not if, they will get it. The vaccine now chooses the consumer (in an almost utopian vision, the film never shows anyone even needing to pay for the vaccine).

The movie thus shows how viral outbreaks facilitate a shift in transnational capitalism towards a more viral model, and the ways in which such viral interruptions—of health, products, and travel—reinvigorate these ailing networks to make them more efficient and in higher

demand. This is what theorists have called the symbiotic relationship between the viral and capitalism: "Instead of imposing strictly defined homeostatic models to patch up flows deemed dangerous (like contagions), this mode of capitalism taps into the creative modulations and variations."[45] In other words, in overcoming a viral pandemic, transnational capitalism seems to receive a much-needed booster shot. *Contagion* finishes its narrative on this note, with a viral rhythm that continues through its last few scenes, where each of the main characters acquires the vaccine in rapid order. Dr. Cheever gets his vaccine from Admiral Haggerty, who in passing it along to him also informs him that he is due to speak in front of Congress. In the next scene, Dr. Cheever gives his vaccine to Roger's son, who would otherwise have to wait longer. Then, in another quick cut, Dr. Cheever administers the vaccine to his fiancée. All dialogue and diegetic sound stops here, and another electronic, but this time less high pitched, soundtrack beat plays. The scene cuts to Alan interviewing survivors at various vaccination sites, taking pictures of military personal. Then, we move to Dr. Hextall and her partner deep in a vault, where she places samples of the Mev-1 virus next to other deadly outbreaks (SARS and H1N1) in a deep freeze. The scene cuts back and forth between Dr. Hextall and a series of vaccination centers where the vaccine is administered via nasal spray to citizens, in which the cuts are choreographed to the beat of the soundtrack. We are back in viral time, only the pitch has changed.

The effects of hypervisibility change based on the tools outbreak narratives use to image their viruses. Previous critiques of hypervisibility focus on specific imaging tools like the electron microscope, and the way it projects the danger of a murderous intruder onto minority groups by visually isolating the virus from other "healthy" parts of the body. Instead, *Contagion* uses 3D protein modeling, where the appearance of the virus is exaggerated to create an accurate depiction of how the virus integrates into the body. The focus is on connections, sequences, and

integration, and subsequently the threat of the virus shifts to the speed of transition between characters and the potential interruption of communications. In *Birth of the Clinic*, Michel Foucault describes how the development of the medical gaze at the beginning of the 19th century, a gaze that searched for pathogens within the body, led to a new form of biopolitics, in which the focus of power shifted from deciding who lives and who dies to regulating life itself. Foucault saw this shift happen prominently in the clinic, where doctors urged patients to adopt certain life styles as a form of preventative medicine instead of simply treating the symptoms as they arose: "The idea of a disease attacking life must be replaced by the much denser notion of pathological life."[46] Foucault's words predict another shift in 21st-century representations of outbreaks, since the virus no longer acts as an agent attacking life, but rather as one that fully integrates into and exploits life. The current danger, *Contagion* argues, is that both the virus and networks that make up the body become indistinguishable from each other. Due to new digital tools, vision is no longer as limited, but it also does not ensure clarity or easy visual consumption. 3D models allow scientists to see the virus's connections from all angles, but they simultaneously make it difficult to delineate separate parts. It is no longer possible to simply image and then cut out the infected parts to save the whole.

The dangers of hypervisibility are mirrored in the movie's network narrative, where audiences follow the point of view of ten different characters as they fight a viral outbreak and adjust to new daily routines. Yet for all of this visual intimacy, we still have trouble distinguishing who are the ones securing our healthcare system and who are the ones exploiting it. Is Dr. Cheever telling the public to keep calm for their own safety, or is he purposefully leaving out information to help, as he says, "those in [his] lifeboat"? Is Dr. Hextall, as Alan Krumwiede sarcastically comments, "Jesus in a lab coat" for testing the vaccine on herself to

save time, or did the pharmaceutical companies, in league with the CDC, "rush the trials" without considering future side effects? Is Alan Krumweide helpful in exposing unethical partnerships with the CDC, or is he financially benefiting from the uncertainty he produces? "I'm not the first person to make money off the fact that our immune system is a work in progress," Alan says to a hedge fund representative he works with to sell Forsythia, a homeopathic treatment for the virus. "I don't think anyone is immune to opportunity," the man replies to him. This might be the movie's sober take on the outbreak genre. Everyone—both brave virologist and conspiracy theorists, protective dad and riotous neighbor—is vulnerable to opportunity and exploits the networks they are part of, especially during times of crisis. This is not to say that everyone is unethical, as *Contagion* shows, but that even seemingly united global health initiatives are combinations of conflicting interests. There is no apparent cure for opportunism, and the effect is that opposite actors start to look eerily alike. By the end of the movie, even the government's dispersal of the vaccine starts to mimic the efficient spread of the disease it was supposed to halt. Hypervisibility in *Contagion*, therefore, displays in digital detail the full integration of the virus, and its logic of exploiting networks, into our daily lives. Such 21st-century outbreak narratives reveal an image of pathogens, but rather an image of a pathological life.

Note

[1] The outbreak film can be delineated both by its search for visual evidence of disease (as I have detailed above) and by its diegetic story of the sudden appearance and rapid spread of an infectious disease. These films often tell a story of the emergence of a previously unknown pathogen that has spread beyond its original location. Initially unseen or ignored, the pathogen moves quickly through a population, overwhelming medical and scientific institutions. Often the

military intervenes to establish order and try to prevent further spread. After the initial outbreak, these films generally split into two different outcomes. The first type of narrative continues by following a team of scientists who are trying to find a vaccine or serum of antibodies before the virus spreads. If not a group of scientists, then the film follows a group of people who must try to survive in the outbreak zone and often become inadvertently integral to the discovery of a cure or the further spread of the disease. Though not an exhaustive list, these films include *The Andromeda Strain* (1971), *The Crazies* (1973), *And the Band Played On* (1993), *12 Monkeys* (1995), *Outbreak* (1995), *Fatal Contact: Bird Flu in America* (2006), *The Andromeda Strain* (2008), *Doomsday* (2008) *Carriers* (2009), *Pandemic* (2009), *The Crazies* (2010), *Contagion* (2011), *Flu* (2013), and *Infini* (2015). In the second type of narrative outcome, the people infected become a new threat to those still healthy, and the focus is less on finding a cure than establishing a new life somewhere safe. These films often fall into the category of zombie films, and they include *The Omega Man* (1971), *Resident Evil* (2002), *Dawn of the Dead* (2004), *28 Days Later* (2002), *[REC]* (2007), *I Am Legend* (2007), *World War Z* (2013), *Train to Busan* (2016), and *The Girl with All the Gifts* (2017)—though there are many more not listed here. Films often move back and forth between these two diegetic outcomes, and some, such as the film *Blindness* (2008), move beyond the tropes of the genre more radically. In *Blindness*, since the disease is not lethal (it just causes blindness), the characters must learn to live with their disease. For the infected, their blindness in addition to the isolated space of the military quarantine zone radically restructures social hierarches.

[2] Ostherr, *Cinematic Prophylaxis: Globalization and Contagion in the Discourse of World Health*, 148.

[3] Ostherr, 15.

[4] Ostherr, 15.

[5] Ostherr, 190.

[6] Caetlin Benson-Allott, "Out of Sight," *Film Quarterly* 63, no. 2 (Winter 2011): 14.

[7] Priscilla Wald, *Contagious: Cultures, Carriers, and the Outbreak Narrative* (Durham: Duke UP, 2008), 36–39.

[8] Neeraja Sundaram, "Imagining Bio-Disaster, Reproducing Social Order: Epidemics in Contemporary Hollywood," *Journal of Creative Communications* 7, no. 1 & 2 (2012): 135–51. See also Benson-Allott, "Out of Sight," 14; Brent Bellamy, "DVD Reviews: Contagion," *Science Fiction Film and Television* 6, no. 1 (2013); Aaron Baker, "Global Cinema and Contagion," *Film Quarterly* 66, no. 3 (Spring 2013): 12; and Dahlia Schweitzer, "Going Viral in a World Gone Global: How Contagion Reinvents the Outbreak Narrative," in *The Last Midnight: Essays on Apocalyptic Narratives in Millennial Media*, ed. Leisa Clark, Amanda Firestone, and Mary Pharr (North Carolina: McFarland & Company, Inc., 2016). Other unpublished conference talks on *Contagion* also examine what, if anything, its digital images can tell audiences about contemporary outbreaks.

[9] Benson-Allott, "Out of Sight," 14.

[10] Brent Bellamy, "DVD Reviews: Contagion," *Science Fiction Film and Television* 6, no. 1 (2013): 123.

[11] "What Is Electron Microscopy?," Microscopy, accessed February 7, 2018, https://www.jic.ac.uk/microscopy/intro_EM.html.

[12] Ostherr, *Cinematic Prophylaxis: Globalization and Contagion in the Discourse of World Health*, 181.

[13] Susan Sontag, *AIDS and Its Metaphors* (New York: Farrar, Straus and Giroux, 1989). Susan Sontag makes a similar argument in her examination of the label "plague," as opposed to the neutral "epidemic," to name the outbreak of HIV. For Sontag, this associates HIV with a divine punishment for homosexuals, while simultaneously linking it to a primordial Africa from which the virus was thought to have emerged.

[14] W. Ian Lipkin, "Opinion | The Real Threat of 'Contagion,'" *The New York Times*, September 11, 2011, sec. Opinion, https://www.nytimes.com/2011/09/12/opinion/the-real-threat-of-contagion.html.

[15] Gavin Yamey and Hwang Jimee, "An Outbreak of Scientific Accuracy," *British Medical Journal* 343, no. 7828 (October 22, 2011): 850.

[16] Yamey and Jimee, 850.

[17] Jennifer Cutraro and Holly Epstein Ojalvo, "When Contagion Spreads: Crowdsourcing Disease Outbreaks," The Learning Network, 1316028717, //learning.blogs.nytimes.com/2011/09/14/when-contagion-spreads-crowdsourcing-disease-outbreaks/. See also, "The Movie "Contagion" for High School Students | One Health Sweden," accessed February 7, 2018, http://www.onehealth.se/ohs/node/161. See also, "MOVIE REVIEW- 'Contagion' - 9th Grade Academy," accessed February 7, 2018, https://sites.google.com/a/bklawtech.com/9th-grade-academy/movie-review.

[18] *Contagion - Steven Soderbergh - Director* (labiennaletv, 2011), https://www.youtube.com/watch?v=drOGfPbh8Sw.

[19] Baker, "Global Cinema and Contagion," 12.

[20] See Benson-Allott, "Out of Sight," 14. She argues that digital images of the virus are relegated to screens in order to show the limits of vision.

[21] For revisions to this section, I will use Stephen Prince's work on perceptual realism to build a more robust historical framework for this move to the digital aesthetic.

[22] Eugenie Brinkema, "Violence and the Diagram; or, The Human Centipede," *Qui Parle: Critical Humanities and Social Sciences* 24, no. 2 (Spring/Summer 2016): 87.

[23] Donna Jeanne Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge, 1991), 163. Haraway argues that if bodies are increasingly understood through the model networks, then it restructures questions of health and bodily integrity into

questions of successful interfacing: "No objects, spaces, or bodies are sacred in themselves; any component can be interfaced with any other if the proper standard, the proper code, can be constructed for processing signals in a common language."

[24] Bellamy, "DVD Reviews: Contagion," 123. Bellamy reasserts Jameson's claim: "At its core, the film points out that the precise remainder of englightenment progress cannot be represented -- that is, the picture thinking of a contagion could only produce the question of totality and not its thought, not its cognitive map" (123).

[25] Nick Srnicek, "What We Talked About At ISA: The Decline of Cognitive Mapping (Part II)," *The Disorder Of Things* (blog), May 11, 2011, https://thedisorderofthings.com/2011/05/11/what-we-talked-about-at-isa-the-decline-of-cognitive-mapping-part-ii/.

[26] Srnicek.

[27] Srnicek.

[28] Baker, "Global Cinema and Contagion," 13. Aaron Baker helpfully summarizes Vivien Silvey's argument. To see the original text go to Vivien Silvey, "Not Just Ensemble Films: Six Degrees, Webs, Multiplexity and the Rise of Network Narratives," ed. Jana Funke and Lena Wanggren, *University of Edinburgh Postgraduate Journal of Culture and the Arts*, no. 8 (Spring 2009).

[29] Neil Narine, "Global Trauma and the Cinematic Network Society," *Critical Studies in Media Communication* 27, no. 3 (2010): 223.

[30] Tim Dean, "Bareback Time," in *Queer Times, Queer Becomings*, ed. E. L. McCallum and Mikko Tuhkanen (Albany: State University of New York Press, 2011). This rhythm is distinct from other theoretical understandings of temporality during the time of an epidemic. Tim Dean's "viral time" argues that the HIV epidemic, because of the virus's delayed effects and its partial suppression from drugs, causes infected gay men to have anxiety about what timeline they inhabit. The infected subject recognizes a disparity between their individual timeline and that of the virus as it incubates inside of them, causing an unbearable level of uncertainty about when they will die. In *Contagion*, however, viral time is faster, and therefore the characters in the opening scene have little to no anxiety, since they are unaware of their shortened lifespan. As Mitch says, "This happens really, really fast." Most outbreak movies similarly exhibit an impossibly fast incubation period that pushes their fictional virus into the realm of science fiction. *World War Z*, for example, has a dizzyingly fast incubation period of ten seconds from when the subject is first bitten to when they become a viral-induced zombie. *Contagion* is not quite so fast: the virus maintains a 24- to 48-hour incubation period that leaves little time in between finding out one is sick and dying. Regardless of their scientific accuracy, these films try to portray the threat of speed. Unlike Tim Dean's HIV time, which makes the subject feel a doubled time, the virus in *Contagion* fully transforms the subject's timeline into a viral life cycle. The virus quickly passes through and kills bodies, but as it invades and kills their cells, it simultaneously syncs these bodies up to a universal rhythm.

[31] Jussi Parikka, "Contagion and Repetition: On the Viral Logic of Network Culture," *Ephemera* 7, no. 2 (2007): 293.

[32] Parikka, 295.

[33] Ralph Wilson, "The Six Simple Principles of Viral Marketing," *Practical Ecommerce* (blog), May 10, 2012, https://www.practicalecommerce.com/viral-principles.

[34] Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," 163. See quote: "The privileged pathology affecting all kinds of components in this universe is stress—communication breakdown" (163).

[35] Eugene Thacker and Alexander R. Galloway, *The Exploits: A Theory of Networks* (Minneapolis: University of Minnesota Press, 2007), 122.

[36] Steven Soderbergh, *Contagion*, DVD (Warner Home Video, 2011). If this particular interview scene feels long, it is because it breaks the movie's average scene length with a run time of three minutes and thirty-six seconds, more than three times the movie's average scene length, making it the longest in the movie and one of only two scenes to risk extending past the three-minute mark. Its length not only causes this scene to stick out for audiences, it also momentarily halts the televisual "beat" of the narrative through a televised interview that itself addresses whether spreading information too quickly, without being properly vetted, is synonymous with spreading a biological virus. The interview starts with the newscaster asking Dr. Cheever about how there are "stories circulating on the internet" that in India the drug Ribavirin has shown to be effective against the virus, but that the CDC is not announcing it as a possible cure until they can stockpile the drug. Dr. Cheever responds to these accusations by saying that the CDC needs more time to conduct a full examination of the drug, but as of now there is "no science to back any of these claims."

[37] Ellis Hanson, "The Future's Eve: Reparative Reading after Sedgwick," *South Atlantic Quarterly* 110, no. 1 (December 21, 2011): 104, https://doi.org/10.1215/00382876-2010-025.

[38] *Contagion - Steven Soderbergh - Director*.

[39] Benson-Allott, "Out of Sight." Benson-Allott characterizes this final scene as a Rube Goldberg-esque chain of events, which helped me see how its structure of looking farther and farther back for the initial cause does not necessarily allow us to understand the current moment any clearer, however tempting it might be.

[40] Dahlia Schweitzer, "Going Viral in a World Gone Global: How Contagion Reinvents the Outbreak Narrative," in *The Last Midnight: Essays on Apocalyptic Narratives in Millennial Media*, ed. Leisa Clark, Amanda Firestone, and Mary Pharr (North Carolina: McFarland & Company, Inc., 2016), 83.

[41] Bellamy, "DVD Reviews: Contagion," 122.

[42] Benson-Allott, "Out of Sight," 15.

[43] The film *28 Days Later* (2002) parodies this grocery store trope in zombie films by having the characters stumble across a full grocery store, where they joyously shop to their hearts' content without worry of payment to the nonexistent cashiers.

[44] Parikka, "Contagion and Repetition: On the Viral Logic of Network Culture," 295.

[45] Parikka, 296.

[46] Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception*, 188.

Chapter 3: Animating Infection: Digital Hordes and Risky Mobility

While much media scholarship on infection examines the use of explicit medical images in narrative cinema—images that promise to hold the pathogen still long enough to make it intelligible—the most prominent depictions of bodily infection in the 21st century are blockbuster films, which rarely, if ever, delve inside the body; instead, blockbuster films displace their images of internal infection onto the seemingly innocuous visual effect of the digital multitude. To understand how cinema animates infection today, this chapter looks at the overlapping animation technologies used in both biology research, which tries to model molecular movement within a cell, and in blockbuster films, which from 2000 to the present use virtual multitudes to render fictitious armies, zombies, and crowds at astonishing new scales. Though digital multitudes are commonly used to populate stadiums, theaters, fields, and buildings as a way to increase the grandeur or realism of a scene without having to rely on live-action extras, they exhibit different characteristics in films about infection. In these films, the digital multitude transforms into an unthinking and mobile horde, capable of engulfing military defenses, yet rife with internal collision and opposing movements among its individual constituents. Such films as *Final Fantasy: Spirits Within* (2001), *I, Robot* (2004), *Dawn of the Dead* (2004), *Resident Evil: Extinction* (2007), *I Am Legend* (2007), *District 9* (2009), *Juan of the Dead* (2011), *Warm Bodies* (2013), *World War Z* (2013), *Dracula Untold* (2014), *Train to Busan* (2016), and *Girl with All the Gifts* (2016) all employ these mobile hordes in their narratives to project their characters' internal battles onto the landscape, thereby collapsing interior and exterior spaces, in what Scott Bukatman describes as the sublime experience of watching such visual effects.[1] In their interviews on the creation of the zombie horde, the visual development department for *World*

War Z articulated that they wanted to give the horde an explicit feeling of a larger body made of multitudes, "almost as if the mass itself was the 'creature,' and the individual zombies were merely cells of that larger organism."[2] With its ability to condense both the movement of multitudes and the movement of a larger, individual body into a single image, the digital horde constitutes a crucial role in depicting the aesthetics of infection in contemporary cinema.

In infection films, the digital horde links internal movement of molecules and pathogens to the film's narrative examination of mobility in other formations, in the nation (the body politic), and in populations that move between nation states. Kristen Whissel's seminal work *Spectacular Digital Effects: CGI and Contemporary Cinema* helps to elucidate the potential of digital multitudes to simultaneously anchor a film's significant narrative events and allegorize its thematic conflict.[3] In films about infection, the use of digital hordes comes to represent the contested effect of mass mobility at the beginning of the 21st century, characterized by the competing forces of globalization (e.g. the mass movement of refugees, migratory labor forces) on the one hand, and overpopulation (the increasing scarcity of resources and space) on the other. By linking internal infection to moving masses, hordes emblematize three main thematic concerns in the narratives in which they appear: the first is the potential of excessive movement to cause devolution. This devolution forces the characters to ask how much they are willing to give up for total freedom of movement. In the second, the horde's ability to visualize hundreds of thousands of bodies piling on top of each other to surmount a wall allegorizes social theories of collateral damage, the capacity of one group to gain upward mobility at the expense and immobility of another. Finally, in its visually arresting encounter between two opposing forces, the digital horde provokes a realization in the characters about how illness and immunity are initially misrecognized as opposites when are found within each other. Taken together, infection

films use digital hordes as an effects emblem to map questions of the mobility of bodily multitudes onto the mobility of populations and classes. In doing so, the digital horde allows these films to bridge the extreme scale difference between molecular and global structures that both, in aggregate, determine the health of the body.

BIOANIMATION

The digital construction of hordes uses the same computer animation technology as biomedical imaging, making the depiction of two drastically different scales—multitudes and molecules—a product of a similar technological process. Janet Iwasa is considered one of the leading scientists in bioanimation, and she works with collaborators to animate their research for both educational outreach and for better representation of infection at the mesoscale, the scale depicting the inner workings of a cell. Recalling her initial training in Hollywood animation studios, Iwasa explains there was an epiphanic moment when she realized the potential of software like MASSIVE (Multiple Agent Simulation System in Virtual Environment) to depict the mesoscale of cells: "The demonstration examples they showed us were arena scenes or huge crowds walking across a field or large-scale battles, but I was sitting there thinking, 'My gosh, proteins.'"[4] Bioanimation differs from traditional images generated from electron microscopy because it can easily integrate into the image a variety of data gathered from different fields such as structural biology and developmental biology: it is accumulative in its ability to synthesize and then illustrate a series of data sets from different labs. Microscopy, on the other hand, focuses on isolating an individual cell or virus, which is preserved or frozen at a particular stage of development on a slide, and then photographed. The photograph not only occludes the inner workings of the cell, but it reduces movement to a static presence, drawing from the conventions

of portrait photography. As described in Chapter 1, this portrait-like image motivates a metaphorical "meeting," a face-to-face intimate encounter between scientist and photographed pathogen in films like *Outbreak* (Wolfgang Petersen, 1995), *And The Band Played On* (Roger Spottiswoode, 1993), and *The Andromeda Strain* (Robert Wise, 1971). As Scott Curtis argues, "The history of medicine could be written as the history of attempts to tame—to hold *still*—the unruly body through such techniques as autopsy and illustration."[5] For Curtis, even modern digital imaging technologies such as MRIs and CT scans, which can take multiple images over time and sequence these images together in a loop, are centered on the doctor's ability to pause the image to make the body and its illness intelligible. In comparison, bioanimation focuses not on the single pathogen but on the mechanisms and processes of movement between and within a cell. What we see is a dynamic movement of masses, combining and splitting, dispersing and synthesizing. Although these animations do not hold the same (tenuous) claim to photorealism or even indexicality as the photographic technique of microscopy, as D. S. Goodsell describes, they are "the most effective approach for exploring the dynamic nature of the mesoscale" and they "allow viewers to see biomolecular processes in the context of their cellular environments."[6]

Bioanimation requires thinking of the body as a multitude of molecules in constant flux, going through a complicated process of assemblage and dispersal. Drew Berry, an animator at Walter and Eliza Hall Institute of Medical Research in Melbourne, Australia was awarded a BAFTA, an Emmy, and a MacArthur Genius Grant for his animations that depict malaria's introduction into the cell and the origin of breast cancer.[7] For Berry, bioanimation helps shift concepts of the body to issues of motor capabilities: "I'm really just showing people the mechanism. If you give them a glimpse of the motor or the contraption—the cables and the pumps—they'll lean in and take a look."[8] Similar to Janet Iwasa's animations, Berry's

animations make it challenging to focus on any single molecule because they move in and out of frame while the camera often stays still, and because his animations run in the "real time" of fast molecular processes; yet, his animations provide an unparalleled view of inter-cellular movement. Because there is so much motion at the molecular level, bioanimation requires a balancing act between two types of competing motions in the cell: stochastic motion, the random movement and dispersal of molecules in the cell, and scripted motion, the guided motion of biomolecular processes the animator is trying to highlight. The animator must depict both types of motion without one dominating the other. To emphasize certain scripted motions, animators invest the body with visual metaphors, such as seeing certain components as "a highway," a common metaphor in bioanimation, and one also prevalent as a metaphor in Hollywood feature films about infection (fig. X).[9] The change of focus in biomedical imaging towards computer-animated motion helps illuminate a theoretical shift in how to define the body in an age of technical intervention. As Eugene Thacker argues, "What we find with biomedia is a constant, consistent, and methodical inquiry into this technical-philosophical question of 'what a body can do.'"[10] For Thacker, at stake in biomedia is a new ontology of the body, which he reiterates from a similar critique by Gilles Deleuze: the question is no longer what counts as a body, but rather what can the body do, what are its capacities? Bioanimation works within this new framework by trying to illustrate how a body constructed of multitudes moves and the various processes that give it this capacity.

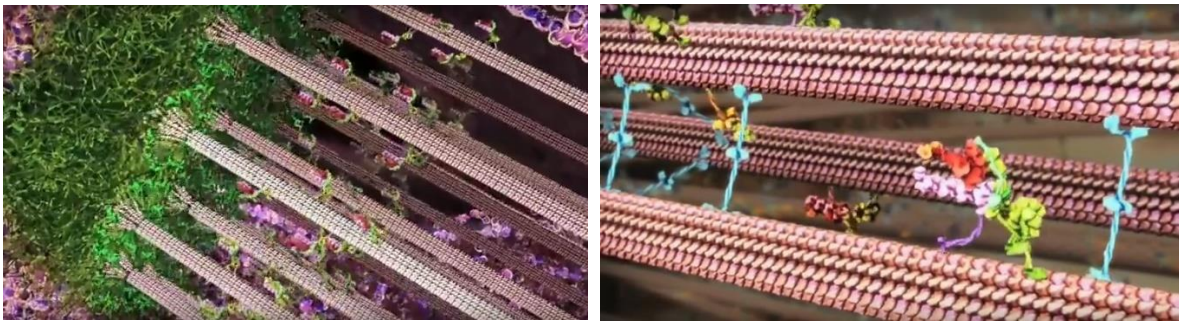

Figure 4.1a-b: Drew Berry's bioanimation of mitosis[11]

Blockbuster films about infection do not often take the camera inside the body to visualize infection as in bioanimation, but they instead use digital hordes to externalize onto the landscape what would otherwise happen internally within a character's body. The dynamic movement of the digital horde as hundreds of individual agents combine, writhe, flow together, and then disperse makes them uniquely suited to stage the types of internal molecular movement characterized in bioanimation. Indeed, such feature films make explicit the parallels between infected bodies and the digital hordes that move across the landscape and overcome city defenses. Hironobu Sakaguchi's 2001 film *Final Fantasy: The Spirits Within* is considered the first photorealistic, computer-animated feature film, and it tells the story of a post-apocalyptic world where a meteor has hit the earth, releasing hordes of phantom creatures. If touched, these phantoms can detach part of themselves and infect the bodies of the human characters. *Final Fantasy* opens with a scene of a miraculous escape, only to find that one of the protagonists, Captain Gray Edwards (Alec Baldwin), has been infected. A body scanner reveals an ethereal, mud-red mass burrowing through his body, which forces Doctor Aki Ross (Ming-Na Wen) to conduct surgery to save his life. During surgery, Aki takes a robotic laser and guides it to the infected areas, while the red mass burrows even deeper to avoid detection. Though Aki is eventually successful, this initial surgery reoccurs at the end of the film, but at a larger scale,

when the remaining humans try to use a space-station weapon called the Zeus Cannon to kill the meteor and the phantoms within it only to have them burrow deeper into the earth to escape. In the final scene of the film, Dr. Aki Ross and the Captain find themselves trapped in the wound-like hole in the earth made by the cannon as hundreds of phantoms descend upon them. In this visual parallel, the film positions the earth as wounded like Captain Gray's infected body and shows that the medical strategies barely successful at securing his health need to be retooled if they are to protect the health of the planet. Dr. Aki Ross's solution is to redirect the positive energy charge emitted by organic matter towards the phantoms to cancel out their negative charge, rendering them harmless. The science behind the story is, as one of the villainous characters in the film proclaims, "utter nonsense"; however, through this explanation, the film characterizes the energy charge of organic life much like how an antibody would take the inverse shape of the pathogen it targets to render the pathogen harmless when they combine. At the end of the film, this balance of organic and phantom energy proves to ameliorate infection better than a violent elimination via the laser cannon.

The ending's emphasis on a balance between organic and inorganic life supports the film's stance on photo-realistic animation. As a visual effects supervisor for the film notes, there was a lot of critique during the film's production that new CGI technology, and *Final Fantasy*'s full embrace of it, would be the death knell for live-action actors; however, the film's production showed how live-action actors were still needed as models for the animators, requiring a balance of live-action and animation rather than an elimination of one or the other.[12] Although the film's narrative of a harmonious combination of inorganic and organci life mirrors the film's production, *Final Fantasy* ultimately underperformed in the box office due to the uncanny effects of this merging. Because CGI at the time could not dilver all of the visual information

human eyes search for in a face, the CGI characters seemed internally dead. As Stephen Prince argues, this was not just an issue for *Final Fantasy*, but haunted most use of CGI and motion capture for the next fifteen years: "The failure of mocap data to supply accurate eye information—particularly blinks and saccades—is responsible for the zombie-like quality of many photorealist digital characters."[13] The use of digital hordes to externalize the internal infection of the characters, therefore, had the consequence of emptying out the characters, themselves, of a sense of interiority.

Like *Final Fantasy*, Marc Forster's 2013 film *World War Z* deploys its digital hordes as a way to externalize onto the landscape the infection from a zombie bite, with the consequence of turning cities and transit networks into bodily metaphors. In *World War Z* an unknown virus causes people to experience an extreme form of rabies. Within days of the outbreak, cities are burning, and the human population faces possible extinction. To capture the spread of infection, the camera zooms in on the wound created once someone is bitten; then darkened veins creep from the wound upward towards the head and brain. When the infected veins reach high enough, the victim's eyes turn opaque, and they fully transform into zombies. To emphasize this upward movement of infection, the camera starts at ground level and then tracks upward from the wound to their head, until it moves even higher to look down at the infected individual. Each time someone is bitten, this entire process takes twelve dizzying seconds.

In the film, the most elaborate special effects sequence mirrors this type of upward-moving infection of veins when the digital horde of zombies breaches the outer walls of Jerusalem by piling on each other into large pillar-like structures to reach the top. The camera movement of the scene similarly parallels the individual infection scene, where the camera first starts at the ground level and then cranes upward past the tops of the pillars to look down on the

humans on the other side as zombies rain down from above. The zombie horde snakes through the winding city streets until they reach the airport at the center, or head, of the city where all radio communication buildings are based. Once they overrun the airport, the government considers Jerusalem to have fallen. To further reinforce the visual connection between ascending hordes and infected body parts, the film presents amputation as the only means of survival. In the Jerusalem scene, a bodyguard (Daniella Kertesz) tries to protect the protagonist, Gerry Lane (Brad Pitt), when a zombie suddenly bites her on the hand. She gives Gerry a fearful look, but before the infected veins have time to crawl up her body, Gerry takes a machete and chops off her arm. As they escape in a commercial airplane, the scene of amputations repeats in a new form. Unknown to all, a zombie has stowed away in the back of the cabin, where it starts to infect those around it, causing the virus to spread upwards towards the front of the plane where Gerry and the bodyguard sit. Seeing that they are trapped hundreds of feet in the air with zombies approaching, the bodyguard repeats her fearful look at Gerry, who quickly pulls out a grenade and lobs it towards the back of the plane. The explosion severs the plane in half, and although the front half crashes, Gerry and the bodyguard miraculously survive.

While the digital hordes of *World War Z* visualize an upward-moving infection, the digital hordes in Sang-ho Yeon's film *Train to Busan/Busanhaeng* (2016) initially crawl upward only to weigh the body down. In the film, an unexplained virus reanimates the dead and similarly causes them to begin a feeding frenzy. A speed train on its way to Busan seems to be one of the few safe havens, until a zombie stows away on board and starts to transform those seated in the back of the train. The first person we see infected is a train passenger who drags along her infected leg, discolored by blackened veins, as she limps through the aisles. While she initially tries to tourniquet the leg to stop the infection, it inevitably breaks through the barrier and

reaches her head. The film restages this leg infection in a later scene when the digital zombie horde forms itself into a pile to drag down the train containing the last remaining human survivors. It is up to the protagonist, Seok-woo, in what is another spectacular metaphor of amputation, to detach the zombies holding onto the back of the train to save his child from certain infection. In these films, the image of the body expands to the transportation networks used to move people throughout different cities. Instead of the winding streets of Jerusalem, however, the digital horde rushes through train stations and terminals, while the train itself, as seen in a cut to a smartphone showing the train's route, moves through vein-like lines to its destination in Busan while harboring an infection that could contaminate the city. The digital hordes break through the film's mise en scène of horizontal lines—either the tracks that stretch into the distance, the yellow footpaths on the train floor that guide passengers forward, or the glass barriers that section off different compartments. Constructed of infected bodies from an unknown virus, the digital horde infects and weighs down the networks of transportation that supply movement throughout South Korea, and without efficient transportation, the nation slows to a deadening halt. As these films demonstrate, the digital horde becomes a metaphorical image that links the spread of bodily infection to the dismantling of infrastructure within larger cities and states.

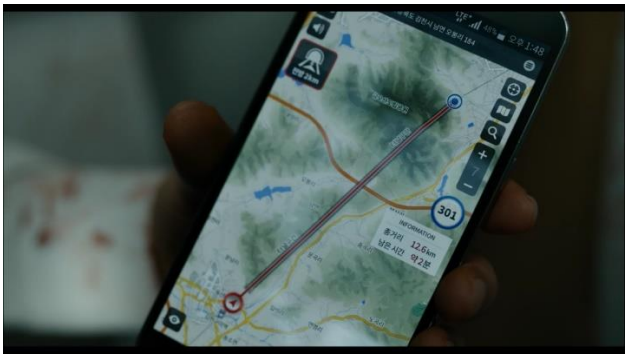

Figure 4.2a-d: Lines of infection in *Train to Busan*

As cinema and media scholars have noted, the increasing prevalence of spectacular digital effects in such blockbuster films might return viewers to the visual pleasures associated with early, non-narrative cinema, such as Edison's Kinetoscope, which would exhibit a motion picture in a loop for a nickel. Tom Gunning's article, "The Cinema of Attractions," which attempts to celebrate the enduring presence of non-narrative spectacles as cinema transforms after 1907, is often taken-up by digital media scholars to re-examine how 21st-century special effects similarly present "cinema less as a way of telling stories than as a way of presenting a series of views to an audience, fascinating because of their illusory power."[14] These special effects momentarily interrupt the narrative with visual splendor, inciting the audience to experience, in a conscious manner, the pleasure and curiosity of visual investigation. Scott Bukatman sees new digital effects, particularly those that abound with kinetic energy such as Superman's ability to defy gravity and tumble through the sky, as a way for the spectator to experience a feeling of the sublime:

> Sublime initiates a crisis in the subject by disrupting the customary cognized relationship between subject and external reality…. The final effect is not a negative experience of anxious confusion, however, because it is almost immediately accompanied by a process of appropriation of, and identification with, the infinite powers on display.[15]

As Superman shoots into the air, the terrorizing feeling of instability caused by this upward motion turns into a positive identification through his ability to escape from the confining social spaces of the city below. Bukatman's definition of the sublime as an initial crisis between the subject's internal and external realities is similar to the ability of digital hordes to blur a character's internal infection with external landscapes, but unlike Superman, this terrifying feeling never becomes sublimated into identification with the character's mastery of the situation. Instead of mastery, the digital horde produces an experience of vulnerability as the horde breaks through defenses, and a visceral feeling of crawling skin in wide shots of thousands of individual zombies ascending structures (walls, streets, landscapes). Science animator Drew Berry explains that audiences have a similar experience watching his bioanimations: "A lot of people are actually pretty creeped out by the animations, because they're these writhing, dynamic systems going on inside of us. It's confronting."[16] Both the digital horde and bioanimation produce a "confronting" affect because they provide glimpses into internal, dynamic movements of the body without any of the promises of control or freedom from it. Though scholars see the spectatorial experience of special effects as an interruption of the narrative, infection films exploit this experience to thematize issues of speed and control within their narratives.

Crowd Movement in the Digital Era

Digital hordes have not historically been so mobile. Software engineer Craig Reynolds first introduced crowd simulation software in a seminal 1987 article on the simulation of flocks of birds and schools of fish.[17] Reynolds designed what was called particle simulation, in which individual units within the flock were designated as particles and allowed to interact with each

other to produce a smooth flow around obstacles. In 1994, a software developer at MIT named Karl Sims published the article "Evolving Virtual Creatures," which defined a new way to design moving crowds outside of the particle model to allow for different forms of movement and behavior. Peter Jackson's *The Lord of the Rings* trilogy marked a turning point for crowd simulation when Sims' work was used by Stephen Regelous to develop the software MASSIVE (Multiple Agent Simulation Systems in Virtual Environment) for Jackson's studio Weta Digital to make their digital armies. Digital multitudes could now use artificial intelligence to allow each individual "agent" within a crowd to act autonomously but with a shared target. However, early uses of MASSIVE created multitudes that mostly stood their ground or marched forward in straight lines. Kristen Whissel argues that the formal characteristics of the digital horde allowed films like *The Lord of the Rings: The Two Towers* (2002), *Star Wars: Episode II – Attack of the Clones* (2002), *Troy* (2004), and *I, Robot* (2004) to exploit the sheer size of the crowd for allegorical potential: "The digital multitude almost always fills the width of a high-angle wide shot, extends beyond the left and right sides of the screen, and recedes far into the background of the shot, thereby radically altering the appearance of the landscape it occupies."[18] Whissel persuasively argues that digital hordes that stretch across the horizon help spatialize time and visually enact an apocalyptic encounter between two historical periods, the old guard starkly contrasting with the sudden appearance of an approaching, new era. In its unique ability to visualize hundreds of thousands of people within a single frame, the early work of MASSIVE evokes a surprisingly consistent thematic question, as Whissel explains, about the nature of homogenous collectives that encounter a competing group of individual heroes.

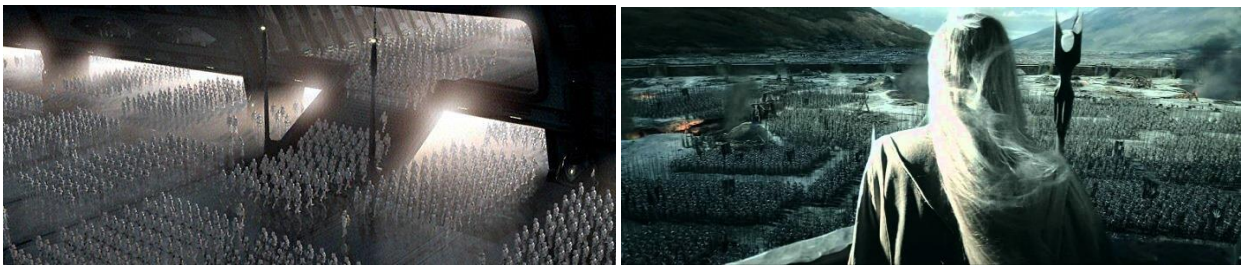

Figure 4.3a-b: disciplined formations in *Star Wars: Episode II Attack of the Clones* and *Lord of the Ring: The Two Towers.*

The relative immobility of the digital horde at the turn of the 21st century made it particularly suited for images of soldiers controlled by a single ruler and characterized by a mastery of pacing and formation that is astonishing exactly because of the multitude's expansive scale. Because of the identical marching and geometric formations of digital hordes in *Attack of the Clones*, W.J.T. Mitchell reads the digital horde as resurrecting the modernist fear of the loss of identity within crowds in the age of genetic cloning (fig. X). In the film, a single bounty hunter named Jango Fett is cloned to produce a massive army for the Republic. The cloned army becomes an extreme version of the crowd, in which sameness is maintained even after the army dissipates because mimicry continues to occur at the biological scale of DNA: "They are 'deep copies' of their parents and of each other who maintain their group identity no matter how drastically they are separated from the mass."[19] Though the digital horde was produced using MASSIVE, seemingly endowing each agent with autonomy, their "deep copies" suggested the opposite: multiplication produced by cloning units over and over.

The clone army's identical physical appearance is only half of the story, however. We learn the clones are also genetically engineered to be more compliant to orders from a general and therefore less likely to think individually; in addition, they have been coded with a secret voice command called "Order 66" that, when triggered, requires them to murder their

comrades—the Jedi—in battle. Thus, genetic replication is not just about sameness, in both its visible (phenotype) and invisible (DNA) expressions, but also, and perhaps most importantly for the narrative, in the clones' hard-wired submission to a leader's commands, no matter how unethical. The movement of the digital horde in these early-2000s films is above all disciplined, with bodies moving in precise formations, which seem in opposition to the oncoming, apocalyptic force they are meant to emblematize. In *Lord of the Ring: The Two Towers*, the movement of the digital multitude as they assemble for battle is so ordered, though it is made up of apparently bloodthirsty orcs and goblins, that presumably the creatures must repress their chaotic urges in order to listen as their leader, Saruman, gives a speech in his tower (fig. X). Digital hordes in this period are largely appendages of a single ruler, and so the spectacle is centered around the amazing feat of watching such immense numbers of bodies disciplined towards a single cause.

The use of digital hordes has since changed, both in the type of narratives they populate and how they internally interact with each other. Further development of MASSIVE and other crowd simulation software has shifted the focus of digital multitudes towards internal collision and more dynamic movements, which allow multitudes to better interact with each other, pile up, collide, collapse, fall, writhe—all which breaks out of the previously disciplined aesthetic, and introduces an aesthetic of infection or corruption. *I, Robot* signifies this aesthetic shift directly in its narrative about artificially intelligent robots that rebel from their programmed commands and wreak havoc on a human world that relies on their submission. Initially, the digital robot multitudes start as an orderly group, selflessly abiding by the laws and rules humans have constructed for them (fig. X). It is only once their data becomes "corrupted" by an unknown entity that the robots start to move and act differently, often signaled by aggressive movement

(jumping, crawling, and crashing downward in a pack or horde) and a change in the color of their cranium hardware from sterilized, soft-white to a deep, moody red (fig. X). As the film dramatizes, the danger is when the robots start to move independently from their human operators, and in one montage sequence, we see a series of robots, each sold as home helpers that are ordered to clean and cook, disobey their human owners and take over the city. In terms of frame composition, the digital horde shifts from remaining mostly in the background, with the signature figurehead or leader in the foreground, to moving into the foreground, leaderless. At the end of the film, the robots have become too independent (and therefore too dangerous), so they are discarded into a giant, dried-up lake Michigan, though the film ends by implying that one day they will revolt against the humans and once again upend the social order. As *I, Robot* makes clear, infections, whether biological or digital, produce an unruly, chaotic horde that many films in the last decade use to signify questions of uncontrollable populations. The same transformation occurs in *Dracula Untold* (Gary Shore, 2014), which stages the clash of a disciplined digital horde with one that is imbued with a new mobility. In this scene, a digital Turkish army marches in formation against a single figure, Vlad, who must make a deal with the devil to be able to defend his lands. In a complicated special effects sequence, Vlad breaks into a swirl of hundreds of thousands of bats, flies upward and dives downward, collapsing onto the stationary army and creating chaos in the ranks. These new digital hordes, with their upward mobility and downward movement, allow Vlad to win the battle, but "sickened by his monstrous acts," they also corrupt his body. His sudden vertical mobility is met with the consequences of losing control of his own body as he kills against his will. To stop his body from acting independently of his wishes, he eventually commits suicide by exposing himself to the sun. As these films make clear, the digital horde now moves beyond a steady forward march, deploying a

new dynamic movement that makes the horde more formidable while simultaneously challenging the control, and corrupting the body, of the leader who wishes to command them.

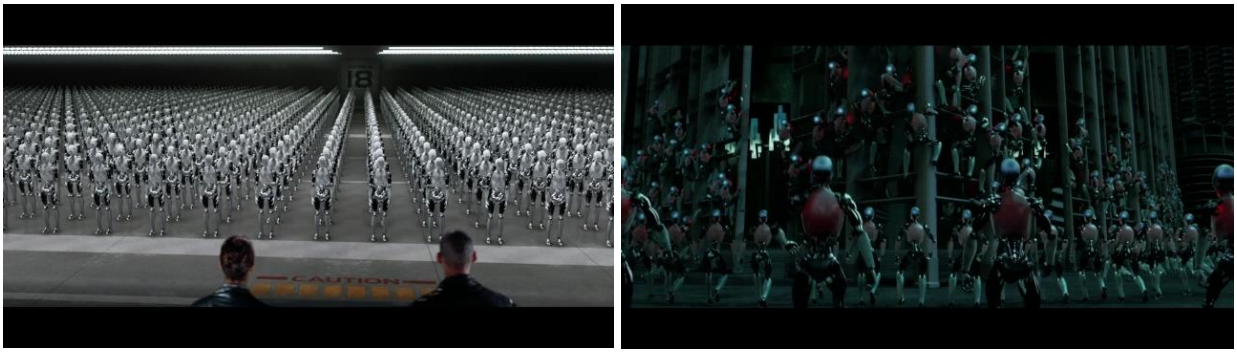

Figure 4.4a-b: Corrupted movement in *I, Robot*

Although crowds-simulation software is commonly used in a variety of genres, from battles in fantasy films to political speeches in historical dramas, the digital horde is often associated purely with infection and infestation, since it depicts a movement of mass bodies that has turned chaotic and ungoverned. As we move into the 2010s, zombie films have become the dominant genre to address bodily infection and transformation from the outbreak of a deadly pathogen, and the digital horde becomes the vehicle to see infection at a large scale. The zombie genre has a well-documented film genealogy that dates back to the low-budget 1932 film *White Zombie* (Victor Halperin), which explored the mysteries and dangers of Haitian voodoo, where zombification was a product of spiritual possession via potion and represented the enslavement of a malleable labor force. Another watershed film was Georgio Romero's similarly independent 1968 film *Night of the Living Dead*, which depicted the animation of dead bodies caused by radioactivity from a destroyed space probe, and linked the death of the protagonist (Duane Jones), who was killed by the sheriff's search party, to the violence of police brutality and white supremacist groups during the American civil rights movement. With the key exception of Peter

Jackson's film *Dead Live* (1992), it was only in the 2000s that zombie films started to explicitly and exclusively link the cause of bodily reanimation to the spread of a viral or bacterial infection.

With this thematic variation, the zombie genre simultaneously went through a drastic transformation in the audience, budget, and production process. As the animation adviser in charge of creating the visual effects for *World War Z* proudly claimed, "Thanks to teams of talented editors and visual effects practitioners working under the leadership of an uncompromising director and producer, *World War Z* raised the standard for zombie movies from perennial B-movie status to a polished, solid 'A.'"[20] As zombie films shifted from independent backing to larger-budget blockbusters with a global viewership, they began to utilize expensive visual effects animation. The most significant of these visual effects was background photo reconstruction and illumination, which gave the film crew the ability to shoot on location, often in busy urban areas, and then extensively alter background images in the frame afterward. Similarly, film crews could shoot on a sound stage and use photo-reconstruction to create digital mattes for the background of a city that was otherwise too expensive and logistically difficult to shoot in. The location of zombie films, therefore, moved from rural or suburban areas with isolated interior spaces to open, urban cities. The second was the creation of digital hordes, which often consist of hundreds of thousands of bodies in a single frame. Animators construct digital hordes using crowd simulation software, such as the Golaem or Miarmy plugins for Maya and MASSIVE. The process is a hybrid of analog and digital components, with live-action actors used as models for motion capture, while the crowd simulation software multiplies these bodies and choreographs their interaction with each other. The effect is that these films look drastically different from the formal features of lower-budget horror films, with their abrupt cuts and darkened mise en scène to hide the appearance of the

zombie or allow it to approach unnoticed. In contrast, today's blockbuster zombie films employ wider angles and deep focus shots that take place during the day and give audiences time to examine mass numbers of zombies as they move through recognizable cityscapes.

In an interview conducted around the 50th anniversary of his film *Night of the Living Dead*, George A. Romero laments that the special effects of blockbuster zombie films have effectively reduced the genre's provocative potential down to a shiny surface spectacle:

> Along comes Brad Pitt and he spends $400 million or whatever the hell to do *World War Z*. Max Brooks is a friend of mine, and I thought the film was not at all representative what the book was and the zombies were….My films, I've tried to put a message into them. It's not about the gore, it's not about the horror element that are in them. It's more about the message, for me.[21]

Romero is not the only one to critique these films for what they see as merely a vehicle for animated special effects. As one critic writes of *World War Z*, "The film is a feast for the eyes (the 3D conversion is very good), while the zombie horror consists mostly of mild jolts," and another called it "just bloody eye and ear candy."[22] Contrary to Romero, Kristen Whissel's work helps to show how the message of the film is maintained and developed at the level of special effects. While blockbuster zombie films, a cycle that is still ongoing, can now garner a quarter of a billion-dollar budget, they also need to recuperate this investment, and so it is necessary to keep their rating both within the American MPAA's (Motion Picture Association of America's) PG-13 guidelines and other international rating associations. This restriction forces the crew to cleverly displace explicit signs of bodily violence into metaphorical images that convey the same information. For example, instead of showing a zombie gruesomely devouring a victim in front of the screen, they show an oncoming horde engulfing the victim by their sheer numbers, like a wave that sweeps up the victim without blood or visible pain.[23] The hunger of the individual

zombie transforms into an allegorical understanding of the assimilation of the crowd. Romero fails to acknowledge the artistry of large teams of animators and concept designers that work closely with the director and writers to produce narrative cohesion and emblematic special effects.

RISKY MOVEMENT, INTERNAL COLLISION: *I AM LEGEND* AND *WORLD WAR Z*

The increased complexity and development of crowd simulation software, as well as the software's ability to break masses out of a linear forward movement and endow individual agents with dynamic interactions, allows the horde to express a new set of narrative possibilities around the competing roles of mobility versus stagnation, freedom of movement versus the need for quarantine. In the opening monologue of *Resident Evil: Extinction*, the protagonist describes the consequences of a world populated by roaming zombie hordes: "What few survivors there were learned to keep on the move…. If we stopped any place too long, they would be drawn to us. For those of us left, staying on the road seemed the only way to stay alive." Movement, however, could also put one at risk, such that the benefits and dangers of movement must be reassessed at each new location. The question of whether to move or not manifests through the horde, which is often characterized by a hypersensitivity to motion, where they are blind and harmless unless someone reveals themselves by moving, much like the T-Rex from Steven Spielberg's film *Jurassic Park* (1993). Movement, therefore, becomes the catalyst for narrative tension in such scenes where humans try different ways to slip quietly past the horde only to accidentally kick an empty soda can (*World War Z*, *Train to Busan*) or stumble into their den (*I Am Legend*), causing an all-out sprint for survival. Films exploit the issues of mobility, inherent in the visualization massive, fast-moving crowds to address other consequences of excessive speed in the 21st

century: migrating populations, mobile drone armies, fast-moving capital, and irresponsible medical progress. Even though the films discussed in this chapter come from a variety of geographic contexts, they maintain the digital horde as emblematic of an excessive mobility that inevitably leads to a loss of political sovereignty and bodily devolution.

Francis Lawrence's film *I Am Legend* (2007) uses the digital horde's reckless movement to articulate its critique of medical science's race towards a cure for cancer, which has counter-productively led civilization backward into ruin. The film opens with the daily news of an interview with Dr. Alice Krippen (Emma Thompson), who has just developed a cure for cancer by redesigning a virus:

> Dr. Krippen: In this case, the measles virus, which has been engineered at a genetic level to be helpful rather than harmful. I find the best way to describe it. If you can imagine your body as a highway and you picture the virus as a very fast car being driven by a very bad man, imagine the damage that car could cause. But then if you replace that man with a cop, the picture changes, and that's essentially what we've done.

Through her metaphor of a fast-moving car, Dr. Krippen argues that the cure for cancer is a matter of speed: if only we could co-opt the speed of the virus and use it to police the body instead of damaging it. Following the interview, the screen goes black and then opens on a bright morning overlooking New York City, with a title card that signals three years have passed. The camera pans upwards to reveal a now deserted city, covered in vegetation and quarantine tape, with the Lincoln Tunnel flooded in the foreground. The time compression of the title card produces a feeling of whiplash through its contrast between speed and stagnation: in such a short time, New York City has declined, and conversely, what was one of the busiest places in the world has come to a complete halt. The camera tracks forward over the city as we hear the rumbling of a car below. In a literalization of Krippen's car metaphor, a red Mustang races

through the deserted streets. The protagonist, Dr. Robert Neville (Will Smith), the only human left in the city, is hunting a horde of digital deer through a deserted landscape. Though he speeds through the streets and onto the sidewalk at a breakneck pace, he seems unable to catch the horde as different obstacles—tunnels and parked cars—block his way. At the end of the scene, even when he tracks a deer on foot, one of the lionesses who escaped from the zoo beats him to the kill, and he goes home hungry.

The opening chase is only made possible by a series of special effects: the first is to create a dilapidated New York City using matte painting and photo reconstruction. Since principal photography took place in New York City, the scene required that animators first remove all traces of human life by digitally erasing bystanders, and then adding signs of deterioration to the buildings and sidewalk. The second special effect was the creation of the digital deer horde that, for all of Robert's speed, was always just out of reach. These effects allowed the film to stage the question of human progress as a matter of physical speed: Robert races forward in his car to catch an elusive prey against a backdrop designed to look as if he is moving backward in time to a pre-human era, where vegetation and wildlife stood in place of great, urban centers. At the end of the opening scene, Robert proves to be on the same track as Dr. Krippen, as they both view speed as the only obstacle to human survival and health.[24] It is through this hubris of speed that Robert recklessly steers into dangerous situations. In a parallel scene, Robert chases after his dog, who has followed a deer into one of the dark buildings that contain a sleeping zombie horde. "Don't go running into the dark, dummy," Robert chastises the dog after they barely escape alive, though he fails to take his advice and later blindly runs into a wired foot trap set up by the zombies. A reckless forward speed, where one is unable to assess the dangers of one's surroundings, becomes the visual reference for a film about how rapid

progress could counterintuitively lead to social decline. In the final scene, Robert has to learn to change his speed or die: cornered by a zombie horde outside of his lab, he must make the decision to either run head-first into them, grenade in hand, or learn to "listen," as he says, to the signs around him (a tattoo of a butterfly on the neck of a zombie) that point to a different path of escape.

In the film, the humans are all live-action while the zombies are computer-generated, a distinction that required initially filming live-action actors in motion capture to serve as models, but then scrubbing these actors from frames and adding digital creatures to replace them. As described by the animation team behind the zombies, they made this to give the zombies a unique form of movement. In pre-production, the zombie horde was initially composed of "live-action performers wearing practical prosthetic makeups," but the scenes envisioned would have been too dangerous to perform. In one scene, the zombie horde has tracked Robert back to his barricaded home near Washington Square Park when they break in.[25]

> These were supposed to be very athletic characters who could jump really high and bounce off walls and stuff like that...the production had cast athletes and dancers, but to really get them to run breakneck across this park with absolutely no care for their own safety just wasn't possible…We found that we couldn't have people run through a park in the dark, over obstacles, in the really high-energy way we wanted, without risking life and limb.[26]

As a special effect, the digital horde not only remedies the potential danger to stunt performers or actors in violent scenes, but they also articulate a corrupted type of human movement, stripped of regard for its own well-being.

Due to the animators' need to scrub out what is recognizably human from human motion, the digital horde embodies the film's thematic concerns about a risky speed that will eventually cause Robert's devolution. Robert records a similar sentiment when he escapes a zombie horde

jumping out of a window into the sunlight, only to have the trailing zombies, who are sensitive to light, jump out with him and instantly burn alive. Robert records this bizarre event in his journal that night: "Behavioral note: An infected male exposed himself to sunlight today. Now it's possible decreased brain function or growing scarcity of food is causing them to ignore their basic survival instincts. Social de-evolution appears complete. Typical human behavior is now entirely absent."[27] The zombies' excessive mobility is a sign of their loss of an internal life; they are all motion and no psychology, creatures that simply move as their sole way of existing. As the film progresses, Robert similarly starts to lose typical human behavior as he goes through the motions of each day without much thought, repeating his routine of working out, eating, driving, and then returning home. Although another human family saves him, he finds he has become so isolated from other humans that he has difficulty reconnecting with them. Robert's devolution is almost complete: in the final scene, as the zombie horde tries to break in, Robert looks at the wall of his lab where he has hung a series of photographs to document his experimentation. Here, he is forced to realize that his reckless experimentation on zombies, in which his testing of various vaccines has left none alive, has made him a monster in their eyes. The horde visualizes in spectacular effect the logical endpoint for Robert's risky speed: if he continues to move forward on his experiments without regard for other's well-being or self-reflection, he will have devolved to such an extent that he will be unrecognizable from the infected zombies he is trying to cure.

While *I Am Legend* uses the digital horde's risky movement to signify de-humanization as the inevitable outcome of scientific hubris, *Juan of the Dead/Juan de los Muertos* (Alejandro Brugués, 2011) restages risky movement to explore the dehumanizing effects of being displaced from one's past. In *Juan of the Dead*, a virus has spread across Cuba, turning those who have recently died into zombies, and forcing Juan (Alexis Díaz de Villegas) and his team of ragtag

neighbors to open a cleaning service to help dispose of them. In this comedy, the roaming zombies ironically help spark a capitalist enterprise for the group of communist vagabonds, who aim to profit from a national crisis. Most of the zombies are portrayed by slow-moving live-action actors, easily disposed of with a bat, but in the few scenes with digital hordes, they represent an adversary that the team cannot overcome with physical force. The digital horde thus induces the team to undergo a risky journey from Cuba to Miami in search of a better life, a migration Juan has previously derided as a betrayal of his country and its history of resistance against American imperialism. The digital horde not only motivates this migration but literally enables it, when, in an outrageous special effects sequence, the team assembles a pile of zombies to use as a ramp to propel their make-shift boat into the water towards Miami. At the end of the film, however, Juan decides to leave the others who are escaping to the US and remain in Cuba. The film ends with a freeze frame—a refusal of cinematic movement—to emphasize his immobility, his failure to move away from his homeland, as he gears up to battle the zombie horde that is quickly approaching. Even in a lower-budget film outside of an American context, the digital horde allegorizes the consequences of risky movement. In this film, Juan is willing to give up his mobility and face certain death to maintain his roots and preserve his national identity, without which he would feel inhuman.

Like with *Juan of the Dead*, the digital horde in *World War Z* imbues scenes with tension over the benefits and consequences of movement, dominated by herd-like mentalities. In the opening credits of *World War Z*, the film presents a montage of people moving about their daily routine in different countries, as they commute to work on trains and cars, wait in line, and board airplanes. These images are interspersed with footage of animals and insects in flocks, hives, and herds that replicate the same, conforming movement. Like in *I Am Legend*, the opening starts

with the morning news reporting on a steady stream of global events: an unexplained beaching of a school of dolphins, and a new outbreak of avian flu caused by human proximity to livestock. Scientists and politicians are interviewed to discuss the disastrous effect overpopulation has on both the environment and human health. As the title sequence continues, the movements of these crowds become more and more aggressive, with cuts to surveillance footage of a man beating someone senseless, and then nature footage of a pack of wolves fighting over a carcass. The opening montage places the origins of the deadly viral outbreak and the creation of the zombie horde firmly within overcrowded spaces, as the inevitable outcome of a world where frantic fighting over resources has become necessary for survival. As Whissel discusses in her work on digital multitudes, the allegorical significance of the crowd describes anxieties around conformity and the crowd's absorption of individuality, but here the danger is displayed as in-fighting and internal conflict. In this crowded world, one is more likely to be killed as part of a crowd rather than as someone outside of it.

Figure 4.5a-b: Herd mentality in *World War Z*

The title sequence of *World War Z* sets the stage for the appearance of the digital horde, which embodies anxiety over the disintegration of order as a consequence of overly crowded spaces. The opening scene starts with a traffic jam in Philadelphia as the main protagonist, Gerry Lane (Brad Pitt), sits in his car as he takes his children to school. This daily routine is interrupted

when a garbage truck suddenly plows through the line of cars in the lane next to them, killing a police officer and upending every vehicle in its path. A scene that was once stagnant becomes a frenzy of motion, reinforced by the camera's rapid pans and hand-held style bouncing movements that makes it seem as if we are running amongst the crowd as they desperately leave their cars, but are blocked by others all trying to do the same thing. Gerry and his family are only able to break free of the gridlock by speeding down the path left behind by the garbage truck before another car collides headfirst into them. The danger of the crowd comes when everyone is trying to move all at once. Counter to the chaotic shots in the streets, which characterize the first minutes of the scene, the perspective soon shifts to an overhead tracking shot of the entire Philadelphia square, populated by digital hordes of humans and zombies running forward in desperation. The clarity of the shot allows the viewer to see the ripple effect of a contagious panic as it spreads across multiple bodies, where waves of zombies jump on top of the humans close to them, and then transform their victims into new aggressors, ready to reproduce the same encounter with the next person.[28] The scene crystalizes a set of caveats to mobility that the protagonist will have to learn to work through: freedom of movement is inhibited and can even become a threat when everyone decides to exert it all at once. Like *I Am Legend* and *Juan of the Dead*, forward mobility does not always mean progress or freedom, and in some cases may need to be restricted, counterintuitively, to reduce crowd panic.

Gerry initially seems reluctant to grasp the potential negative consequences of excessive mobility. Though audiences see little of his past life, we find out that he was a United Nations field worker deployed to countries embroiled in civil war, before he decided to give up that life and settle down with his family in Philadelphia. He now works as a stay-at-home dad, and though he admits he is superb at making breakfast for the kids, he cannot help but stare longingly

at the TV when news of foreign turmoil comes on. After the Philadelphia zombie attack, as if returning to the ideology of his previously mobile life, he tries to convince an immigrant family that helped his family hide out overnight that they should leave their home and come with him to find safer ground: "I used to work in dangerous places and people who moved survived, and those who didn't, um… Movimiento es vida. Movement is life." The family does not listen, and Gerry's lecture, while well-intentioned, seems to disregard how the family presumably knows the benefits as well as the costs of migration. The digital horde provides the most convincing example of a movement gone wrong, in which reckless or unthinking mobility means death, or worse, the undead. The zombie's rabid movement comes into focus when the family tries to escape a housing unit in New Jersey by helicopter. As the helicopter lifts off, a group of zombies fearlessly fling themselves off the building to try to grab on—only to fall to off the side of the building. *World War Z*'s visual development supervisor, Kevin Jenkins, argued that it was impossible to model the movement of the zombies off traditional live-action models:

> We looked at American football players and English rugby players…and one of the things we noticed was that they all moved with some understandable concern for their personal safety. Even if you're the bravest stuntman with the maximum padding on, if you leap to attack something, it's human nature to leap with your arms first because you don't want to break your neck. Zombies don't exhibit human nature, though.[29]

Like in *I Am Legend*, the solution was to digitally animate large groups of zombies in attack scenes to allow them to "move in a very unique way," a head first dive that would give the zombies a way to attach themselves and weigh down their target, but also cause a great deal of bodily harm, even if they cannot feel it.[30] As visual effects supervisor Scott Farrar said, this reckless motion became one of the defining "high concepts" of the visual effects, developed by the animation team and supported by the director: "This philosophy of the zombie as an unthinking entity that would lead with its teeth, its arms falling back, even to its peril."[31] The

digital horde, therefore, came to embody physical freedom from human limitations, but also the danger of "unthinking" mobility, which is characterized by the zombie's upward leap and subsequent head first, downward fall.

The special effects of the zombie's unthinking mobility help to visualize, through hundreds of thousands of digital bodies, the competing forces of freedom of movement and attachment to one's national identity. It is no coincidence that Gerry must look for the origins of the virus in contested, geopolitical spaces, first on the border between North and South Korea, where he locates the emergence of human-to-human transmission between an overly aggressive soldier and a military doctor, and then in Jerusalem, where he travels to find out how the military has effectively stopped the zombie's movement. Both are areas in which multiple nations ground their histories and lay claims to the same territory, making them some of the most policed and regulated areas in the world in terms of movement back and forth across checkpoints, walls, and military presence. In the film, Gerry flies to Israel's Salvation Gate, a preemptive wall built when a Mossad official intercepted a message from an Indian general who used the word "Rakshasha," meaning undead, and therefore predicted the coming infection.

In the film's most expensive scene, we see both Israeli and Palestinian soldiers cooperating to admit human refugees through protected tunnels that allow access through the wall but block zombie infiltration. In shots that are reminiscent of military checkpoints along the West Bank, refugees' vehicles are first checked with dogs and under-car mirrors for zombies (not explosives), and then waved through. In an almost wishful unity that overcomes years of bloody infighting, we see a group of newcomers waving Palestinian flags and another group of orthodox Jews singing beside Muslims as they pray. The scene cuts back and forth to soldiers looking over those entering from an elevated bridge. One of the newcomers grabs a microphone

attached to the square's speaker system everyone sings together. Within Jerusalem's extensive and militarized walls, audiences see a vision of cooperation under strict military oversight. The signifiers of ethnic, religious, and national differences are emphasized via dress, but the military strictly controls movement. Jerusalem becomes a sign that national borders and sovereignty must be reinforced, but that such nations must also accept the diversity of citizens.

The attack of the digital horde challenges this utopian yet militarized nation through its inverse formulation: a homogenous group that acts heterogeneously and whose movement is uncontrolled. In the film's most spectacular special effect sequence, over 250,000 zombies rush to the Jerusalem wall, and, by climbing over each other, form long tendril-like structures that provide a new verticality to defeat the city's defenses, with an ability to scale the wall and even to reach upward and grab helicopters. The zombie horde was constructed using Moving Picture Company's (MPC) in-house crowd system, ALICE, to simulate the interaction between the zombies, and Papi, a physics engine used to simulate the zombies' fall.[32] While the previous use of crowd technology was designed to allow hundreds of thousands of individual agents to move simultaneously through space without hitting each other, software engineers reprogrammed it to maximize the amount of collision that would occur. As the zombies rushed through the winding streets, they would form an unstoppable wave, dangerous to themselves as the zombies in the front collapse under the momentum of the horde behind them: "Each of the intelligent agents in MPC's ALICE program effectively have a mind of their own. They act by being given an objective, a set of rules to achieve it, and then a simulation is run."[33] The digital horde preserves an independence of movement, but de-emphasizes individual identity markers like nationality, religion, and ethnicity previously put to the forefront by the live-action refugees. Through this internal conflict, the zombies become more effective as a group, creating dangerous tendrils that

only works when everyone is in competition with each other to reach the top. At the end of the Jerusalem scene, the digital horde destroyed Israel's strategy of a bordered yet peaceful coexistence between groups that preserves their national and religious identities. It is after this spectacular sequence that we see a turning point in the film, where Gerry must switch strategies to survive. The creation of borders and defenses to fight off zombies fails, and now a new, far more mobile, far less nationally motivated defense is needed to defeat the zombie horde. Previously a former UN agent deployed to locations around the world often in political and economic turmoil, Gerry gave up his risky job to return to his family in Philadelphia as a stay at home dad. The outbreak of the zombies, however, returned him to the role of wanderer, working for the US military, to ensure his family would be protected by them even if his own movement put his life at risk. As *World War Z* exemplifies, the digital horde stages an encounter between reckless movement and guarded safe harbor, allowing the film to map onto spatial dynamics thematic concerns about the protagonist's struggle between absolute independence of movement (from his family, home, and country) and the preservation of his national identity (citizen of US) that ensures his family's safety.

Figure 4.6a-b: Digital zombie hordes in *World War Z*

Scholars have interpreted the digital horde of the 21st century, with its masses of mechanically-produced units, as a contemporary instantiation of what Siegfried Kracauer called in his 1920's essay "The Mass Ornament."[34] For Kracauer, the mass ornament was an aesthetic reflection of the capitalist assembly line visible in such entertainment spectacles as the popular British dancing troupe The Tiller Girls, which he later would describe in his 1940s book *From Caligari to Hitler* as a precursor to a fascist aesthetic. The Tiller Girls as a choreographed dance would mesmerize the viewer with synchronizing gestures and leg movements such that they created dazzling, abstract visual patterns that made it hard to delineate individual bodies from the larger whole. As Krauceur explains, "These products of American distraction factories are no longer individual girls, but indissoluble girl clusters whose movements are demonstrations of mathematics."[35] The digital hordes of today's cinema work similarly as a spectacle that dissolves individual, virtual actors into a larger stylized pattern. Though animation teams work hard to construct different appearances within the horde, through different clothing, hair, and body types, the long-distance shots that characterize most of these special effects shots make the hordes look homogenous. For Kracauer, the danger of the mass ornament, and indeed the assembly line, was not only about a loss of individual specificity to the whole, but the malleability of the individual to fit into the larger unit without resistance: "It is only as a tiny piece of the mass that the individual can clamber up charts and can service machines without any friction."[36] It is this lack of friction that leads Kracauer to later connect the mass ornament to the rise of fascism and the way masses of individuals would easily transform into mere appendages of a single leader. In her chapter on the digital multitude's ability to allegorize a historical change, Kristen Whissel acknowledges such live-action predecessors to the digital multitudes as Leni Riefenstahl's 1935 documentary about the Nazi rally, *Triumph of the Will*. Quoting Frank Tomasulo, Whissel notes

that the pattern formed by the tens of thousands of rally participants, in combination with cross-cutting of Hitler looking out over the crowd, created a visual uniformity that suggested "a renewed sense of national identity and unity following a period of economic and political instability" that coalesced around Hitler's body and signature hand salute.[37]

The use of the mass ornament as a tool for the renewal of national identity is where the digital horde of contemporary infection films most drastically departs. As in *World War Z* and other films discussed in this chapter, it is exactly the digital horde that stands in as the predominant danger to the fortification of national boundaries or the ability of a leader to control the masses. Instead, scholars have suggested that we update Kracauer's mass ornament for the new means of production in a digital and far more global age. In his analysis of digital multitudes in Zhang Yimou's *Hero* (2002) and *Red Cliff* (2008), Jason McGrath argues that these films are misread as supporting the need for individual warring "heroes" of China to sacrifice themselves for a unified, national agenda and military might. For example, in the final scene of *Hero*, a digital multitude kills the protagonists to unify China under one ruler. McGrath argues that the production of these digital multitudes, which he notes is largely by an Australian company, undercuts the film's nationalist narrative and advances the idea of a borderless and mobile labor force: "The modular units of technical labor that create the digital effects of global blockbusters are themselves spread globally, competing to exceed each other's technological prowess in creating convincing illusions while undercutting each other's costs."[38] McGrath rightfully notes that the dispersal of animation studios across the globe, often with three or more studios working on different components of a single scene, makes national and regional boundaries increasingly irrelevant to any single film, even if the film foregrounds a single national identity (though this seems true for other aspects of production as well).[39] As Peng-yi Tai similarly argues, the

production pipeline for the digital multitudes in *World War Z*, which required moving through three different animation companies across the US and UK, reflects the horde's mobile and global presence.[40]

While production of a single digital horde in a film is distributed across multiple studios around the world, the challenge of the animation teams is to maintain a consistent aesthetic. In its aesthetic quality, the digital horde of infection films, however, intentionally resist Kracauer's prediction of an entertainment spectacle that forgoes individual resistance in place of national identity. Whissel's analysis of digital multitudes acts similarly to a digital mass ornament, but contemporary digital hordes, threaten sovereignty more than they reinforce it; they display in spectacular visual effects the way excessively mobile masses disrupt state power and resist forms of control or quarantine by traversing walls, cages, military barricades, and medical facilities meant to contain them, while thwarting a variety of military leaders sent to curtail them into submission. As emphasized by *World War Z*'s Jerusalem attack sequence, the digital horde not only preserves independent motion through its artificial intelligence software, but purposefully provokes internal collision and conflict that interrupts any perceived unity amongst the multitude's ranks. If Whissel reads the digital multitudes of early 2000s fantasy films as an "expression of the idea of multiplicity that functions as one," then the digital hordes implemented in today's infection films show what happens when this unit is corrupted or breaks down from internal strife. In its expression of a multiplicity that acts against itself, the digital horde portrays the breakdown of both national and bodily sovereignty.[41]

Instead of representing the mechanized unity of the assembly line, the unruly digital horde reflects what current biopolitical theorists argue is the consequence of permeable national borders and mobilized citizen populations. In his work on necropolitics, Achilles Mbembe

explains that the goals and targets of geopolitical conflict shift with globalization at the turn of the 21st century. The emergence of the figure of the suicide bomber, who is willing to die to inflict damage on non-military populations, shows how military conflict is no longer about out-surviving the enemy as in traditional warfare. Everyday civilians, when mobilized, can become powerful nonstate actors that threaten national sovereignty:

> This new moment is one of global mobility. An important feature of the age of global mobility is that military operations and the exercise of the right to kill are no longer the sole monopoly of states, and the "regular army" is no longer the unique modality of carrying out these functions. The claim to ultimate or final authority in a particular political space is not easily made. Instead, a patchwork of overlapping and incomplete rights to rule emerges.[42]

Mbembe looks specifically at the African and Middle East contexts, where private mercenaries and other militia groups, who recruit from citizen populations, work outside of a single state agency and are hired and dispersed across borders for purposes often antagonistic to the state. The digital horde, in its ability to overcome stationary defenses through excessive mobility, portrays a similar problem for the survival of the nation. In infection films, the traditional military is never able to keep pace with or stop the hyper-mobile horde; instead, civilians rely on bands of armed heroes, who are not hampered by a chain of command and who must give up specific attachments to a homeland to become as effective as the roaming hordes (Gerry's family loses the protective benefits of their US citizen status—a spot on the US airplane carrier—when the military thinks Gerry has died).[43] The digital horde's excessive mobility, especially at the risk of self-harm or suicidal tendencies, helps to show how moving populations have restructured the goals of warfare away from the occupation of territory and towards targeting populations. The goal of the zombies is not to claim a city but to decimate the human population. This new target helps explain the areas underexamined by what Michel Foucault called "biopower," a means of

governmentality that sought to invest in the health and daily life of citizens to gain authority.[44] For Mbembe, biopower was not sufficient to address struggling populations around the world, particularly racialized populations, where a lack of investment in health from governments and private agencies effectively quarantined them for eventual death. We might see in Mbembe's description of necropolitics an epigraph for the digital hordes of infection films, where unruly and homogenous populations return like some terrible nightmare to tear down the national defenses that were either unable to protect them or simply left them for dead.

> I have put forward the notion of necropolitics and necropower to account for the various ways in which, in our contemporary world, weapons are deployed in the interest of maximum destruction of persons and the creation of *death-worlds*, new and unique forms of social existence in which vast populations are subjected to conditions of life conferring upon them the status of living dead.[45]

Instead of digital incarnations of Kracauer's mass ornament, the digital hordes of contemporary zombie films are better emblems of necropower, of stateless populations who have return to seek revenge against sovereign institutions that had left them unprotected. Ironically, it is the very statelessness and mobility of the digital horde that gives them the edge.

DEAD WEIGHT, COLLATERAL DAMAGE: *TRAIN TO BUSAN*

The scenes with digital hordes discussed above all depict crisis situations of cities or transportation networks under attack, threatened by unknown masses capable of piling upward. Through their dynamic movement, they allegorize an upward class mobility capable of bypassing barriers at the expense of the downward collapse of a lower class. These films initially define personal value (and even moral grounding) in terms of who can pull their weight. Towards the beginning of *World War Z*, Gerry is told by the general that he must go on a mission to discover the virus's origin or he and his family would lose their bunk on the aircraft carrier:

“Take a look around here, Mr. Lane. Each and every one of these people are here because they serve a purpose. There’s no room here for non-essential personnel. There is a long line of people waiting for one of those bunks.” Gerry accepts what everyone understands to be a suicidal mission to find the origin of the virus through zombie-infested land to secure his family’s place onboard the floating aircraft. Not that his sacrifice pays off, as his family is immediately moved off-board when Gerry is presumed to have died in combat. In zombie films where movement is central to survival, who counts as “essential personal”—those worth taking and those to be left behind—becomes a metaphor of weight. Indeed, a great deal of rhetoric around social safety “nets” and government “support” services similarly visualizes questions of class in terms of weight and motion. The upper class has redefined itself as “essential personnel,” regardless of the labor they offer, because their monetary contributions outweighs their personal consumption: for example, as the argument goes, they give more to the government in taxes than they take out in services, effectively giving others a “free ride” who take out more than they pay in. These metaphors are mapped onto characters’ movements in zombie films, such as the militaries claim to Gerry that they cannot bring his family along if they do not contribute to the military mission. In opposition to this logic of “essential personal,” the digital horde illustrates a moment of class collision in which a previously discarded population, now mobilized, can return to challenge entrenched social hierarchies that previously portrayed them as purely parasitical.

Jonathan Levine’s zombie-comedy genre hybrid, *Warm Bodies* (2013), looks at the aftermath of an unknown virus that has turned most of the human population into zombies. The film locates its point of view in a zombie named R (Nicholas Hoult), who has fallen in love with a human girl, Julie (Teresa Palmer), whom he was initially supposed to eat. Like star-crossed lovers, they must meet in secret, since Julie is the daughter of the military general in charge of

the last remaining human outpost, and he is explicit about his disdain for zombies as nothing more than threats to survival. The zombies in this film, even when they congregate into hordes, are all live-action and maintain a comically slow movement, which the film uses for laughs to the point that the audience starts to sympathize with their ineptitude. Due to the zombies' sluggishness, the film displays them as representatives of a generation who has lost their ability to be productive. These zombies seem to be constantly wasting time, literally dragging their feet to do anything. The protagonist starts the film with an internal monologue: "What am I doing with my life?," and then goes on to describe his day: "I can't remember my name, or my parents, or my job, although my hoodie would suggest I was unemployed…This is a typical day for me. I shuffle around, occasionally bumping into people…I'm not sure what we are all waiting for." The scene continues as R looks around imagining what jobs everyone must have had before they became aimless corpses. In contrast, their human counterparts, as seen by Julie's perspective, are required to go on daily missions to collect food and medical aid from beyond the safety of their walled city to ensure the survival of their families. Julie's father, the head of the human town, appears on a video screen to reaffirm to the band of youths that their work is essential: "You are a critical part of what stands between us and extinction, therefore, you have an obligation to return to us safely."

The third and lowest group of people in this social hierarchy—"Bonies," as they are derogatorily called—have lost all sense of humanity, their bodies literally stripped of skin and the capacity to convey emotions. They are the final stage of devolution, after the zombies lose touch with their humanity and only live to eat. Even the zombies cannot stand the sight of them. Unlike the common zombies, the "Bonies" are truly a menacing force, and although they are the lowest in the social hierarchy, they have superhuman agility. These Bonies are all digitally

animated and populate the film's signature scenes of a digital horde running across the landscape. Like others described in this chapter, the digital horde articulates the dangerous mobility that threatens the various fortifications set up to divide the humans and zombies. By the end of the film, the Bonies have displaced the zombies from their previous homes and tried to invade the human city, setting up an encounter between the three groups. Through their attack and eventual defeat, the digital horde breaks the social hierarchy established at the beginning of the film by forcing the humans and zombies to work together and even recognize each other's humanity to defeat the oncoming threat. The Bonies even motivate the zombies into a new era of productivity and social mobility. At the end of the film, the zombies slowly integrate back into human society; they get jobs and form human-zombie relationships. The last scene is a computer-generated special effect of the demolition of the giant concrete wall surrounding the human city, which opens free movement between zombie and human populations. The Bonies act as collateral damage for the zombies' eventual class mobility.

Like *Warm Bodies*, the digital horde in *Train to Busan* breaks social hierarchies by causing a sudden encounter between two previously separated classes. *Train to Busan* shows the consequences of South Korea's massive economic progress over the past fifty years by centering its narrative around a train rushing onward through the landscape, while a bloody battle for survival occurs internally. In the film, only a little girl, who takes the time to look out the train window, catches the warning signs of the zombies' approach, while other passengers are busy looking down at their phones, listening to music, or sleeping. In a comical moment, one of the train's employees, who has just failed to see a bleeding zombie slip through the door he was stationed at, criticizes another employee for having an untucked uniform. The appearance of professionalism distracts from the legitimate work of securing the passengers' health. In a scene

of cross-cutting between two areas of the train, a zombie stows away in the bathroom, while a businessman (Eui-sung Kim) waits impatiently outside. Angry at the delay, the businessman gets an attendant to unlock the bathroom door, but instead of the zombie, he discovers a homeless man (Gwi-hwa Choi) who has stowed away onboard, muttering to himself about an oncoming apocalypse. The attendant tells the homeless man he will have to get off at the next station if he cannot purchase a ticket. Instead of discovering the zombie festering in the bathroom one cart back, the passengers notice the homeless man and view him as the more immediate threat.

The film situates the current social status quo as a blind, forward motion by the upper and middle classes, ignorant of the collateral damage produced in the inevitable event of a class collision. The film opens with a farmer passing through a health inspection check-point, where he is told a "minor leak" at a biotech company near the Jinyang Reservoir requires officers to sanitize his truck. As he continues past the checkpoint, he is distracted by his ringing cell phone and misses seeing a deer step into the road in front of him. They collide: the deer is flattened into the pavement, while the car and driver are uninjured, and continue onward. The deer is the first instance of collateral damage in the film, an accepted byproduct of the forward movement of both the driver focused on his phone and the biotech company that has poisoned the reservoir from which the deer drinks. As the man drives away, however, the camera lingers: to our surprise, the bloodied deer starts to twitch, shakes its head, and then, through digital animation, rises again, unfettered by the collision. It stares straight into the camera with milky eyes, and the screen cuts to the title—"Train to Busan." Through this opening, audiences are not only warned of the oncoming zombie attack but also are allowed to see the eventual consequences of distracted, forward progress. The re-animation of the deer, a scene that will repeat at a larger scale with the digital hordes, visually articulates what happens when those who are left for dead

return from the grave to seek revenge. The reanimation of populations en masse through digital animation forms the film's special effect emblem. *Train to Busan* uses the reanimation and dynamic movement of the digital horde to stage a collision between the rigid social hierarchies that divide South Korean society into two mutually-opposing groups, those who have been left behind and those who have gained mobility at the other's expense.

In the film, the visible collateral damage from to the country's economic boom is mirrored by the protagonist's abandonment of his own family in the hopes of attaining a higher-paying job. The protagonist, Seok-woo (Gong Yoo), is one of the rising upper class, who works as a fund manager in Seoul. His long hours at work cause his wife to move to another city, Busan, and their sole daughter, Su-an (Su-an Kim), must travel back and forth between them. "A marriage shouldn't be abandoned so easily," his mother tells Seok-woo when he returns home late from work one day, and then places a videotaped performance of Su-an's school recital on the bed. Seok-woo failed to come, and Su-an, not seeing him in the crowd, similarly failed to complete her song in front of the class. As Seok-woo undresses from his work clothes and watches the video, he seems exhausted from the burden of having to financially support both his mother who lives with him and his child all on his own. While Seok-woo's job and gender allow him to aspire to reach the upper class, he must sacrifice his own family, time, and morals to support them.

As the film progresses, both live-action and digitally-animated zombies act as a destabilizing force with the potential to derail the status quo and halt economic momentum; however, there is a difference in effectiveness live-action zombies and zombie digital hordes. The live-action zombies, used in the tight quarters of scenes inside the train, are often outsmarted and restrained by the human passengers. The human survivors find themselves separated into

three different sections on the train, separated by cars packed with zombies. To reunite, each team of humans has to fight their way to the cars in the front of the train. The live action-zombies are, in other words, just another group that must be disposed of to attain upward mobility. These live-action zombies are smaller in number and easily disposed of with baseball bats and punches. Sensitive to sound, they are also distracted by cell phones and immobilized by darkness. In one scene, the team of humans bypasses a group of zombies standing in the aisles by crawling through the overhead luggage compartments, mere inches from the zombies' heads. The live-action zombies, therefore, mirror the pitfalls of the distracted humans that we see early in the film. Most tellingly, the zombies can be quarantined by simply closing the clear, plastic doors that separate the cars from each other, since they are too mindless to figure out how to open them. The door becomes a point of contention for the human passengers as well over who should have the final say over who should be allowed in or kept out. The live-action zombies do not disrupt previous class hierarchies as much as they call upon "hero" characters to overcome such dangers and reinforce the need for a clear separation between cars and classes. In the film, the two visibly upper-class passengers on board, Seok-woo and another businessman, become the de facto leaders of the two human groups.

In contrast, the digital horde's dynamic movement is immune to the various barriers and human ingenuity used to quarantine or pacify them. Their sheer numbers produce a certain strain that ultimately ruptures the many barriers—glass doors, windows, train walls, military blockades—meant to contain them, in a way that is not possible for the live-action zombies of the film. In a reversal of the luggage-rack scene in which the humans slipped past overhead, the digital horde often rains down on the humans from a higher vantage point, immobilizing their victims. The digital horde, therefore, visualizes not only the return but also the empowerment of

groups of abandoned people, who through the accumilated of enough bodies, can now break down the barriers meant to contain them.

Train to Busan maps its critique of the economic survivability of South Korean society onto spatial matters of physical speed, creating within its narrative a brutal logic that those who are slow or need assistance are a liability to the larger group. After the digital horde attacks the train, much of the dialogue thereafter supports this allegorical pairing of speed with survival and weight with death: the leader yells "We have to move now," or "We gotta move. Come on," while the trapped passengers tell the conductor over the intercom, "Full speed no matter what!" Those who fail to move quickly enough fall into four representative types. The homeless man walks with a signature limp and seems always to be dragging behind where he is not wanted. In one scene, he literally becomes a burdensome weight when in the middle of trying to sneak past the zombies, he accidentally falls and crushes a can on the floor, alerting the zombies to the group's presence. If the homeless man represents the section of the population who are a weight on economic sustainability, then the film extends this logic further to traditionally sacrosanct groups. The pregnant woman, Seong-kyeong (Yu-mi Jung), becomes a hindrance since she is carrying a child inside her and constantly requires others to wait for her or lift her up. In the logic of "carrying your weight," motherhood becomes akin to a debilitating disorder, burdened by carrying extra baggage. The third form of dead weight is the child, Su-an, who similarly requires others' assistance to survive. In the film, this is articulated through her passivity and inability to move during fight scenes, as she stands doe-eyed waiting for others to protect her. Seok-woo's success as a trader comes from his ability to cut excessive costs, and within the logic of the train, he similarly shuts the door on the pregnant woman and her husband in order to secure the safety of himself and others in the group: "You are clearly an expert at leaving useless people behind,"

the husband yells at him once they manage to make it through. Faced with the slowness of his own daughter, however, Seok-woo must learn to go backward to help carry stragglers.

Counter to Seok-woo's outlook, at the end of the film, the digital horde displays how dead weight may be useful, if not necessary, for society's ability to survive a crisis. As Seok-woo rides away with Su-an and Seong-kyeong on the last car to Busan, a digital horde of zombies chases them in the hopes of boarding. In a stunning special effects sequence, the horde, instead of trying to board individually, each latch onto a zombie in front of them as one holds on to the back of the train, creating a pile-up that drags the train to a grinding halt. Literal dead weight transforms into a powerful force to counteract the forward-moving train. Seok-woo is eventually able to kick off the zombies, but he holds onto this lesson of the masses. The digital horde thus crystallizes an epiphanic moment of transformation for Seok-woo when he realizes how a person's individual value—what he spent his job calculating as a stock trader—misses their collective benefit. The lesson is soon put into practice when the other businessman on the train, having turned into a zombie, attacks the three remaining humans and manages to bite Seok-woo before dying. In a similar move to the piling horde, Seok-woo gives himself over to gravity as a helping hand to the rest of the passengers on the train. The camera focuses on the shadows projected onto the gravel below as we see Seok-woo first go limp, then let his weight drag him downward, and finally fall off the back of the train to his death. His descent downward sparks a flashback to when he first raised Su-an up into his arms after her birth. His dead weight and downward fall visually raise up the next generation. This sacrifice echoes an earlier moment in the film when the homeless man, previously considered a parasite threatening the group's survival, throws himself at the oncoming horde and uses his body's weight to allow Su-an and Seong-kyeong enough time to escape. The film certainly supports traditional gender dynamics in

its eventual portrayal of the need for men to give up their privileged positions (and bodies) to ensure the mobility and safety of women and children, who are eventually considered essential for the social and biological reproduction of South Korea after the zombies are destroyed. However, as its visual effects suggest, the film focuses not on uplifting women onto a pedestal, but rather on the shared onus of dead weight as a necessary condition of economic progress and public health.

By staging the collision between two mutually opposed groups, the digital horde provokes in these narratives an epiphanic moment of realization for the protagonists, where they suddenly see immunity hiding within illness. At the end of the films, after coming face-to-face with the horde, the characters realize they have misrecognized what is and what is not an essential component of their society. In *Train to Busan*, what were initially thought to be social illnesses—the dead weight of those in poverty and the burden of raising children—become crucial components of society's survival. Similarly, in the final scene, an injured Su-an and Seong-kyeong limp through a darkened tunnel to Busan, having escaped the zombies; however, the guarding soldiers on the other side misrecognize their movement as that of approaching zombies. At the moment they are about to shoot, Su-an starts to sing, sparking a moment of realization that they are human after all, and should be allowed in.

Figure 4.7: Hiding in plain sight in *World War Z*

In a similar moment of realization at the end of *World War Z*, Gerry watches as an oncoming digital horde inexplicably bypasses a cancer patient, “like a river around a rock,” while attacking other humans around him. The special effects sequence stages a confrontation between two opposites, an excessively mobile horde versus a stationary boy, who tries to hide in plain sight. It is only at the end of the film that Gerry realizes the significance of the scene he has just witnessed. The figure of the cowering cancer patient, previously recognized as terminally ill and a weight on the medical system, holds the key for survival. In remembering the encounter, Gerry deduces that the human population could gain immunity to the zombies through a similar form of “camouflage.” Gerry purposefully injects himself with a terminal illness to make him unrecognizable to the roaming zombie hordes and unappealing as a host for the virus. Central to this scientific twist ending is a visual sleight of hand earlier in the film where what the characters thought was a weakness (a sick boy) was really a strength in disguise. As the horde rushes forward from the back of the frame towards the camera, ignoring the boy, viewers are similarly

distracted from seeing an answer to the zombie threat that is hiding in plain sight. The speech of a Harvard virologist (Elyes Gabel) sent to help Gerry discover a defense against the zombie virus is particularly explicit in its understanding of the sudden discovery and inversion of strengths with weaknesses.

> Mother nature is a serial killer. No one's better, more creative. But like all serial killers, she can't help the urge to want to get caught. What good are those brilliant crimes if no one takes the credit? So she leaves crumbs. Now, the hard part, why you spend a decade in school, is seeing the crumbs for the clues they are. Sometimes the thing you thought was the most brutal aspect of the virus, turns out to be the chink in its armor. And she loves disguising her weaknesses as strengths.

Ignoring the intuitive desire to search for a cure in hidden spaces, the unchecked lab of an abandoned building, the darkened parts of the frame, or the mysterious interiror of the body, the virologist argues we must instead see "the crumbs for the clues they are." The formal qualities of the digital horde make this emphasis on surface possible. Instead of the previous zombie films where zombies predominately live in the shadows and scare the characters by suddenly appearing out of hidden spaces, contemporary zombie films that use the digital hordes take place mostly out in the open, in daylight, where the characters can watch as the horde approaches. These formal qualities court the audience to visual pay attention to what is visible and foregrounded as much, if not more, than what might be lurking in the background or behind a door.

In another version of this realization, the confrontation with the digital horde at the end of *I Am Legend* forces Robert to realize how to use survive. As the horde bangs into the glass wall of the lab to reach Robert, the glass cracks in a pattern that looks like a butterfly. Upon seeing this image, Robert remembers the last words his daughter said to him—"Daddy, look! A butterfly!"—and then, for the first time, sees a butterfly tattoo on the neck of his zombie patient

that has been there the whole time, hiding in plain sight. At this moment, he realizes that the horde is not after him but the patient he has been experimenting on, meaning they must have some remnants of their former lives still intact. Robert realized that the infected and bound zombie on the operating table, a creature he thought he would have to kill to make a vaccine, instead could save the family by counterintuitively being set free. The digital horde visualizes a collision between binary forces—upper versus lower classes, speed verses stagnation, scientific progress verses devolution, freedom verses imprisonment—which allows the characters to visually comprehend how such opposite categories often touch and fold into each other. The characters find that what they have been searching for was, in fact, always visible on the surface, hiding in plain sight: immunity hiding within illness.

More than mere visual effects that interrupt the narrative for the audience's pleasure or empty the film of critique, digital hordes serve to map the thematic effects of mobile bodies at the beginning of the 21st century onto the technical production of motion in cinema. The digital horde helps to visualize an understanding of both the body and the nation as constructed of mobile multitudes that threaten any sense of national or bodily sovereignty, undermining the vision of delineated territories that can be protected and controlled. Similarly, the digital horde acts as an effects emblem to allegorize a set of narrative tensions between movement and confinement: the mobilization of classes left for dead that return for revenge, and an encounter between two opposing forces that reveals a means of survival hidden in plain sight.

In both cases, the digital horde would suggest versions of what Robin Wood calls the uncanny "return of the repressed" in horror films, where the film's monster represents a character's repressed desires come back to attack, a monster that is hideous but also fascinating exactly because it shows what is perverse, yet desired, within that society.[46] Through Wood's

definition, however, the digital horde is not exactly a return of the repressed: they are rarely, if ever, physically familiar or grotesque (in fact, it is almost impossible as a viewer to see them individually); rather, their *movement* is uncanny, where the audience recognizes something is strange in the way they climb, collide, and dive over walls and across barriers. Films achieve this uncanniness of motion formally through crowd-simulation software as opposed to the jerky performances of in-camera human actors, recognized as such by the audience because of the cautiousness they maintain for their own physical wellbeing.[47] Therefore, the digital horde offers a psychology of motion: filmmakers can use the horde's "uncanny valley" effect, where audiences believe the CGI characters look internally "dead" because they lack the facial information traditionally present in a human face, to allegorize groups of people who move so recklessly in order to pursue safety that they devolve and lose all interiority—they become all motion with no thought. Vivian Sobchack notes a similar effect in the uncanniness of the digital morph, and how through its quick-time transformations, it fascinates the adience's look: "The morph fascinates us not only because of its physical impossibility and strangeness but also because its process and figuration seem less an illusionist practice than both a presentational mode and an allegory of late capitalist 'realism.'"[48] In line with Sobshack's account of digital morph, the digital horde's movement is uncanny not only because it represents an unthinking and reckless motion, which goes against human intuition to protect onself from harm, but because it also allegorizes the ease through which populations in the 21st-century can transform into stateless, chaotic, and mobile threats.

The ability to produce uncanny motion through digital hordes might be what zombie films add to infection narratives, which have previously relied on a human-centric representation of disease spread. The strange, yet somehow familiar, motion of the digital horde helps bridge

the gap between internal infections and large-scale epidemics. In his analysis of the motion captured character, Gollum, from *Lord of the Rings: The Two Towers*, Tom Gunning helpfully pinpoints how an attention to motion shifts the audience's reception of fantastical digital creatures: "The fantastic possibilities of motion, or rather its role in rendering the fantastic believable, and I would say visceral, shows the mercurial role motion can play in film spectatorship and film style."[49] Motion's ability to make the fantastical felt viscerally is where the digital horde strikes new ground as a tool for exploring the embodiment of infection on screen. Digital hordes, with their reckless and unthinking movement of hundreds of thousands of bodies that pile up, writhe, and then disperse, enabled through crowd-simulation technology, become visually more reflective of cellular infection than their purely analog counterparts.

Notes

[1] Scott Bukatman, *Matters of Gravity: Special Effects and Supermen in the 20th Century* (Durham, N.C.: Duke University Press, 2003), 92.

[2] Jody Duncan, "World War Z: Zombie Wars," *Cinefex*, no. 135 (October 2013): 14.

[3] Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*.

[4] John Fleischman, "ASCB Profile: Janet Iwasa," *ASCB Newsletter*, February 2009, 39.

[5] Scott Curtis, "Still/Moving: Digital Imaging and Medical Hermeneutics," in *Memory Bytes: History, Technology, and Digital Culture*, ed. Lauren Rabinovitz and Abraham Geil (Durham, N.C.: Duke University Press, 2004), 221–22.

[6] David S. Goodsell, Margaret A. Franzen, and Tim Herman, "From Atoms to Cells: Using Mesoscale Landscapes to Construct Visual Narratives," *Journal of Molecular Biology*, June 2018, 6, https://doi.org/10.1016/j.jmb.2018.06.009.

[7] Drew Berry has created some of the special effect images of DNA in the feature film *The Day the Earth Stood Still* (Scott Derrickson, 2008). Peter Munro, "Vivid Ideas: Biomedical Animator Drew Berry Brings Together Art, Science and a Bit of Bjork," The Sydney Morning Herald, June

8, 2017, https://www.smh.com.au/entertainment/vivid-ideas-biomedical-animator-drew-berry-brings-together-art-science-and-a-bit-of-bjork-20170529-gwfg5b.html.

[8] Drew Berry, *Animations of Unseeable Biology* (Sydney, 2011), https://www.ted.com/talks/drew_berry_animations_of_unseeable_biology.

[9] "Janet Iwasa, Assistant Professor of Biochemistry at the University of Utah," PBS News Hour: Brief but Spectacular, accessed July 24, 2018, https://www.pbs.org/newshour/brief/228376/janet-iwasa; Berry, *Animations of Unseeable Biology*.

[10] Thacker, *Biomedia*, 6.

[11] Berry, *Animations of Unseeable Biology*.

[12] Jody Duncan, "Final Fantasy: Flesh for Fantasy," *Cinefex*, July 2001, 86.

[13] Stephen Prince, *Digital Visual Effects in Cinema: The Seduction of Reality* (New Brunswick, N.J.: Rutgers University Press, 2012), 124.

[14] Tom Gunning, "The Cinema of Attraction[s]: Early Film, Its Spectator and the Avant-Garde," in *The Cinema of Attractions Reloaded*, ed. Wanda Strauven (Amsterdam: Amsterdam University Press, 2006), 382.

[15] Bukatman, *Matters of Gravity: Special Effects and Supermen in the 20th Century*, 92.

[16] Konrad Marshall, "Animator Drew Berry on Revealing 'the Wondrous Nature of How Our Body Works,'" The Sydney Morning Herald, November 18, 2017, https://www.smh.com.au/lifestyle/how-bringing-to-life-the-bodys-inner-workings-through-animation-won-drew-berry-an-emmy-20171031-gzbrs2.html.

[17] Craig Reynolds, "Flocks, Herds, and Schools: A Distributed Behavioral Model," *Computer Graphics* 21, no. 4 (July 1987): 25–34.

[18] Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*, 68.

[19] W. J. T Mitchell, *Cloning Terror: The War of Images, 9/11 to the Present* (Chicago: University of Chicago Press, 2011), 40.

[20] Duncan, "World War Z: Zombie Wars," 31.

[21] Aaron Couch, "George A. Romero on Brad Pitt Killing the Zombie Genre, Why He Avoids Studio Films," The Hollywood Reporter, October 21, 2016, https://www.hollywoodreporter.com/heat-vision/george-a-romero-says-brad-pitt-killed-zombie-genre-942559.

[22] Todd McCarthy, "World War Z: Film Review," The Hollywood Reporter, June 4, 2013, https://www.hollywoodreporter.com/review/world-war-z-film-review-562560; Matt Zoller Seitz, "World War Z Movie Review & Film Summary," Rogerebert.com, June 21, 2013, https://www.rogerebert.com/reviews/world-war-z-2013.

[23] Duncan, "World War Z: Zombie Wars." Animators for World War Z explicitly created the zombie horde to move like a wave over victims. Although other zombie films, such as *Day of the Dead* (1985) or *Night of the Living Dead* (1969), similarly show a victim falling into a crowd of zombies, the use of digital hordes almost exclusively removes any bloodshed from the image. The focus is less on bodily violation and attack than a sense of inertia and collision: those that fall behind will be swept up with the movement of the oncoming wave of zombies.

[24] As another example of how speed becomes the measurement of human survival, Robert argues with his wife about why he must stay in Manhattan while everyone else is traveling to safe ground in the country: "The window is still open. We find something in a week or two weeks....we can reverse the spread." Francis Lawrence, *I Am Legend*, DVD (Warner Bros, 2007).

[25] Jody Duncan, "I Am Legend: Urban Legend," *Cinefex*, no. 112 (January 2008): 71.

[26] Duncan, 71.

[27] Unlike the zombies, not all animals are reduced to their basic instincts. Robert's dog, Sam, is given an expansive internal life, where she desires things besides food, goes along for daily activities with Robert, lounges, listens to music, and enjoys sticking her head out of the passenger seat window. Robert, therefore, treats her like a human, making her eventual death an emotionally devastating one in the film. Lawrence, *I Am Legend*.

[28] Even the making of the film experienced this issue of the dangerous crowd: *World War Z*'s production was infamously troubled, running over budget, starting a feud between producers and directors, having extensive rewrites of scenes after principle photography, but also because the crowd scenes, requiring several hundreds of extras, were too unwieldy. There was not enough food and, in one scene, "Several extras have suffered injuries including broken bones, cuts and bruises during the course of filming" (Hollywood Reporter). Brad Pitt was reported as saving the life of one of the extras during shooting by helping that person up when he fell and was trampled. It was a moment when life imitated the movies. Marc Forster, *World War Z*, DVD (Paramount Pictures, 2013).

[29] Duncan, "World War Z: Zombie Wars," 17.

[30] Duncan, 17.

[31] Duncan, 17.

[32] Duncan, 29.

[33] WIRED, *World War Z: Building a Better Zombie Effects Exclusive-Design FX-WIRED*, 2013, https://www.youtube.com/watch?v=tvoUMH9Ghpo.

[34] Jason McGrath, "Heroic Human Pixels: Mass Ornaments and Digital Multitudes in Zhang Yimou's Spectacles," *Modern Chinese Literature and Culture* 25, no. 2 (2013): 51–79; Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*, 60–63.

[35] Siegfried Kracauer, *The Mass Ornament: Weimar Essays*, ed. and trans. Thomas Y. Levin (Cambridge, MA: Harvard University Press, 1995), 75–76.

[36] Kracauer, 78.

[37] Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*, 61; Frank Tomasulo, "The Mass Psychology of Fascist Cinema : Leni Riefenstahl's Triumph of the Will," in *Documenting the Documentary: Close Readings of Documentary Film and Video*, ed. Barry Keith Grant, Jeannette Sloniowski, and Bill Nichols, n.d., 102.

[38] McGrath, "Heroic Human Pixels: Mass Ornaments and Digital Multitudes in Zhang Yimou's Spectacles," 73.

[39] McGrath, 73.

[40] Peng-yi Tai, "The New Mass Ornament: Crowd Simulation in World War Z" (Society for Cinema and Media Studies, Toronto, ON, 2018).

[41] Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*, 173.

[42] Achille Mbembe, "Necropolitics," trans. Libby Meintjes, *Public Culture* 15, no. 1 (2003): 32.

[43] Mbembe, 31. Speaking of the new type of warriors, Mbembe says, "They rest their superiority over the settled population on the speed of their own movement…their ability to travel light and not to bother with the kind of belongings which confine the mobility and maneuvering potential of the sedentary people."

[44] Michel Foucault, *Security, Territory, Population: Lectures at Collège de France, 1977-1978*, ed. Michel Senellart, François Ewald, and Allessandro Fontana (New York, NY: Picador/Palgrave Macmillan, 2009).

[45] Mbembe, "Necropolitics," 40.

[46] Robin Woods, "The American Nightmare: Horror in the 70s," in *American Nightmare: Essays on the Horror Film*, ed. Richard Lippe and Robin Woods (Toronto, ON: Festival of Festivals, 1979), 28.

[47] Duncan, "World War Z: Zombie Wars." Ellis Hanson was essential in pointing out this chapter's central stakes in the "the psychology of motion." He helped with the phrasing of this sentence.

[48] Vivian Carol Sobchack, *Meta-Morphing: Visual Transformation and the Culture of Quick-Change* (Minneapolis: University of Minnesota Press, 2000), 4.

[49] Tom Gunning, "Moving Away from the Index: Cinema and the Impression of Reality," *Differences* 18, no. 1 (2007): 45. For more on the effects of animation, see Stephen Prince's *Digital Visual Effects in Cinema: The Seduction of Reality*: "As Disney's animators realized long ago, movement conveys attitude and personality, and creating digital monsters in Alien Resurrection enabled the animators to design a more expressive creature than the man-in-a-suit version that appeared in the earlier movies" (112).

Chapter 4: Digital Transitions and the Micropolitics of Identity

Scholars have increasingly acknowledged that the molecular has become a common lens through which to analyze subjectivity in the 21st century. Nikolas Rose sees pharmaceutical companies' role in providing global health, via precise molecular manipulations that are more quotidian and yet longer-lasting than surgery, as evidence of a molecular subjectivity.[1] Eugene Thacker locates a new frontier of biopolitics and control within the development of gene editing enzymes, such as CRISPR Cas9, that can cut and paste DNA sequences to reduce disease and even select for physical traits.[2] Tim Dean traces a psychoanalytic shift caused from modern-day epidemics, particularly HIV with its long duration of infection, that contour questions of kinship and fantasy around biological understandings of molecular processes and the routine use of antiviral drugs.[3] Instead of a clear break from the molar, however, these scholars more precisely ask how new molecular models influence molar categories (of gender, race, class, family, and sexuality). Nor is the focus on the molecular unique to the 21st century, just the forms and significations it takes. Accounting for today's molecular subjectivity, therefore, does not simply require answering what are the new medical technologies of the 21st century, but instead understanding how those medical technologies shape the current iteration of the molecular.

Hannah Landecker argues that early 20th-century film theory was influenced by scientists who sought to use the temporal and spatial manipulation of film to make cellular life perceptible.[4] At the time, film theory was flush with cellular metaphors, such as Sergey Eisenstein writing on "montage cells," Jean Epstein's work on magnification, Andre Bazin's exploration of film's unique ability to capture realism, Bela Balazs's notion of the close-up, and Siegfried Kracauer's explanation of how film decomposes given wholes into "tiny particles."[5]

Landecker explains that these theorists did not see film as merely a type of microscopic view on life, but rather that scientific films that used microscopes where fundamental to understanding the foundations of cinema in general:

> Writers thinking through the relations of parts and wholes in terms of shots and frames, montages and narratives, looked to scientific techniques of decomposition and synthesis as demonstrated in scientific films as a mode of articulating and theorizing the specificity of the film medium. In particular, they looked at these techniques in relation to the visualization of life over time, and this was a way of articulating the specificity of the *power* of the film medium to depict life as such.[6]

Scientific films, such as Jean Comandon's and Alexis Carrel's microcinematography, were produced for a scientific audience as a way to train new scientists and share research. At the same time, they were made to be a spectacle of awe and viewed by the general public. These films, which for the first time allowed cells to be seen in motion on a screen, relied on two key technologies to visualize the otherwise imperceptible movements of the cell: magnification and time-lapse. Together, they produced a concept of life in terms of acceleration that visualized life as "boundless proliferation."[7]

At the beginning of the 21st century, we are witnessing a resurgence in the popularity of cellular vision, akin to its prevalence and importance in early film theory and practice, as described by Hannah Landecker and Yuri Tsivian.[8] However, the technologies have changed, and so too have their depictions of what constitutes life. Due to the development of digital visual effects that can be easily incorporated into films at a relatively low cost, there has been a substantial increase of scenes over the last twenty years that explore the cellular interiors of their characters in films diverse in genre and budget, from arthouse films to global blockbusters, such as *Fight Club* (1999), *The Hulk* (2003), *Inside* (2007), *Enter the Void* (2009), *Limitless* (2011), *Prometheus* (2012), *Lucy* (2014), *Antman* (2015), *BPM [Beats Per Minute]* (2017), *Annihilation*

(2018), and *Spider-Man: Into the Spider-Verse* (2018). Such digital effects give films the ability to dive into the body of their characters and zoom in on their microscopic insides through a first-person view, all within a single unbroken shot, emphasizing the spatial proximity and continuity between the external and internal. While these scenes do not constitute much of narrative in terms of length, they are crucial for framing a character's physical and psychological journey throughout the rest of the film.

In early twentieth-century Microcinematography, scientist first had to extract the cells from the body and then image them on a microscope slide.[9] As Lisa Cartwright explains, this means the filmmakers altered or manipulated the organism to best fit the cinematic apparatus, requiring a certain width and transparency so light can pass through.[10] Scientists used frogs and other creatures with thin skin as the first cinematic specimens for imaging blood circulation, but for imaging living cells, scientists would also have to develop the technology to culture tissue (often using cells from the heart of a chicken) in glass containers, keeping the cells alive in nutrient-rich broths. Now keyframe animation, digital morphs, and digital composites allow the camera to blend live-action convincingly with CGI images to create a seamless transition into the body, without need for a specimen. Moving seamlessly from molar to molecular allows for the film to view the cells within the environment of the body, particularly important in films such as *Annihilation* that make analogies between their cells and characters in how they respond to different environmental stressors. Keyframe animation allows animators to illustrate just the central or "key" frames of a sequence, as software programs help fill in the frames in between, adjusting for changes in lighting, object movement, and backgrounds between the two keyframes. Previously used to allow a character in the film to change shape, digital morphs now allow filmmakers to blend two separate shots into one by morphing them together at moments of

similar composition, such as a dark screen, giving the illusion of a continuous take. Finally, CGI allows the camera to maintain fluid movement even in places most cameras cannot go, such as following a molecule as it travels throughout the body. In films such as *Lucy*, this technique is crucial for capturing what the film argues is a radical molecular movement that allows the protagonist to make evolutionary jumps in the genealogy of the human species within a short period. Together, these digital technologies create new parameters for the aesthetics, effects, and limitations of the molecular vision in film and the types of narratives they engender.

Over the last twenty years, the molecular image in film has come to take on multiple meanings and effects. This chapter consists of four sections to address the four common iterations: the first section discusses micropolitics by showing how the molecular portrays queer sexuality and kinship in terms of viral processes; the second section, on origins and births, examines how the molecular vision in film reveals an occluded origin of complex familial structures that characters then have to use to survive; the third section, on drugs and leakages, shows how molecular vision helps to capture fast-moving particles through the body that stand in for either evolutionary progress or stagnant gender roles. The fourth and final section looks at fractals and apoptosis to consider how a molecular vision reveals the importance of environmental stimuli in shaping the self-perception and psychological health the characters. These different meanings of the molecular do not tell us about the truth of what life looks like at a small scale, but instead, and more importantly, they reveal the continuities and disparities between the molecular body and the various molar identity groups we use to define them. The integration of live actors and practical effects (shot in camera) with digital animation in such visual effects shots stages a film's thematic concerns about the technological modification of bodies in the 21st century.

MICRO-POLITICS: *BPM*

Chapter 1 examines how scenes of a character "encountering" their insides through a microscope act like a traumatic encounter with a past loss. These scenes always emphasize a visual logic that there must be a tool mediating between characters and their molecular interiors. The microscope, therefore, becomes particularly vulnerable to projection, a visible tool for which the viewer attaches paranoid anxieties. The very lack of a microscope and the smooth transition of the camera in molecular digital effect sequences provide a more direct relationship between character and molecule. For example, in the 2017 film *BPM (Beats Per Minute)/120 battements par minute,* a group of ACT UP activists are dancing in a club after a successful rally, when the camera zooms into the dust floating in the air above them, and in a seamless transition, zooms in further to reveal HIV viruses similarly dancing around white blood cells. The transition is shocking both for the genre of the film (not science fiction or fantasy) and for the lack of any medical instruments visible in the scene.

In *BPM*, the shocking transition from club to molecular fluid reveals how the sexual lives of this community of activists—apparent in the switching of dance partners within the club, a sort of free-floating pairing—has a molecular equivalent. The continuity between interior and exterior works to make clear the film's claim that the personal (in this case the microscopic) is political; they quite literally mirror each other. As one of the activists says, they are "living politics in the first person," which is indeed the perspective the camera takes as it dives down into the body to see, at the molecular level, what the activists are fighting for at a larger scale: a way to maintain their distinct sexual practices while also surviving. For the rest of the film, the group will try to pressure a pharmaceutical company to release what they call a "new molecule"

or antiviral drug that the company is reluctant to release until a scientific conference that will provide them with accolades.

The film makes clear how in the 1980 and 90s, a shift occurred where political legislation had to address how identity groups, such as women and queer communities, were being defined by their molecular needs and illnesses: as Susan Stryker and Aren Z. Aizura note, "New political alliances forged during the AIDS crisis, which brought sexual and gender identity politics into a different sort of engagement with the biomedical and pharmaceutical establishments."[11] In *BPM*, the molecular vision returns once more as the group of activist read aloud at one of their meetings an excerpt from a recently published and well-received book by French priest and psychologist Tony Anatrella.[12] We hear only the narration as we watch a giant white blood cell floating on the bottom of the screen, as small black HIV molecules once again dance around it in the blood:

> We can observe the insincerity of the homosexual psyche, favoring cheating in relations, going from carefreeness to emotional inauthenticity. This lack of truth explains unstable homosexual relations, where trust often has no place.

The molecular image then fades into a shot from underwater, where a circular outline of the sun glimmers on the bottom of the screen while two male bodies swim around it. Finally, we return to the source of the narration, to the ACT UP meeting where two men, Sean (Nahuel Pérez Biscayart) and Nathan (Arnaud Valois) stare affectionately at each other, while their former lovers sit across the room, looking on in frustration. The molecular transition shows us how the white blood cell and HIV molecule stand in for a vision of the "homosexual psyche," one of carefree relationships and a passing around of partners and pairs outside of traditional models of monogamous marriage: a viral kinship. Indeed, a day after Sean dies of AIDS, Nathan asks one of those longing ACT UP members to sleep with him as a form of comfort. The film does not

shy away from seeing these types of free-floating sexual pairings, demonized by Tony Anatrella, as both sexy and psychologically healing.

The transition from white blood cell to swimmers to the ACT UP meeting does not reduce the molar down to the molecular, but instead acts as a form of comparison, a type of continuity and a space to connect the personal and political. The molecular becomes a battleground for the characters since those infected with HIV who rely on pharmaceutical companies for their survival, while they also have to fight the companies for more research and better care. Similarly, the pharmaceutical companies are not only providers but also reliant on gay men with HIV to volunteer for risky drug trials with painful side effects and low chances of success. While the molecular has become the focus of the fight, the ACT UP activists realize the potential of the molecular as a new spectacle that can be exploited to convince the public. The group previously interrupted political speeches and attacked a pharmaceutical lab with fake blood, but their most successful activism came when they visualized molecular and viral transmission at a larger scale. After learning about the way HIV viruses invade the cell, replicate, and then burst open to flood the pathways of the body to infect other white blood cells, the group staged a similar "die-in" protest where protesters clog the throughways of Paris by lying down in the middle of the street. The images of the protesters, shot from above, mirror the projector images used by the group to visualize the stages of HIV replication and proliferation.

The group enacts the ultimate form of molecular protest in the final scene of the film, when they decide to use the ashes from Sean's cremated body to corrupt the food and air at an insurance holiday party. In a touching scene, they first have to discuss with the mother about the percentages of how to divide up his ashes hours after her son's death: will it be 50-50, 40-60, or 80-20? The scene is shocking but amicable, serious and playful as the characters laugh about the

ridiculousness of the situation, in which a political agenda supersedes the normal kinship rituals between mother and son. In the final scene, protesters throw ashes from Sean's body over an elegant banquet of finely decorated French pastries and meats. The insurance employees are horrified and disgusted as the ash disperses everywhere, in the food and into the air, such that the particles of a dead HIV patient coat everything and everyone in the room. The group uses the very permeability of bodies (akin to that of cells) and the free-floating characterization of the homosexual's mind and body to interrupt the company and grab the attention of the public. As the ash rises, clouding the screen, the scene makes one final transition to the space of the club, this time perhaps only as a fantasy, where dancing bodies and dancing particles transform into political statements: a micropolitics.

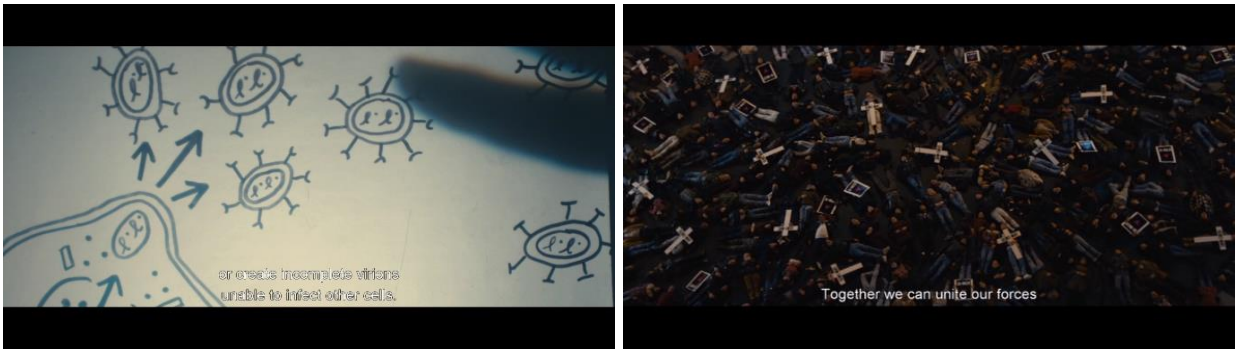

Figure 5.1a-b: The viral as activism in *BPM*

The return to molecular vision in films like *BPM* coincides, not incidentally, with a recent turn to the molecular in such humanities fields as queer theory, object-oriented ontology, affect studies, and biopolitics. These fields are redefining subjectivity, embodiment, and power in the 21st century, but they all agree that molar identities, such as gender, race, and class must now contend with a new molecular understanding of the body. The influential *Women's Studies Quarterly* edition on "the viral" takes the molecular processes of viruses, and the various metaphors that have spawned from it (viral videos, computer viruses, etc.), as a chance to

articulate types of resistance within networks and control societies: "Rather than viewing viruses as alien others, infiltrating systems from the outside, we might consider the virus's ability to bring to light aspects of discord inherent in the networks in which they thrive."[13] Although the contributors denounce "viral capital," most of them see the viral as a unique form of reproduction that can keep pace with and therefore disrupt the non-linear networks of global capital. From this disruption, others see the viral as a speculative aesthetic that can gesture towards futurity or potentiality. For Zac Blas, who writes a much-cited article in the edition, the viral is a tool for queer becomings.[14] In the fields of object-oriented-ontology and vitalism, Timothy Morton understands many biological processes—of particles, cells, minerals, and not just viruses—as inherently queer, such that if we look close enough, the physical world is already "antagonistic to the demands and logic of contemporary capitalism."[15] These interpretations of the molecular draw energy from Deleuze and Guattari's idea of "becoming" (as opposed to being), a movement characterized by the act of moving from the molar to the molecular. For Deleuze and Guattari, the molar is that which produces coded identities that are defined by the similarities they share across a wide group or space. Against this larger macro-organization, the molecular (sometimes referred to as the microphysics of desire) is constantly shifting and breaking away from recognizable molar categories, making the molecular indiscernible.[16] These minor changes, however, can eventually constitute a larger shift at the molar level.

Against this vision of the molecular as a decentralized form of transformation, other queer theorists argue that Deleuze and Guattari's becomings are misinterpreted to collapse molecularization with neoliberalist notions of self-modification. While Jasbir Puar was one of the editors of the "viral" edition of *Women's Quarterly*, she has moved away from her previous

emphasis on the resistant quality of the molecular to see how it now fits into a more Foucauldian model of governmentality. For her, the fetishization of things like fluidity, flexibility, particles, and becoming (what she calls "piecing") are rather convenient products of neoliberalism: "The commodification not of wholeness or of rehabilitation but of plasticity, crafting parts from wholes, bodies without and with new organs. Piecing thus appears transgressive when in fact it is constitutive not only of transnormativity but also of some aspects of neoliberal or market economies."[17] For Puar, while the rhetoric of identity has shifted away from a molar rigidity towards malleable and fragmented bodies that can move between them, she sees shift as hiding subtle forms of control, in which the medical-industrial complex is able to freely exploit a subject's subindividual capacities.[18]

Is the molecular a zone of biological resistance, or a new regime of biopolitical control and capitalist exploitation? The answer is ambiguous exactly because the molecular has become increasingly abstracted—meaning it can signify multiple, sometimes conflicting, things.[19] While these discussions address the effects of molecularization, they take as a given how we have come to know what it is. In other words, few of these discussions consider the various technologies that mediate and construct the molecular body. The goal of this chapter is to ask how imaging the molecular—the technologies we use to give them life, and the cultural products in which they appear—give us a different perspective on these theoretical questions. Answering what the significance of the molecular is today must first contend with how filmmakers produce and integrate the molecular into a cinematic narrative, or how molecular images resist this integration through technical obstacles or limitation. When does molecular vision fail to provide insights and what, if anything, does its integration obscure?

ORIGINS, BIRTHS: *PROMETHEUS*

One effect of molecular vision in films is to signify an origin story that reveals how violent social structures emerge. This origin returns to the very basic units of life, often by looking back in time to the "birth" of a species. In the opening scene of Ridley Scott's 2012 film *Prometheus*, we fly in over a waterfall on a primordial earth and see a mysterious alien, who consumes a vial of black liquid in the act of ritual sacrifice. Quickly after drinking, the alien buckles over in pain, and the camera plunges into his body through a pulsating vein on his wrist to observe how the liquid internally corrodes his DNA, killing him, but then reforms into a recognizable double helix of human DNA. The camera zooms out to reveal newly spawned cells in the process of cellular division as the title sequence materializes over the screen. The molecular vision, as described above, sees the basic parts of life——the DNA that brings humans into existence—as characterized by a coup, a disassembling of one body for another, one generation for the rise of the next. The molecular level allows the audience to observe how the larger battles of galactic conquest that will play out in the film must first be won at a much smaller and more intimate scale. As the scholar Jordy [Jordana] Rosenberg notes, "The molecular is exemplary of this limit as particulate matter becomes a kind of sublime miniature and a point at which ontological wonder blooms."[20] While this opening sequence shows the origins of the human species, it also provides the humans with an original sin—a necessity to kill the previous generation for the ascension and prosperity of a new one—baked into their very DNA. Indeed, the film will follow as human explorers travel across the galaxy to find their creators, but upon meeting them, the humans learn they must kill them to secure the safety of their own home planet. The molecular vision shapes the human race (and their biological processes) as a product of intergenerational violence that will inevitably continue onward.

Figure 5.2a and 5.2b: Origins of violence in *Prometheus*

In *Prometheus*, filmmakers used a combination of practical effects, shot in camera during filming in Iceland, and digital effects shots, produced by Weta Digital in New Zealand months after the live-action shot, to create the seamless transition between the molar and molecular shots.[21] To overcome the spatial and temporal differences between the practical and digital effects shots, two teams had to coordinate with each other and map out each moment of digital and practical interaction to ensure that they captured every component of each scene. The actor who played the alien was fitted with 55 pounds of translucent silicone muscle to give the statuesque figure of the alien; however, to visualize the exterior disintegration of the alien as he drinks the liquid that will kill him, Weta Digital produced a full computer-generated version of the figure that they integrated into the environment by using "clean" digital plates of the waterfall, shots taken without the actor. To create the molecular disintegration of alien DNA, the effects team filmed melting polystyrene (disposable plastic used in styrofoam) as a model for digital animation and then used fluid simulations and particle effects to animate the DNA

movement and cellular division.[22] The visual effects shot had to tell the story of the birth of the human species within a short sequence of about twenty seconds and with no dialogue. As one of the visual effects supervisors recalls, the effects sequence had to undo the narrative of human existence as the effect of gradual evolution the audience is more familiar with: "Ridley wanted a very aggressive taking over of his body and we knew we had to get into a molecular level to see his component parts being torn apart, molecule by molecule, by the infection or the goo…Ridley said, for this section, it has to look like war in there."[23] The highly technical process of showing the internal body, and seamlessly connecting it to live action sequences in the film, helps to naturalize the body as a product of war between generations and species.

The origin scene is a paradox, since the digital effects show us the biological origin of complicated social structures, which motivates many of the characters' actions in *Prometheus*, but the effect's own origin, its moment of cinematic creation, remains split: animators construct the image (called a digital composite) from multiple images taken at different times by different crews across the world. The film self-consciously reflects on the multiple origins of the molecular image in the following scene when we move forward from primordial earth to the year 2089, where a group of anthropologists are on a dig in the Isles of Skye in Scotland and discover cave markings similar to five other images discovered in digs from ancient civilization across the world at different times in history. The scientists wonder how all the images can be similar since the creation of the images shares no clear temporal or spatial connection. The drawings all contain a stick figure pointing to five round balls that cluster together, like the molecular vision of duplicating cells introduced in the first scene. Through a projector, the scientists overlap all five recorded images onto each other, creating a composite image, where the similarities reveal a map. The overlapping molecular shapes are also the structure of planets in a particular system

they believe is home to their creators. When the lead scientist, Dr. Elizabeth Shaw (Noomi Rapace), introduces this map to the crew hired to travel with her, they greet her with skepticism about its accuracy. When asked how she knows the map is accurate, Shaw answers, "I don't. It's what I choose to believe." For her, the extraordinary coincidence of the pattern across disparate images, and the insight they could bring about human creation, overpowers the impossibility of their origin. In Shaw's insistence on the maps potential for discover over its accuracy, the film is self-reflective about its own digital visual effects. Scholars have largely learned to see digital images as outside the photographic model of a moment recorded at a particular time and place; however, the molecular effects in particular, with their promise to provide insight into the origins of human behavior, ironically ask the audience to have faith and accept its own multiple and obfuscated origins.

The film juxtaposes the molecular vision of the opening scene with other types of dangerous molar vision. Dr. Shaw's husband and fellow scientist, Dr. Charlie Holloway (Logan Marshall-Green), sees the long-since-dead bodies of the aliens he has come across the galaxy to meet, and he toasts a glass of champagne to their misfortune ("Here's mud in your eye!"), while promising he would do anything to finally meet them. In response to Holloway's toast, an android named David (Micheal Fassbender) secretly spikes Holloway's drink with a mysterious black goo he found on the planet. In the next scene, as Holloway stares into a mirror, he suddenly catches sight of a small black worm wiggling its way across his eyeball (a horrible fulfillment of his previous toast of "mud in his eye"). Through good fortune, he has received his wish to meet the aliens, but the film shows that the visual encounter he sought also makes him vulnerable to parasitism and colonization: the eye itself becomes a place for the alien to grow, and the scientist only sees this when it is already too late to survive. Similarly, other films in the

Alien franchise famously stage scenes where male scientists, who look too closely into an alien egg, all die horribly. In the original *Alien*, a crew intercepts an S.O.S. message coming from an unknown planet. One of the crewmembers asks Ripley if they will get a reward for deviating off route, "If they find what they're looking for, do we get full shares?," to which Ripley replies, "Don't worry, Parker, you'll get what's coming to you." Indeed, when they explore the planet and find a chamber of eggs, the crew member peers into the egg as it opens only to have an alien suddenly spring outward to cover his face (they are lovingly called "face-huggers" by fans). As it latches onto the face, the alien drops a fetus in the crewmember's stomach to gestate, and a few days later the alien bursts out through the chest when it is fully mature. The sequel to *Prometheus*, the 2017 film *Alien Covenant*, repeats this scene when a rogue AI robot tries to persuade the lead male explorer of the expedition to look inside one of the alien eggs: "Take a look, something to see…," the last lines spoken before the alien hatches and infects the human. In this horror/science fiction movie franchise, visual curiosity breeds parasitic infection, and yet the molecular vision in *Prometheus* evades this danger. Unlike the hesitant character peering into the alien egg, the molecular vision in *Prometheus* detaches itself from a single character's perspective, so that it can dive into another body without fear of reverse colonization.

The molecular vision has other echoes throughout the film that provide a way to see the potential of the alien at a small enough scale to know its true danger before it is too late. "Big things have small beginnings," says the android, David, as he discovers the initial black goo with molecular viruses swimming inside of it. In one scene, the now infected crewmember, Holloway, passes on the black goo to the film's protagonists, Dr. Elizabeth Shaw, when they have sex. Although Shaw is infertile, the black goo develops inside her into an alien fetus, which is discovered by accident during an X-ray medical scan for another illness. In the film's most

controversial scene, Shaw uses an advanced self-automated surgical pod to remove the alien via cesarean birth. The scene single-handedly pushed the film into an R rating and caused Ridley Scott to decide between removing the scene or taking the risk of a financial loss from younger audiences. He kept the scene, repeating his famous *Alien* chest-bursting scene, but with critical differences: unlike previous films, Dr. Shaw does not fall prey to a scientific (and largely male) visual curiosity; instead, her lapse of judgment comes from a disbelief in her ability to give birth, which in the film's theoretical exploration of the concept of creation, is an act that makes one a God.[24] While the alien fetus has fully colonized her body, she regains control by actively removing it through surgery. Dr. Shaw's unexpected pregnancy allows the human characters to realize they that they have been looking for the aliens at the wrong scale. While the characters initially think the humans are the alien's greatest creation, and the one that will eventually overtake them, they learn at the end of the film that this molecular black goo, which has already killed its maker, will spawn a "perfect organism" capable of killing life earth. It is only at the molecular scale, the film argues, that audiences can see the danger before it arrives, since the molecular reveals patterns that at a larger scale become either too dangerous or hard to see.[25]

Molecular vision in *Prometheus* provides an origin story for intergalactic and intergenerational events that threaten human survival, if only the characters could learn to pay attention to this small scale instead of only considering larger being (such as the Aliens) as worthy of their attention. Only through the process of birth—where something as small as a molecule eventually grows into a molar creature—does some of the crew, most often women, learn the lesson that all big things first have small beginnings. The visual effects that make this origin appear through a molecular vision, however, rely on the audience's blind acceptance in the accuracy of the image and a disregard for the visual effects own multiple and obscured origins.

DRUGS, LEAKAGES: *LUCY*

If the molecular is a zone that signifies a return to origins, then the ability to manipulate one's molecules would have a drastic effect on a person's history, agency, and identity. Pharmaceutical companies, in partnership with hospital and university biomedical research, have made great advancements in the production of drugs that make precise and effective molecular adjustments to the body. The market for drugs, both illegal and prescription, spans the globe and constitutes a significant portion of a country's imports and exports; however, films have increasingly looked at the effects of drugs at a smaller scale by diving into the body to see how, if at all, the cells are affected. Films like *Lucy* and *Limitless* both argue that at the molecular level, drugs can help naturalize traditional gender norms, sexualities, and agencies. These drugs are also prone to leakages and side effects that cause them to interact with the body in unplanned ways. This chapter examines the ways that a molecular vision, through visual effects, shows how one's gendered identities are attached to the molar substances one consumes, but that this attachment allows for moments of error and leakages in the reproduction of gender.

The 2014 blockbuster film *Lucy* opens with a similar origin sequence as *Prometheus*, but uses its molecular vision to capture the biological shifts in inter-generational succession. *Lucy*'s title sequence opens with a digital image of a single cell that divides over and over again. This vision is unexplained until a scene later when Professor Samuel Norman (Morgan Freeman) describes in a lecture the birth of life on earth from a single cell: "Life starts approximately a billion years ago. We will have to wait 400,000 years to see the aberration of the first nerve cells. This is where life as we know it began…It's not possible to determine any sign of intelligence yet…One neuron, you're alive. Two neurons, you're moving, and with movement interesting things begin to happen." This opening molecular vision, much like *Prometheus*, signals a return

to the very basic units of life, where audiences can visualize the more simplistic birth of a now complicated human species; however, the opening lecture adds another level to this origin story by showing how the question is not simply about visualizing how were we born, but what progress we have made since. The goal of the film is to ask how, if at all, we have advanced beyond our origins.

As Professor Norman explains, "with movement comes interesting things," and for the rest of the film, audiences will watch Lucy's (Scarlett Johansson) own journey from captured victim to vengeful martyr. The film constantly crosscuts her journey with documentary footage of animals in parallel forms of movement (a mouse scurrying across a floor, a cheetah stalking its prey, dolphins diving into the water). These juxtapositions restructure the question of origin: how, if at all, has Lucy moved past her animalian origins, *Australopithecus afarensis*, the oldest human descendant, named Lucy by the team of archeologists that discovered it.[26] As the film will show, development and growth are far harder to see than one's birth. Lucy explains to a group of scientists how a car moving down a road is visible to them, but if the car speeds up fast enough, "the car disappears." Movement, therefore, is what the film promises to capture—not just the camera's movement inside the body to see Lucy's mutating cells, but the dramatic evolutionary advancements they produce.

In the first half of the film, the animal crosscuts mirror Lucy's position as an animal too slow to escape a predatory world. As a naïve American student studying abroad in Taiwan, Lucy is convinced by her boyfriend, whom she met at a bar the week before, to deliver a package to a mysterious businessman, Mr. Jang (Min-sik Choi). During this scene, the film cuts back and forth to documentary footage of a cheetah stalking its prey. There is a visual joke here as Lucy's outfit, a red dress and cheetah overcoat, hides her true position as a gazelle, an unsuspecting

victim to a large drug organization that abducts tourists in Taiwan to use as drug mules to transfer drugs safely back to America and Europe. As a previous consumer of drugs, she is not aware of her position within this hierarchy as the bottom of the food chain. After her abduction, the scene returns to Professor Norma's lecture, where he describes how evolution can be understood solely in terms of the increased ability for an organism to tap into their cerebral capacity, with most animals only capable of accessing 3-5%, while humans can access 10% and dolphins 20%. For example, this 20% allows the dolphin to organically develop "an echolocation system more advanced than any sonar invented by man." While the science of the 10% myth is dubious at best, what the film purposefully illustrates is a sense of human potential that lies already waiting within the body, if only one could tap into it.

The new CPH4 drug allows Lucy to access more of her body's capacities, reflecting on the current form of medical intervention, where pharmaceutical companies construct subjectivity through the management of molecular substances. A precursor to *Lucy*, the 2011 film *Limitless* has a similar premise. The film follows a lazy and self-sabotaging writer, Eddie (Bradly Cooper), who takes a new, yet-untested drug that allows him to tap into more than the standard 10% of his brain's capacity. After he takes the drug, the camera shows the effects by zooming out from the center of his brain, with its neural connections sparking in a multi-colored sequence, outward to his molar face, where Eddie now has a completely different grasp on life. The result: he cleans up his apartment, finishes writing his book, lands a coveted job at a financial firm, makes millions on the stock market outsmarting other investors, and rekindles his relationship with his ex-wife. In other words, the drug—something a highly potent version of Adderall—allows him to finally live up to a model of the hyper-successful, white-collar male he was previously unable to attain. The major danger in *Limitless* is how to keep the drug for himself (and yet not get

addicted to it) in order to stay on top of the financial world. The comparison to *Limitless* clarifies how, in these films, accessing one's full cerebral potential is riddled with gendered models of success and failure, laziness and work ethic, disinterest and desire. While there is no visible gender attached to the cells we see as we dive into Eddie's mind, his reasons for modifying them, and the types of capacities he hopes to open up, gender his molecular subjectivity.

Paul [Beatriz] Preciado helpfully develops the term 'pharmacopornographic' to describe how new age drugs—including hormones, Prozac, Viagra, and birth control pills—have reproduced gendered relations in what he argues is equivalent to the pornography industry.

> The pharmaceutical and audiovisual digital industry are the two pillars on which contemporary biocapitalism relies…The pharmacoporno program of the second half the twentieth century is this: control the sexuality of those bodies codified as women and cause the ejaculation of those bodies codified as men. The Pill, Prozac, and Viagra are to the pharmaceutical industry what pornography, with its grammar of blowjobs, penetrations, and cum shots, is to the industry of culture: the jackpot of postindustrial biocapitalism.[27]

Such drugs have a similar effect as cinematic narratives that codify gender norms. In a film like *Lucy*, where audiences watch as teams of men fight over and abuse the often sexualized and initially naive *Lucy*, the question remains whether the drugs "the kids in Europe are going to love" might also self-reflectively characterize the film itself. Preciado seems to define pornography in terms of certain content (blowjobs, penetration, money-shot) and yet, in the book in which Preciado writes this criticism, he starts with an anecdote of how he took testosterone and filmed himself masturbating to upload then this video to the internet. The difference in how he views his own masturbatory video and the "audiovisual digital industry" of pornography reveals for Preciado how something like molecular manipulation could either codify or challenge gender norms. For Preciado, this becomes ever more prevalent for transgender subjects who rely on the mass production of hormones such as testosterone for gender expression. While Preciado

does describe testosterone as a site for possible resistance, it is clear that he is skeptical of the rhetoric around transitioning as the saving grace for trans communities, since it fits too neatly into a biopolitical notion of self-betterment through greater levels of biomedical invasiveness (he sees hormones as soft technologies, which "become part of the body: they dissolve into it, becoming *somatechnics*").[28] The common use of these forms of molecular manipulation have shifted, for Preciado, the dichotomy between the technological and the natural: "It is no longer about discovering the hidden truth in nature; it is about the necessity of specifying the cultural, political, and technological processes through which the body as artifact acquires natural status."[29] *Limitless* and *Lucy*, through their own complicated visual effect scenes that peer inside the body, embody just how much technological development, coordination, and execution is necessary to naturalize the molecular as a natural component of the body.

While *Limitless* focuses on how a substance like Speed, if taken responsibly, could allow an underperforming male to fulfil his gendered role as successful businessman, *Lucy* depicts how a substance meant to pacify the body, if ingested incorrectly, could allow Lucy to transition out of her gendered position altogether. Although director Luc Besson explains in interviews that he is proud he constructed a racially and nationally diverse cast, including Egyptian, Korean, African American, Caucasian American, and French actors, he seemed to purposefully cast the film as mostly male.[30] Lucy helps an all-male police department (led by Pierre Del Rio) recapture the drug mules from an all-male drug trafficking organization (run by Mr. Jang), while simultaneously teaching an all-male academic group of scientists (centered around Professor Norman) about new stages of human evolution. She is, therefore, the center of mystery and attraction for all of these groups, who are fighting each other to repossess the drugs tucked into her body and learn from their effects. As the only female drug mule, and indeed one of the only

women in the film, Lucy faces threats of sexual violence in addition to her forced surgery. After her abduction, Lucy sits handcuffed to a wall as two underlings in the gang approach her and fondle her breasts. Lucy turns away in disgust, until one of the men, furious at her refusal, kicks her in the stomach and unbeknownst to him, breaks the package "tucked into her tummy." Then, the camera zooms in on Lucy's bandaged wound, and in a seamless transition, dives into her body to see the tiny particles of the drug leak out of the bag and interact with her body, exploding upon impact and transferring energy to her cells.

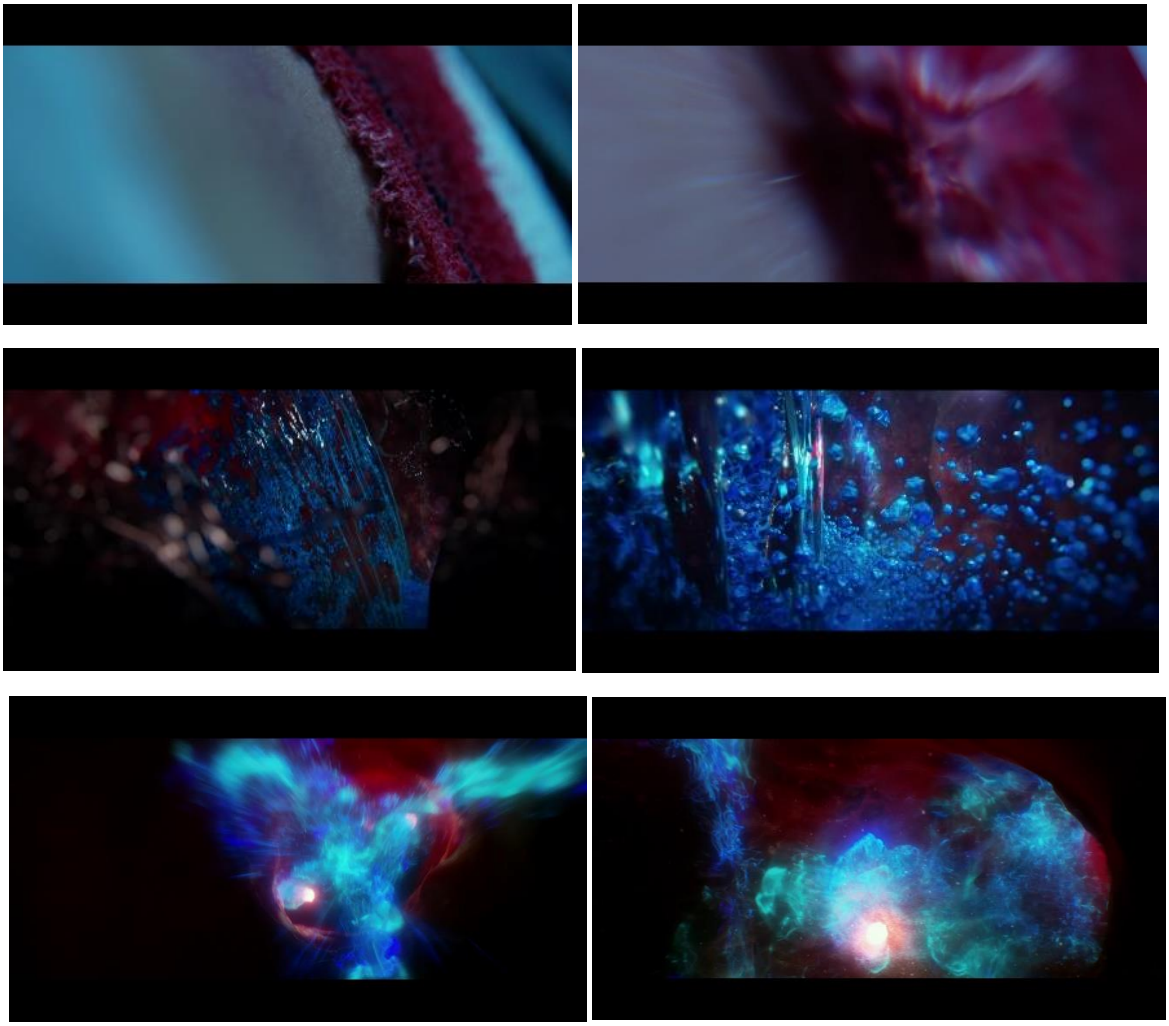

Figure 5.3a-f: Leaking drugs in *Lucy*[31]

The scene then cross-cuts between Lucy's internal (molecular) transformation and her molar reactions. In discussing the inspiration of the film, Director Luc Besson similarly noted that he wanted to thematically connect the movement of molecules and characters: "What impressed me was that there is so much similarity between a cell and a human being. We almost act like cells, we follow the same patterns."[32] At the moment when the leaking drugs activate Lucy's cells, the camera untethers from a character-driven perspective (this new molecular vision could not possibly come from any character). The camera functions similarly to what Kristen Whissel describes as the use of "digital 'camera' moves and compositions" in the film *Gravity* that give its characters a sense of being adrift above Earth: "*Gravity*'s immersive aesthetic and its promotion of a disembodied, floating point of view…undermine[s] conventions of continuity editing and remove[s] the grounds upon which a fixed, monocular point of view and linear perspective depend" (Whissel, 238). In *Gravity*, the film uses a digital free-floating camera movement to force the audience to give up Earth as the visual reference point that grounds their perspective. Similarly, in *Lucy*, the camera's "groundedness" in Lucy's molar perspective embodies the various limitations Professor Norman explains as human's inability to access more than 10% of their brain, while the unthethered camera visually enacts the new ability to move past these limitations. The camera movement, and digital visual effects that produce it, function similarly to the drugs in this scene as tools to access the hidden capacities of the body.[33]

Along with Lucy's new abilities of telekinesis and sonar, she gains a new perspective on her life. With this new drug, she has shed the burdens of "fear," "pain," and "who I was" that otherwise preoccupy human thought and block people from seeing their lives clearly. She is now aware of how others see her, and she learns how to exploit their perception. After the guard that

initially kicked her returns, instead of rejecting him again, she uses her gender as a means of escape by seducing him and then killing him (with his unbuckled belt) when he gets close enough to touch her. Similarly, in another scene, she gets inside Mr. Jang's mind by first pinning him to a chair with knives and then pressing her thumbs into his head, as the camera dives into his brain, so she can see from his perspective the memories of where he sent the other drug mules. While her body was previously a vessel for Mr. Jang to exploit, she can now jump inside other bodies in a reverse form of colonization. In a telling monologue, Lucy admits that now "There are no more obstacles. I'm colonizing my own brain." Unlike *Limitless*'s largely celebratory embrace of molecular enhancements, however, the leaking drugs start to deteriorate Lucy's own body and her control over it. Part of Lucy's transition, then, is not just out of gendered positions of vulnerability, but also species, form, and intelligibility.

Unable to control the speed at which her cells reproduce—"several million per second"—she realizes she will ultimately die within the next twenty-four hours. In the final scene, Lucy decides to liquify and inject all the remaining packets of CPH4 she has collected in order to provide her with the required energy to completely break out of her form: "Some cells inside me will fight and defend their integrity until the very end. In order to attain the last few percents, I have to force it, to crack the cells open to their nucleus." In the final ten minutes of the film, Lucy reaches 90% of her cerebral capacity, and like the molecular vision, the camera untethers from a human perspective and zooms out into space to witnesses the creation of the universe in reverse. All cosmic matter returns to a single point, right before the big bang, with clear parallels to the image of a singular cell. Such a large digital effects sequence at the end of the film, beyond a clear plot function and with little narrative continuity, acts more like a drug-induced hallucination, as if the audience is forced to experience the effects of CPH4 for themselves. In its

portrayal of the visual breakdown of Lucy's body as a drug hallucination, the film puts into narrative form Preciado's claim that bodies can become resistant to pharmaceutical control by becoming unintelligible as molar categories: we need to "look beyond the politics of representation for leakage points in the state's control of fluxes."[34] Preciado sees a specific type of drug use as having the potential for resistance: "Gender must be torn from the macrodiscourse and diluted with a good dose of micropolitical hedonist psychedelics"[35] After Lucy reaches 100%, she completely disappears, leaving behind her discarded feminine garb on the floor. She is now "everywhere"—she tells the groups of scientists via cellphone text—such that it becomes impossible to see her, much like her explanation of a car that ceases to be visible because it is moving too fast. The film ends, therefore, acknowledging how the leakages that allow Lucy to shed her gendered form also make her impenetrable to the camera's prying gaze. In a film that relies on visual effects to activate and visually represent Lucy's transformation, *Lucy* surprisingly ends with a concession that Lucy eventually moves beyond even digital imaging's capacities.

The molecular visions in *Lucy* and *Limitless* have opposite outcomes: in *Limitless*, the camera's singular zoom-out from Eddie's brain to his face mirrors his limited ability to think outside of fulfilling his gender role. In *Lucy*, however, the free-floating molecular vision enables Lucy to have an out-of-body experience that puts her life into a new perspective and helps her transition out of her gendered position. The molecular visions in these films reveal is how the digital camera's movement, in-and-out of the body but also in-and-out of a human-centered perspective, reflect the characters sense of their molar identities and their potential to escape them.

APOPTOSIS, REFRACTION: *ANNIHILATION*

Molecular vision first signifies a return to origins in *Prometheus*, and then the development away from these origins in *Lucy*. The third and final signification of the molecular reassesses the universality of the origin by revealing the effects of environmental stimuli. Alex Garland's 2018 film, *Annihilation*, combines all the different molecular visions discussed in this chapter. The difference between them emphasizes what is lost or erased from the image when scientists look at cells only in vitro (excised from the body and seen through a glass plate). The final molecular vision in *Annihilation* sees the molecular within a living environment, making visible two previously hidden processes, apoptosis and fractals, which both counterintuitively show the necessity of death to increase the overall health of the organism.

Annihilation rethinks the alien invasion film at the scale of cellular processes instead of international cities and grand military attacks. In *Annihilation*, a group of female scientists explores the sudden appearance of what is called the Shimmer, a mysterious zone around a crashed meteor that is expanding and changing organic life within it. Lena (Natalie Portman) decides to join the mission to find out why her husband, Kane (Oscar Isaac), is inexplicably dying after being the only soldier from a military unit to return from a covert mission into the Shimmer. As the team of scientists gets closer and closer to the extra-terrestrial crash, their molecules start to shift and change, much like the life they find around them. Those who are not killed by mutated creatures see their bodies start to alter (their fingerprints squirm, their organs move like serpents, their skin sprouts bark and flower buds), causing psychological distress that threatens the success of the mission. As one of the teammates says at the beginning of their journey, "there are two theories of what went wrong in the Shimmer: one, something kills them; two, they go crazy and kill each other." As the film continues, however, audiences realize this as

a false dichotomy, since the team's horrific fate is more of a combination between the two: something external causes them to mutate, and their new selves start to kill what they were before (a threat that is at once external and internal at the same time).

At the end of the film, Lena is the only one still alive when she meets an alien creature that replicates her form in the hopes of taking her place if she does not make it out of the Shimmer. Lena, however, learns to cope with the disorientation of having two bodies vying for the same identity, and when she eventually escapes, it triggers the Shimmer to receded along with all evidence of the alien. Upon her return to the military outpost, she realizes the Kane that is alive is actually an alien doppelganger who replaced him when he did not make it out of the Shimmer. Instead of reporting him, Lena decides to embrace Kane in the final scene, suggesting that she wants them to restart their previously ruined marriage, though Kane (and perhaps Lena) are no longer who they were before. The film, therefore, shows how biological changes at the molecular level (mutating cells, cancer) affect one's sense of identity and psychological interiority.

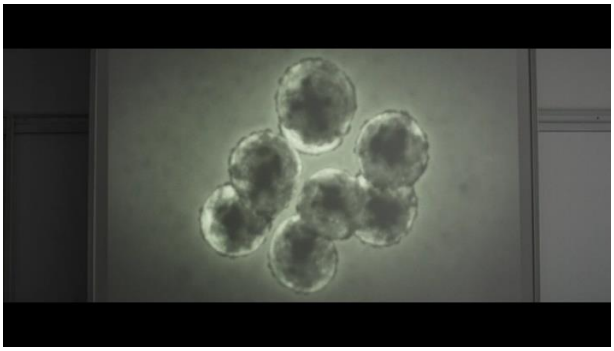

Figure 5.4a and 5.4b: Class on cancer cells in *Annihilation*

Annihilation starts with a close-up of a single cell, in black and white film footage, undergoing mitosis. As the camera zooms out to reveal a classroom at Johns Hopkins University

with medical students taking notes, the cell has divided such that its identical offspring have filled up the screen. The Professor, Lena, explains this development in a long monologue, where she sees the dividing cell as an origin story for not only human life but all life on the planet.

> This is a cell. Like all cells, it is born from an existing cell, and by extension all cells were ultimately born from one cell—a single organism alone on planet Earth, perhaps alone in the universe about four billion years ago. One became two, two became four, then eight, sixteen, thirty-two, the rhythm of the dividing pair, which becomes the structure of every microbe, blade of grass, sea creature, land creature, and human—the structure of everything that lives and everything that dies. As students of medicine, as the doctors of tomorrow, this is where you come in. The cells we're looking at are from a tumor. Female patient, early thirties, taken from the cervix. Over the course of the next term, we will be closely examining cancer cells in vitro and discussing autophagic activity.

From the footage, Lena delineates a certain paradigm of life—the paradigm of the dividing pair—that will structure much of how she understands the world at both a biological and psychological level. Life starts from one, but inevitably divides to produce a pair, and this division continues onwards indefinitely. After this scene, we learn Lena has recently lost her husband on a military mission, but in fear of betraying his trust she decides to socially isolate herself, refusing all invitations to meet or socialize with others, as if life has no meaning outside of being paired. As her colleague tells her after the class, "All work and no play, it's not healthy." The paradigm of the dividing pair, however, quickly shifts towards the pathological. Soon the students realize they are watching cervical cancer, a cell that has suppressed its ability to undergo apoptosis, and therefore threatens the body by dividing indefinitely. The very origins of life—the dividing pair—has the potential for proliferation and the creation of life, but counterintuitively, such unchecked division can lead to the organism's death.

The students take notes, but Lena has taught them to study the cell and not the patient, naturalizing a visual imperative, where to observe the molecular, the molar must first disappear. Lena tells us this cell was excised and imaged from a thirty-year-old woman, but only later in the

film do we see Lena reading a book called *The Immortal Life of Henrietta Lacks*, a journalistic biography of the life of Henrietta Lacks, whose cells make their appearance in this opening scene.[36] Only later does the film hide a clue that allows the audience to piece together the body that is missing from the opening molecular vision. Henrietta Lacks was a poor, black woman who grew up in Maryland, where she was diagnosed and treated for cervical cancer at the age of thirty-one at Johns Hopkins University. Although she received radium treatment, she died soon after, but a sample of her excised cancer cells was cultured by Dr. George Gey.[37] To his astonishment, Henrietta Lacks's cells had two unique qualities: they would divide at an unusually fast pace, and they could survive in vitro, outside of the body in a culture, where most other cells would die. These "immortal" cells provided some of the greatest breakthroughs in biology and biomedicine in the 20th century because Lacks's cancer cells, renamed the HeLa cell line, could be tested on and most importantly observed in a laboratory setting. The HeLa cell line is still used today, copied and cultured across thousands of labs, and largely responsible for billions of dollars of medical advancements, such as vaccines for polio, in vitro fertilization, genome sequencing, and chemotherapy treatments; however, Henrietta Lacks never gave permission to use her cells, and her family was never informed of their use or importance until thirty years later when scientists contacted them, to their bewilderment, for new cell samples due to an infection in the original HeLa cell line. The HeLa cells have become a pivotal story in bio-ethics and the history of medicine for a variety of anxieties around the molecular today, and has spawned many artistic and cultural responses, such as a NYT best-selling book in 2010, a HBO television film in 2017 starring Oprah Winfrey, paintings permanently housed by the Smithsonian, and most recently a theatrical play, titled "HeLa."[38] The HeLa story merges two questions about the property and identity of cells: who owns a cell, and do we consider a cell to

have an identity, to be an extension of the person who created it? Legally, cancer clinics maintain the right to use cancer tissues they have removed from patients for further testing and experimentation, and they can pass on information gathered to other scientists as long as they remove the identities of the patients from the data.[39] For Henrietta Lacks' family, though, the use of her cells without her consent was illegal because they were inherently seen as her property; paradoxically, the family often refer to the HeLa cells as more than Henrietta's property, but also part of her that has continued onward in those cells past her death as if to make her "immortal."[40] The legality of the HeLa cell line highlights how as cells have become the focus of medicine, and as genome sequencing allows all of a person's DNA to be analyzed from a single cell, the property and identity of a cell are collapsing together into paradoxical and legally ambiguous grounds.

Annihilation approaches the ambiguity of cellular identity through the politics of visibility, where historically the ability to see the molecular is largely dependent on the erasure of the molar characteristics of the body. The students in Lena's class only see an excised cell on a clear plate going through mitosis; however, the cell's very visibility—the fact that the students have an image to look at at all—is predicated on the molar categories of the patient. If Henrietta Lacks were not a poor, black woman from Maryland in the 1950s, her cells probably would not have been used without her consent, and students might not have a HeLa cell line to observe in medical classrooms across the country. Lena's understanding of the molecular paradigm of the "dividing pair," which structures everything that "lives and dies," from the "single blade of grass" to humans, reiterates the claim that molecular vision is a neutral glimpse into a primitive world that can reveal some fundamental truth of the origin of life. Yet, by using the HeLa cell line, the film already problematizes Lena's understanding of the molecular as a pre-social origin

story, by showing how this molecular world is reliant on molar identity categories for visibility. The film portrays what Jordy Rosenberg has explained is the current danger in much humanities scholarship that has moved from "queer social subject to the abstraction of the queer object," in particular the molecular, to think of a pre-social world: "[the] subjectless turn has a kind of partial legacy in current ontological work, and specifically in the turn toward the molecular as the pre-eminent 'subjectless subject' of ontologically-oriented theory. The ur-object, if you will."[41] Lena similarly moves from seeing the patient, in all her complexity, to seeing her cells as a strange primitive world worthy of analysis. Rosenberg shows how the desire for the molecular to see an "asocial ontology" relies on a settler-colonial fantasy of the molecular as an untouched world where the social has yet to take hold and scientists can investigate this exotic landscape for research about the general human condition. While *Annihilation* criticizes Lena by having her reiterate the asocial ontologies Rosenberg elaborates, the film also shows how seeing this supposedly primitive world requires a great deal of technological development to be visible, including excising a cell from a body and being able to keep it alive in a petri dish.

It is this vision of cells, removed from the body, that the film will transition out of by showing how dramatically environments effect the molecular changes scientists observe. For the rest of the film, Lena and her fellow team of scientists enter the Shimmer, a seemingly living environment that is growing ever wider. It is impossible to examine the Shimmer from the outside because almost nothing survives or makes it out of its boundaries for testing, and the Shimmer interrupts incoming and outcoming communication once inside. After the team enters the Shimmer, they find that its unique quality is that it mutates or "refracts" the genes of everything in it, producing strange tumorous forms, cross-species hybrids, and, as Lena calls it, "corruptions of form": creatures like crocodiles with shark teeth; plants with multiple species

growing from the same structure; humans with snake-like intestines and fungal-like growths; and bears with human voices. Inevitably, the Shimmer also changes the team's molecular makeup. In one scene, when the team is sleeping, Lena takes a sample of her blood and looks in a microscope to see what is happening. She watches as her blood cell suddenly divides as normal, but instead of an identical new cell, it has a mutation that has reacted to the shimmer and absorbed its color.

As described in chapter one, the microscope in this scene divides the molecular from the molar by requiring a cut to a visible tool that can help transition between these two disparate spaces. Because the internal and external are so different (Lena's appearance versus her blood), this mediating microscope, then, becomes the target of the character's paranoia and disbelief at seeing her unfamiliar molecular insides. The concern shifts from the body to the tool: "Is the microscope dysfunctional" or "Is it purposefully trying to trick me?," and this develops further into the idea that the doctor or scientist using the tool is trying to fool and imprison the patient instead of helping them (we might even see a similar effect in Henrietta Lacks' story, since the predominant narrative paints the doctor or Johns Hopkins as primarily the cause of their family's trauma, not the cancer). Confused that her blood cell divides into a different type of cell with different colors and mutations, Lena pushes the microscope away in disbelief. What she observes challenges her initial understanding of life as defined by "the rhythm of the dividing pair," since in the Shimmer, there are no identical pairs; instead, mutations, asymmetries, and geometric fractals structure life. As in other films, Lena's decision to look through a microscope at her blood brings to the surface a traumatic memory of the moment she cheated on her husband and destabilized her marriage—the reason Kane took on a suicide mission in the first place. After Lena looks at the microscope, a mutated and decomposing bear, similar to the bear tattoo on

Kane's chest, attacks the group as if the Shimmer has mutated creatures within it to take on the form of past memories. Unlike Rosenberg's explanation of the rhetoric of the molecular as falling into a "New-World-style fantasy about locations unmediated by social order."[42] that scientists can analyze, the Shimmer in *Annihilation* is a colonizing force for the bodies of the scientists entering it (Lena's blood is mutated), and the internal landscape reflects and mutates an already existing social order (Lena's marital affair that leads to her self-consuming guilt).

While the opening scene asks students to focus on visible proliferating cells—an image of uncontrollable life—the film suggests that by looking at cells in vitro, excised from the body, we ignore a crucial component to the organism's health: apoptosis, or programmed cell death. As Hannah Landecker has shown, apoptosis only recently in the 1990s and onward became a central pillar for understanding health due to a preoccupation with the visible in cellular biology.[43] Apoptosis describes the regulated (or "programmed") response of the cell to kill itself due to the presence of certain environmental stressors, such as lack of nutrients, viral infection, or damaged DNA. This process is key to the general health of the organism, since it allows the cell to reduce its harmful impact on the rest of the organism. In cancer cells, for example, a special gene suppresses apoptosis, causing the cell to proliferate indefinitely. Therefore, scientists are starting to explain that the overall health of the body may be attributed, in significant part, to whether the cell has the correct level of programmed cell-death, neither suppressed nor overexpressed. Landecker explains that, although the importance of apoptosis had been discerned much earlier in the twentieth century, the general focus on biological life and the desire to keep cells alive or "immortal" through the development of technologies such as culturing cells in vitro caused scientists to overlook the importance of watching what happens when a cell dies. The recent rise of apoptosis in medicine has produced a new metaphor of the cell as an autonomous actor that

must counterintuitively learn how to die on cue, at the exact right moment: “These metaphors mark a radical shift in biological knowledge in the late twentieth century, from an oppositional model of life and death to one in which cell death is integral to the ongoing life of the organism.”[44] Landecker’s narrative makes clear that apoptosis worked against the goals of growing cells in vitro because analyzing cell death required making visible what was previously seen as something to be removed from the view of cell growth.

Like the medical shift from understanding health in terms proliferating life to programmed death, the film requires the audience make a similar shift in understanding the characters: what insights do we gain if we understand their psychology not in terms of survival and proliferation, but of its ability to self-destruct? Each of the five members in the team of scientists are initially self-destructive: The medic from Chicago, Anya, is an addict; the physicist, Josie, cuts herself “trying to feel alive”; the psychologist, Dr. Ventress, has late-stage cancer; Lena cheated on her husband, and the guilt of this betrayal consumes her; and Cass, a geomorphologist, lost a daughter: “In a way, it’s two bereavements: my beautiful girl and the person I once was.” Each has a desire to self-destruct that pushes them towards a mission where only one person has survived, and he is on the brink of death. Dr. Ventress explains to Lena that there is a psychological difference between suicide and self-destruction, similar to the difference between apoptosis and the death of the organism: “Almost none of us commit suicide, and almost all of us self-destruct, in some way, in some part of our lives. We drink or smoke, we destabilize the good job, the happy marriage. These aren’t decisions, they’re impulses.” These forms of self-destruction are a way to try to save the overall organism, to remove them from a marriage or job that may be amicable but is overall unhealthy for the person. It shows how some part of them dies in order for another part to continue onward. In the film, we can see how each

of the characters die in the Shimmer, but part of them continues onwards. Josie, to reduce agony, decides to accept her death as the Shimmer mutates her animal cells into plant cells, making her into a plant, while maintaining her human form; Cass is killed by a bear, but as she dies, part of her voice is transferred over to the creature; Dr. Ventress's body is "annihilated," meaning that each of her particles is separated, but then rearranged to form a new creature; and Kane blew himself up with a phosphorous grenade so that an alien, which had duplicated his appearance, could return to Lena in his place. These deaths—while horrific—help to make visible the ways the characters decide to self-destruct at a certain moment to allow for part of them to continue onward. In this sense, the film uses the apoptosis metaphor of a cell as an actor trying to die on cue as a template for understanding the character's internal psychology.

Although both microscope scenes in *Annihilation* focus only on the proliferation of molecules in vitro, the use of digital visual effects that dive into the body in the final scenes sutures the molecular with the molar bodies. If the final stage of Lucy's transformation in *Lucy* is a loss of form, then Lena's final transformation is a corruption of form, in which Lena first meets and then is mirrored by an alien that wants to take her place as she self-destructs. Like in *Lucy*, audiences and critics blamed the twelve-minute alien encounter, devoid of dialogue, at the end of the film as being overly reliant on visual effects to cover over confusing plot holes.[45] In the scene, Lena stares transfixed into the alien as its interior matter continually pulls outward, in ripples of colors, to form its exterior, like a figure-eight shape that blends internal with external in an infinite loop. Then, in a single, unbroken shot, a bead of Lena's blood pulls away from her face and gravitates into the center of the creature, and we zoom in on the blood cell as it then replicates over and over again. The camera eventually zooms out to reveal that the blood cells have reformed into a metallic humanoid figure. This humanoid figure will eventually mimic

Lena's movement and stop her from leaving the lighthouse she entered. Much like what happened to Kane, the figure will start to take on Lena's physical appearance and attempt to replace her when she kills herself in frustration. The sequence is the culmination of visual motifs in the film—the mutating landscape, the face, the molecular, and the full molar body—all into a single shot where we see how the molar becomes molecular and then molar again.

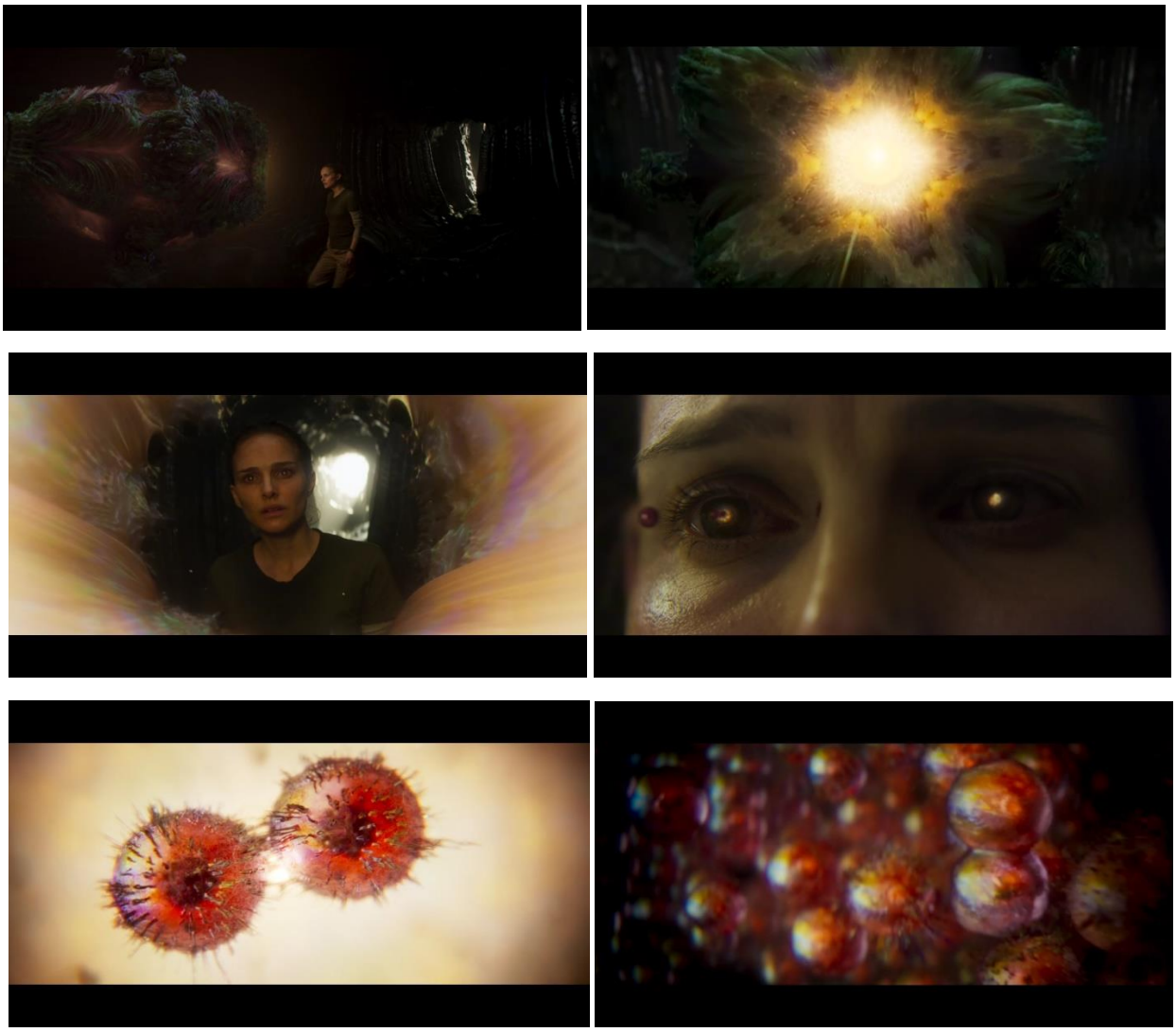

Figure. 5.5a-h: Alien encounter in *Annihilation*

The shot relied on three key forms of technology: particle animation for the blood, keyframe animation for a smooth transition between molecular division and the creation of the molar figure, and finally the Mandelbrot fractals, found both in the design of the background and in the initial alien form. The keyframe animation allowed the camera to evade the microscopic cuts that separate the molecular from the molar. The effect is a continuity between external and internal, and a vision of how they touch and influence each other. The visual effects team created a Mandelbulb through an iPad app, Angisoft Mandelbulb Raytracer HD, which the DNEG effects supervisor, Federico Frassinelli, then used to form the alien.[46] A Mandelbulb is a 3D rendering of a Mandelbrot fractal equation that, when imaged, allows for an infinitely detailed shape regardless of the level of magnification. In other words, the Mandelbrot fractal creates a shape that repeats at all scales: the whole figure looks similar to one of its limbs, which looks similar to one of its digits and so on with small differences. Animators often use the Mandelbrot fractal to construct complicated landscapes and setting for films and video games, anything from lush rural landscapes to futuristic cities, so they do not have to individually design each detail. The repetition with a difference allows the landscapes to remain detailed without looking like they are merely duplicated by a computer. *Annihilation* similarly uses the Mandelbrot fractal to illustrate its landscapes, such as the interior of the lighthouse, the crystal trees, and the fungal growths on the various buildings; however, the film cleverly repurposes this landscape software

to construct a figure. In doing so, the film helps to visually and thematically tie the figures to the environments they inhabit. The alien is literally an aesthetic product of landscape software, and similarly, the scene shows how Lena must now interact and fight with a landscape that is now taking humanoid form and trying to replace her.

This alien encounter scene is ultimately a restaging of the Henrietta Lacks story, with an alien that removes a cell from Lena to cultivate into a new figure that will continue on past her death; however, through the visual effects of both the Mandelbulb and the keyframe animation, the film stubbornly retains the molar body even within a molecular vision by focusing on how environments change how the cell (in this case Lena) reacts. In other words, what Lena misses in her initial understanding of the paradigm of "the dividing pairs" is how it only describes what happens when the cell is removed from the body and external stimuli. In Shimmer, however, the cell responds to the environment through slight mutations—not identical pairs, but refracted ones. It is ultimately Lena's ability to differentiate herself from her alien doppelganger, realizing how she is trapped not with a duplicate but a refraction, that helps her maintain a sense of identity where other team members have failed. Kane, for example, similarly encountered his doppelganger, but was unable to differentiate himself from it, causing an identity crisis. Before his death, he tells his alien double that he can no longer figure out who he is: "I thought I was a man. I had a life. People called me Kane, and now I'm not so sure. If I wasn't Kane, what was I? Was I you? Were you me? My flesh moves like liquid. My mind is cut loose. I can't bear it." Then, he kills himself with a phosphorus grenade. The entire scene is shown on a recorded video with startling cuts, which leave gaps of vision as to how Kane was doubled at a molecular level. Kane's last words of his soliloquy, "I can't bear it," collapse the biological and psychological levels together, since the bear was previously Kane's tattoo, and then a monstrous bear, and now

it became a psychological burden he cannot bear. Lena, however, in recognizing the difference between herself and her doppelganger, takes one of the grenades, holds hands with the doppelganger in a feint of suicide, and then rushes away right before it explodes. While Lena repeats Kane's self-destructive act, she alters it right at the end to survive, leaving her doppelganger behind to die.

Through visual effects, the film tries to visualize how, if at all, molar identity is continuous with one's molecular make-up—and if it is continuous, how they influence each other. The film ends with Lena, having destroyed the alien by feigning self-destruction, returning to the encampment outside of the Shimmer where she explains to the facility employees her survival and the fate of her team. In this interview, Lena learns that Kane's health has stabilized now that the Shimmer has disappeared, though when they finally reunite, Lena privately acknowledges that Kane is not Kane. The scene ends with an embrace and a sense that they can start over from their ruined marriage. In the final moments, the camera lingers on Lena's eyes, and we see a faint glimmer that sparks the question of whether this is Lena or her doppelganger alien. This question of whether it is Lena or a doppleganger, much like the question of whether the Shimmer kills people from without or within, is a false dichotomy. Lena is not likely the alien doppelganger (we saw it die), but she has reacted to her environment by absorbing some of the Shimmer into herself. In this last image, we see a final merging of the cellular and the molar: the pair of multi-colored cells that Lena had seen earlier in the microscope have now merged with her two eyes into a single image, a continuity of face and molecular.

As films continue to utilize new digital visual effects to dive into their characters' bodies within a single, unbroken shot, they can now juxtapose this form of cinematic transition with their characters' molar transformations and journeys. The ACT UP activists from *BPM* learn to

see their kinship and sexual relationships as equivalent in character to the free-floating viruses in their blood, and draw from it inspiration for political spectacles; Dr. Shaw, from *Prometheus*, recognizes the violent rise and fall of the aliens who made her, as evident from their molecular make-up; Lucy, from the film *Lucy*, transitions out of her gendered position at the bottom of the food chain through a leaked bag of drugs that is made visible via a camera that can keep pace with the rapid movement of particles in and out of her body; and Lena, from *Annihilation*, comes to visualize and accept the counterintuitive benefit of programmed cell death at both a biological and psychological level in order to overcome the grief of her marital affair. The combination of both the molecular and the molar in so many popular films allows us to start to push back against strict Foucauldian interpretation of biomedical institutions and media that argue the molecular has become a more significant or primary site of power, over and above the molar. It is true that films often start with what Hannah Landecker describes as "The cell as primal patient"; however, what is evident in films as they progress through their narrative is rather the juxtaposition of these two scales and the new ability to visually connect them.[47]

The molecular vision does not signify one thing. Instead, it signifies a variety of metaphors and situations: for one, the molecular signifies a return to the origins as a way to understand complex and violent social structures. The technology used to image the molecular also helps to show the movement away from origings by illustrating movement through the body at a high speed, untethered from a human point-of-view. This new vision allows for molecular visions to capture the various "leakages" occuring in the body that alter or effect molar legibility. Finally, while films historically access the molecular in vitro, as removed from the body, digital visual effects allow the camera to see how cells respond to stimuli within the body. Accounting for the environment and not just the cell individually helps to highlight the benefit of seemingly

counterintuitive processes like self-destruction that might be benefitial to the orgianism as a whole. The molecular changes in these digital effects all mirror (or even induce) changes in the film's characters, such that to understand the psychology and results of a character's development requires the audience to first look at a smaller scale. As Jordy Rosenberg suggests, "Discourses of embodiment, subjectivity, sexuality, and life itself in the present have come to be marked by a kind of molecularization" (Rosenberg, 11). In 21st century film, the prevalence of scenes where the camera seamlessly transitions inside the body, regardless of the genre or budget of the film, reinforces the notion that molecularization has become a central lens through which to understand molar life. This molecular vision—it's aesthetics, affects, metaphors, and incorporation into a narrative—however, is determined by the digital technologies used to portray it. To see molecularly, therefore, is not to return to a purely biological microscopic-scale of the body, but to account for the technical mastery that make such vision possible.

Notes

[1] Rose, *The Politics of Life Itself*, 40.

[2] Eugene Thacker, *The Global Genome: Biotechnology, Politics, and Culture* (Cambridge, MA: MIT Press, 2005), 175.

[3] Tim Dean, "Mediated Intimacies: Raw Sex, Truvada and the Biopolitics of Chemoprophylaxis," in *Radical Sex Between Men: Assembling Desiring-Machines*, ed. Dave Holmes, Stuart J. Murray, and Thomas Foth, First Edition (Abingdon, Oxon: Routledge, 2018).

[4] Landecker, "Cellular Features: Microcinematography and Film Theory."

[5] Landecker, 904.

[6] Landecker, 936.

[7] Landecker, 927.

[8] Tsivian, Yuri. "Media Fantasies and Penetrating Vision: Some Links between X-Rays, the Microscope, and Film." In *Laboratory of Dreams: The Russian Avant-Garde and Cultural Experiment*, edited by John E. Bowlt and Olga Matich. Stanford, California: Stanford University Press, 1996.

[9] Landecker, "Cellular Features: Microcinematography and Film Theory," 916.

[10] Cartwright, *Screening the Body*, 83.

[11] Susan Stryker and Aren Z. Aizura, eds., *The Transgender Studies Reader 2* (New York: Routledge, 2013), 1.

[12] Tony Anatrella, *Non à La Société Dépressive* (Flammarion, 1993).

[13] Amy Herzog and Joe Rollins, "Editor's Note," *WSQ: Women's Studies Quarterly* 40, no. 1/2 (Spring/Summer 2012): 10.

[14] Zach Blas, "Virus, Viral," *WSQ: Women's Studies Quarterly* 40, no. 1 & 2 (Spring/Summer 2012): 29–39.

[15] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present." Timothy Morton, "Queer Ecology," *PMLA: Publications of the Modern Language Association of America* 125, no. 2 (March 2010).

[16] Deleuze and Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, 249. "A fiber stretches from a human to an animal, from a human or an animal to molecules, from molecules to particles, and so on to the imperceptible." See also pp. 11: "Transversal communications between different lines scramble the genealogical trees. Always look for the molecular, or even submolecular, particle with which we are allied."

[17] Puar, "Bodies with New Organs: Becoming Trans, Becoming Disabled," 54.

[18] Puar, 56–57. "…but rather on the body's suitability for integration, its ability to be integrated as a biopolitical resource into a larger sociotechnical field, or into an apparatus such as the state."

[19] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present," 11.

[20] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present."

[21] Joe Fordham, "Prometheus: Alien Genesis," *Cinefex*, no. 130 (July 2012): 36.

[22] Fordham, 39.

[23] *Prometheus VFX Making*, accessed January 10, 2019, https://www.youtube.com/watch?v=BBD5xtY3_RA.

[24] This exploration carries on into the sequel to *Prometheus*, called *Alien: Covenant*, which focuses more on the android David's psychological position as a being created by man "just because we could." David eventually uses humans as vessels to develop the alien goo into a new creature. After one of the crew members finds out David's plan, he asks David if robots believe in God. David responds, "I believe in creation." Scott Ridley, *Alien: Covenant* (Twentieth Century Fox, 2017).

[25] Similar to *Prometheus*, the 2009 arthouse film *Enter the Void* uses a scene that transitions from a character's molar appearance to inside their body to represent a return to one's origins and the violent succession that produced their birth. The film is about Oscar (Nathaniel Brown), who is killed in a police raid of a bar when he was selling drugs, and then whose mind floats about after his death, both reliving his past, as well as viewing the effects his death has on other characters, such as his sister Linda (Paz de la Huerta) and friend Alex (Cyril Roy). Toward the end of the film, Oscar's mind follows Linda and Alex have sex in a hotel. Oscar enters Alex's mind to see the sex from his perspective, and Linda's face continually shifts from Linda to her mother. As they are having sex, Linda tells Alex to "come inside me," and the provocation to ejaculate inside of her turns into an invitation to see inside of her. The camera dives into body to her vagina, in one continuous shot, as we see a penis thrusting forward again and again until it ejaculates into the camera's vision and clouds the screen. Then, the camera follows the semen up the fallopian tubes and zooms closer to see as an individual spermatozoon fertilizes an ovum, all in one unbroken shot. The shot fulfills Linda William's claim that porn is there to show everything, while simultaneously showing the limits of this definition, because the film, and certainly this scene, would hardly count as pornography. Then, the scene continues in darkness with muffled voices, and ends when suddenly a light opens up below us and the camera is birthed out of someone whose face always appears out of focus. Here we are witnessing Oscar's origin story, from insemination to birth. While Oscar's death in a police raid prompts a series of out-of-body experiences as his mind hovers about, it is this final scene, this in-body-experience that returns Oscar to his first traumatic moment: birth. His birth is preceded by a calming, yet blurry maternal face and breast, two images that will stay with Oscar throughout his life and often motivate him in various ways (for example, he has sex with his friend's mother for money to pay for his sister to live with him. These various women's faces shift throughout the film). Unlike *Prometheus*, where the origin is depicted as a violent battle between older and younger generations, the origin scene here is reminiscent of a drug-induced hallucination. Throughout the film, audiences are privy to long, first-person sequences of Oscar's drug-induced highs. The drug scene where it seems like we are moving initially through different brain neural connections—and which looks a lot like digital imaging of inside the body—then links at the end to birth. The molecular visions in these films, through a seamless transition inside the body, show how molar social and sexual relationships are products of molecular structures and change. The body is manipulated by the molecular, a slave to it, a product of it, equally as important as psychic processes described in psychoanalysis.

[26] There is a lot more analysis of species in this film that I have left out of this section. Jasbir Puar notes that Michel Foucault's sense of biopolitics comes about exactly as a technology of speciesization, where man distinguishes itself from animals: "The (androcentric) human is thus rearticulated as an exceptional form of animality within an anthropomorphized category: humanity. Therefore, although Foucault's own work does not explore the implications of this in

terms of interspecies relating, his theory of biopolitics understands anthropocentrism as a defining facet of modernity" (60). Puar, "Bodies with New Organs: Becoming Trans, Becoming Disabled."

[27] Preciado, *Testo Junkie: Sex, Drugs, and Biopolitics in the Pharmacopornographic Era*, 52. See also: "This pharmacopornagraphic capitalism functions in reality thanks to the biomediatic management of subjectivity, through molecular control and the production of virtual audiovisual connections" Pp. 51.

[28] Preciado, 78.

[29] Preciado, 35.

[30] Although Bessen has repeatedly foregrounded the diversity of the cast members, the film received ample criticism for its portrayal of Asian stereotypes and its implicit depiction of Scarlet Johansson, a white woman, as the pinnacle of human evolution. See also C. Rhodes, "No, Hollywood. Ignore Lucy. Please.," Powder Room, July 28, 2014, https://powderroom.kinja.com/no-hollywood-ignore-lucy-please-1612177570.

[31] The visual effects of the inside of the body were modelled off of Perry Hall's artwork, says visual effects supervisor, Richard Bluff: "Perry creates art with liquids, paints, and different chemicals…Imagine how oil and water repel each other. Then, imagine playing a bass guitar through the liquid so those vibrations repel each other at a different rate. Perry shoots this on his HD camera and projects the video on a wall, makes prints, displays projects in art galleries, projects on the sides of castles with music. When I saw his work, I knew we could use his images all over the movie." Barbara Robertson, "How VFX Supe Richard Bluff Explored New Approaches for Lucy," *Studio Daily* (blog), August 6, 2014, http://www.studiodaily.com/2014/08/how-vfx-supe-richard-bluff-explored-new-approaches-for-lucy/.

[32] Daniel Eagan, "'Lucy' Unleashed: Scarlett Johansson Powers up in Luc Besson's Sci-Fi Thriller," Film Journal International, July 11, 2014, http://www.filmjournal.com/content/%E2%80%98lucy%E2%80%99-unleashed-scarlett-johansson-powers-luc-besson%E2%80%99s-sci-fi-thriller. In addition, Industrial Light & Magic, the visual effects team tasked with creating this sequence, noted that "We'd make sure that when she was flipping onto the ceiling and going against the gravity of the room, we would try to [show the similar movement] inside of her body." Giardina, Carolyn. "'Lucy:' How VFX House ILM 'Surprised' Luc Besson With the Visuals." The Hollywood Reporter, July 30, 2014. https://www.hollywoodreporter.com/behind-screen/lucy-how-vfx-house-ilm-722217.

[33] Eagan. Ironically, Lucy's molecular transition is a product of gender violence and the unintended consequences of drug ingestion; yet, the camera's molecular vision is a product of calculated design and flawless execution by a team of visual effects animators.

[34] Preciado, *Testo Junkie: Sex, Drugs, and Biopolitics in the Pharmacopornographic Era*, 389.

[35] Preciado, 397. See also how Preciado describes a gender politics that fails to reproduce gender through leakages, "Copyleft gender politics, a cellular micropolitics that looks beyond the politics of representation for leakage points in the state's control of fluxes (hormones, sperm, blood, organs, etc.), codes and institutions (images, names, protocols, legal inscriptions, architecture, social services, etc.), and the privatization and marketing of these technologies of production and modification of gender and sex by pharmacopornographic corporations. (Preciado, 389)

[36] Rebecca Skloot, *The Immortal Life of Henrietta Lacks* (New York: Broadway Paperbacks, 2011).

[37] Benjamin Butanis, "The Legacy of Henrietta Lacks," accessed January 11, 2019, https://www.hopkinsmedicine.org/henriettalacks/index.html.

[38] George C. Wolfe, *The Immortal Life of Henrietta Lacks*, 2017. Unlike *Annihilation*, the HBO film purposefully chose never to actually show the HeLa cell line, and instead focused exclusively on the molar story, on the level of social identities, particularly around Henrietta's racialized exclusion from medical institutions and her struggles coming to grips with her family about her mother's death. For reviews about the play "HeLa" look here: "Review: Berkeley Play Gives Life to Exploited, Forgotten Medical Hero." The Mercury News (blog), May 31, 2017. https://www.mercurynews.com/2017/05/31/review-berkeley-play-gives-life-to-exploited-forgotten-medical-hero/.

[39] Rebecca Skloot, "Your Cells. Their Research. Your Permission?," *The New York Times*, December 30, 2015, sec. Opinion, https://www.nytimes.com/2015/12/30/opinion/your-cells-their-research-your-permission.html. See also, Brown, DeNeen L. "Can the 'Immortal Cells' of Henrietta Lacks Sue for Their Own Rights?" Washington Post, June 25, 2018. https://www.washingtonpost.com/news/retropolis/wp/2018/06/25/can-the-immortal-cells-of-henrietta-lacks-sue-for-their-own-rights/. See also, Ornstein, Charles, and Katie Thomas. "Sloan Kettering's Cozy Deal With Start-Up Ignites a New Uproar." The New York Times, September 20, 2018, sec. Health. https://www.nytimes.com/2018/09/20/health/memorial-sloan-kettering-cancer-paige-ai.html.

[40] In an article about the Lack family's legal possibilities, their lawyer argues, "I can approach it as saying Henrietta Lacks is a person, who is continuing to be represented in life by her cells, or that Henrietta's cells themselves are Henrietta Lacks and in so doing she is still living, or her cells are the property of the estate because they belong to her and require protection because she is now deceased and cannot speak on her behalf for her property." DeNeen L. Brown, "Can the 'Immortal Cells' of Henrietta Lacks Sue for Their Own Rights?," Washington Post, June 25, 2018, https://www.washingtonpost.com/news/retropolis/wp/2018/06/25/can-the-immortal-cells-of-henrietta-lacks-sue-for-their-own-rights/.

[41] Rosenberg, "The Molecularization of Sexuality: On Some Primitivisms of the Present," 7.

[42] Rosenberg, 3–4.

[43] Landecker, "On Beginning and Ending with Apoptosis: Cell Death and Biomedicine."

[44] Landecker, 24. See also Landecker's later remark, "Death, in becoming cellular, has become more than a null quantity; it has gained a substantial and significant existence in its own right" (25).

[45] Although critics have complained that the film relied too heavily on visual effects sequences that made little sense for the plot, director Alex Garland argued that "There was an underlying rule that we enforced quite strongly… Nothing happens for arbitrary reasons. This was true for shot design, sound, musical score and color grading—every element directly related to what the film was about. We wanted the sequence to be visually overwhelming; but it had to have an underlying logic, a sense that these evens had meaning. If the audience felt they were simply watching fireworks, the meaning would float away.'" Joe Fordham, "Annihilation: Into the Shimmer," *Cinefex*, no. 159 (June 2018): 159.

[46] Fordham, 30.

[47] Landecker, "On Beginning and Ending with Apoptosis: Cell Death and Biomedicine," 54.

Conclusion: Molecular Vision and The Horizon of Visibility

Molecules are at the very horizon of visibility, the smallest object we can see with the aid of a light-based microscope. The ambition of this dissertation is to see how "molecular vision" functions as on aesthetic, narrative, and production level in contemporary cinema. There is an emerging historical parallel between the new visuality of biological science, with its focus on molecular movement of live-cell imaging, and the increased presence of visual effect shots in cinema that go inside the body of its characters to view moving molecules as a means of adding psychological depth. Many fields, from biopolitics to queer theory to ecocriticism, use the term "the molecular" in different permutations to think through the body and its relationship to subjectivity in the 21st century. Although they help articulate the changes in agency and power at the smaller, more intimate, and perhaps more pervasive scale than those found in the realms of work, family, and government, these theories rarely, if ever, accounted for how the molecular is imaged. Such theories take the molecular as a given—as an agreed-upon aesthetic object. Yet the tools we use to see the molecular shape our understanding of what constitutes it, whether from microscopy, 3D modeling, bioanimation, or the visual effect equivalents that mimic these tools, such as crowd simulation software, digital morphs, and keyframe animation.

Microscopy enacts a radical cut from the molar watcher, who must peer into a darkened viewfinder, to the inside of his or her body, which has transformed into abstract geometric shapes that have lost their social markers that define identity. It becomes difficult to tell which cell is one's own, or what ownership would even mean at a molecular scale. Hence, in films where microscopes play a key role in the script (and there are a surprising number of them), ambiguous images of molecules produce a paranoid narrative about how doctors have implanted

something within their patients' bodies, or worse, have used these molecular entities to shape the patients' external identities without their consent. The microscope becomes a crucial tool to rethink psychological theories that require the ego to see its limits and recognize the self as whole. While the films foreground how molecular vision induces a traumatic loss of identity, many also offer a solution. In these films, the protagonist survives only by discarding a sense of a singular body, since bodies can lose form too easily, and instead he or she learns to read across multiple bodies for the patterns that remain consistent. The protagonist from *The Skin I Live In*, for example, realizes his identity is not derived from the body he is currently imprisoned in, but from the differences between the bodies that he has lived through. The conceptual move from static body to bodily transitions over time is similar to live-cell imaging (the predominant form of biological imaging today) that gives up the static microscopic image for a depiction of cellular change over time.

This microscopic effect seems to be present across a variety of different films from across the globe. In a Hong Kong film, *30 Years of Adonis*, we can see how the microscope induces the same experience but registers body swapping through a Buddhist sense of reincarnation through multiple bodies. The film depicts a child who goes to a local fortune teller that takes a piece of flesh and puts it under a microscope to see his future. While she looks, the traditional molecular shapes transform into an ominous image of two darkened circles that foretell the boy's brutal murder on his 30th birthday. The traumatic molecular vision comes true when the protagonist is chained, cut to bits, cooked, and then eaten by a rival; however, the protagonist realizes in the afterlife that he was murdered exactly because he had betrayed his rival in a former life. When he learns to forgive his death, he is reborn as a new baby from his brother's wife. The role of

Buddhist reincarnation in the film, therefore, works through molecular terror as a way to find identity within a world where our bodies are not our own.

The paranoia generated from microscopes becomes even sharper in the outbreak genre, which is defined by a narrative imperative of imaging disease: a team of scientists must produce an image of an unknown virus as a means of fighting it. Such a reliance on the microscope to find and isolate (then produce a vaccine for) the virus is then mimicked in the story when the military must find the carrier of the disease, a foreign stowaway man or an illegally traded monkey, who must then be removed in order to restore safety. With new forms of viral imaging, such as DNA sequencing and 3D modeling of the virus's protein structure, however, the narratives take a different shape. As opposed to the microscope, which isolates the virus, 3D modeling emphasizes the virus's ability to integrate into the body's networks. In *Contagion*, as well as a series of other contemporary outbreak films, the goal is not to isolate and remove the virus—this task seems impossible—but to study the virus as a way to find out how to better integrate it into modern institutions by restarting commerce, developing new forms of familial relationships, and restructuring governments.

Bioanimation is another key change in biological imaging, where the goal of the animation is to capture the types of protein movements that make cellular processes possible. Created through molecular infection, the digital hordes in zombie films use the same crowd simulation software as in bioanimation. Zombie films utilize Brownian movement, the random movement of particles colliding, to stage the uncanny quality of zombies colliding and forming clusters to break through a city's defensive walls or military barriers. Like bioanimation, these digital zombie hordes decenter human psychology and intent from movement: the digital horde moves in a risky and unthinking manner, often to its own demise, which separates it from the

humans trying to escape them. Cinema is unfamiliar with this Brownian movement since camera and character movement are intentional, and film production has to ensure the actors' and stunt doubles' safety, which crowd simulation software and CGI can gleefully ignore. In these films, the Brownian movement of the digital zombie horde accrues allegorical significance for other types of risky migration, this time in terms of populations, and through questions of who is worth carrying along. If the digital horde allegorizes the movement of infection at a molecular and global scale, then the visual effects of digital morphs and keyframe animation help to smooth the transition between the molar and molecular by having the camera move into the body of their characters in a single, unbroken shot. In doing so, these effects avoid the traumatic break that occurs within scenes of microscopy. The smooth transition characterizes the molecular vision as a return to a character's origins, made visible by the first moment of cellular mitosis or division. However, by showing the continuity between internal and external, molecular and molar, these digital effects incorporate how environmental or outside stimuli, usually removed from the frame in microscopy, mutate the cells and characters under focus. The characters' molecular origins, therefore, are largely about how the characters are able to evolve past them, and how doing so might allow them to fall out of the restraints of their birth, including gender. In sum, such molecular vision stages thematic concerns about the causes and effects of mutation against tools that promise to pin down the truth or origins of one's body.

In turning toward popular feature-length film, I find these films are self-reflective about how audiences respond to or interpret molecular images in layman's terms. It is not an exaggeration to say that molecular vision is central to the structure, the very DNA, of the films for which it appears. Although constituting only a small portion of these films, perhaps only a few minutes overall, images of the molecular often frame the rest of the story by appearing in the

first scene to set up the origins of the complex social relationships characters will overcome throughout the rest of the film, or they emerge in moments of great psychological terror, at the first encounter of an alien or the discovery of a terminal infection, like the great reveal of a monster glimpsed in a horror film for the first time. Because of the multiple significations of the molecular, it would be hard to look at the molecular in isolation or only in isolated moments, which would be like focusing just on the moment Jaws jumps out of the water, thereby missing the shark's ability to produce tension and an uncanny presence for much of the rest of the film. Both blockbuster and independent films stage moments of medical imaging in order to show the context, psychological anxieties, and effects of molecular vision: the character's response, the scientist's drive for ever smaller, more precise forms of ontological certainty, and the aesthetics and threats the molecular induces in the characters for the rest of the film. In other words, it is hard to understand what the molecular is doing if it is removed from the narrative.

I, therefore, have tried to analyze molecular vision in its relation to the entirety of the film. Kristen Whissel helpfully argues that spectacular visual effects—such as, I would argue, molecular visual effects—act as "dynamic textual assemblages" that take up meaning as the film progresses and when taken together reveal the stakes of film.[1] For Whissel, this means looking at the way effects gain meaning through dialogue, which is often ignored altogether in much scholarship in film studies:

> "The spectacular visual effects….rely heavily on dialogue, narrative, and characterization in order to function emblematically in the films in which they appear. The dialogue that brackets, precedes, or follows the display of a spectacular visual effect often foregrounds the meaning attached to an effect, to reveal or unveil its significance; in turn, the spectacular effect charges such dialogue with further significance, affect, and dramatic effect.[2]

Molecular vision, as a visual effect, similarly develops allegorical and thematic meaning from the dialogue that contextualizes it. In *World War Z*, a Harvard biologist explains to the

protagonists that to stop a zombie war created by a new virus, they will have to recalibrate how they search for a cure: "Sometimes the thing you thought was the most brutal aspect of the virus, turns out to be the chink in its armor. And she loves disguising her weaknesses as strengths." He is talking about their journey to South Korea to find a cure by locating patient zero; however, through the visual effect of the digital zombie horde that inexplicably avoids the sick, the protagonist Gerrard realizes the governments have mischaracterized who is worth saving—who is "essential personnel." The dialogue adds to the visual effects a social allegory of the lower classes, previously ignored as too weak or too slow, rising up to become the key to military success over the zombies. In *The Skin I Live In*, the sadistic plastic surgeon Robert tells his patient after a long surgery, "It's a pity you can't see your whole body." Robert refers to how he has removed all the mirrors from the house to keep his patient from the trauma of seeing his body in bandages; however, given previous views of Robert's molecular manipulation, where the audience watches as Robert secretly swaps pig cells for human cells with the visual effect of the microscope, the discussion refers to the impossibility of the patient seeing his body as "whole" given the fluid, permeable, and malleable nature of molecular engineering. In *Lucy*, Dr. Norman explains in an academic talk about the origins of single-celled organisms: "This is where life as we know it begins…One neuron, you're alive. Two neurons, you're moving, and with movement, interesting things begin to happen." The dialogue reveals the significance of the visual effects that follow, when the camera dives into the body of the protagonist Lucy as the bag of drugs surgically implanted into her body begins to leak, sparking the radical growth and division of her cells. The camera's deft mobility as it darts through her body captures the dramatic evolutionary jumps she experiences. With movement comes interesting things indeed, and the visual effects of cells allegorize Lucy's ability to move beyond the limits of her

previously gendered position within the film as a drug mule. It is clear from these films that molecular vision structures the types of narratives and stories in which it appears, from the dialogue, to the plot, to the characters. Ironically, seeing the smallest parts of the body requires one to account for how its effects ripple outward to encompass the entirety of the film and, even further, to cinematic practices within the industry.

New Medical Horizons

In January 2018, an article in the *New York Times* titled, "Brain Surgery in 3-D: Coming Soon to the Operating Theater," chronicled the introduction of a new videomicroscope used at a few elite hospitals during surgery that could record and then display a video image of a patient's body in 3D.[3] If you were imagining it, yes, everyone in the room does have to wear 3D glasses. Videomicroscopes make difficult surgeries, such as those in the brain and spine, more precise and easier on the surgeon, who can now look up instead of craning his or her neck downward, while providing a great deal more visibility. Perhaps the most advantageous part of this new technology is that it allows other medical experts in the room to see what the surgeon sees and then offer supplemental suggestions on what to do. The videomicroscope is both a teaching tool and a form of collaborative surgery: "Surgeons on opposite sides of the table can work together easily."[4]

Critiques of microscopes might also need to be revised: is this new technology just a more invasive gaze, or does the 3D aspect remove much of the criticism around the fetishistic qualities of the microscope that both "flattens" and "fragments" the body of the patient for scientific curiosity and mastery?[5] These criticisms, as I noted throughout the dissertation, are also a product of a largely male-dominated surgical staff, which is thankfully changing, but the medical gaze has historically overlapped with general ease onto the male gaze, though with far

more at stake than sexual arousal. It might be impossible to reverse these associations, or maybe we do not want to, since even videomicroscopes with their less invasive and smaller design maintain their phallic potential: "Standard surgical microscopes are enormous and require a complicated draping process to ensure sterility. Not so with the videomicroscope, which is covered with just a sleeve that Dr. Langer said can be slipped on like a condom."[6] Just the comment to put the patient at ease before they begin a risky brain surgery.

In addition to explaining how the videomicroscope is used, the *New York Times* article covers a series of controversial topics around 3D surgery, including the complex business ties between the surgeons and the makers of the tool, who often place the doctors on their boards as consultants, making the doctor well-disposed towards their products, which cost over half a million dollars each. Similarly, some doctors see this new technology as a gimmick not worth the hefty cost, while others are altogether are unwilling to learn an entirely new set of technical skills after having already gone through an arduous amount of training and had a good deal of success using last year's new equipment. As with much work on medical imaging, the questions revolve around the technology, its development and implementation in hospitals, its business and corporate ties, how if at all it might benefit the patient, and who will pay for it.

As the title of the article insightfully notes, however, videomicroscopes also collapse the distinction between the surgical theater and the movie theater. Indeed, the month the article appeared, *Star Wars: The Last Jedi*, a film about a group of warriors wielding laser and deftly cutting through enemies, came out in 3D, which similarly promised an immersive spectacle for everyone in the room and drew the younger generation into the movie theater by making them feel like collaborators in a cultural phenomenon (many cited the large sale of 3D Imax tickets for the film as what pushed it to be the ninth highest grossing film of all time). Beyond the article's

title, however, it fails to address the effects and consequences if conducting surgery were to become like going to a movie theater. Will it be run by similar marketing practices ("Want to experience neurosurgery? Why watch it in 2D when you can *live* it in 3D?")? Will 3D privilege certain surgeries or medical decisions, and the narratives doctors tell about them, over others? Do the other spectators in the room approach watching videomicroscopes differently than they would a feature film in the movie theater? These questions might seem dystopian, but as some of the surgeons who have used videomicroscopes note, "It's like being in Imax," while another admitted that the 3D images initially made her carsick. Similarly, the chief of neurosurgery at Massachusetts General Hospital said it was like having "Superman eyes."[7] From his comment, we can see how surgeons understand their medical gaze in cinematic language, citing the types of vision films have made possible, such as Superman's vision, itself a DC Universe product.

As I have shown in the four previous chapters, the intermingling of 3D videomicroscopes and 3D blockbuster films goes both ways: not only is surgery like going to a movie theater, but movies are increasingly incorporating surgical spectacles, not just surgeries but videos of photo-realistic images of inside the body—now, also, in 3D. Watch the film *Lucy* in 3D and you will get the experience of being a surgeon with a videomicroscope as the camera takes you through the protagonist's abdomen into her organs and then bloodstream to see the effects of drugs on her body. These surgical moments are different from the hospital melodramas that stick largely to the molar view of surgeons working on a draped patient in the operating room because the camera takes the view of the optical tools the surgeons use to go inside the body. How might the affects of surgery change along with these shifting technologies and spectatorial engagements/ Surgery in film evokes a series of deep emotional responses, ranging from panic to nausea, but these shots almost always take the position of the patient or a background observer. What if the

spectator were inside the body, alongside the scalpel as it rerouted an artery? What genre could even house such a shot—horror, medical thriller, documentary?

In addition to surgical scenes in films, new media platforms allow audiences to view films with more of a surgical eye. For example, Amazon's streaming service "Prime Video" has a special filter that overlays on top of the movie and collects internet data on the film and then displays it at the left part of the screen. Audiences can turn on this feature on with a simple click—and it's called "X-ray vision." As the movie plays, text and pictures appear to the left side of the screen that tell the viewer about such things as the filming location, actor credits and bios, failed casting decisions, names of the song in the diegesis, trivia about the scenes, references embedded in the film to previous films, and factual errors. In other words, the X-ray vision gives us meta-data of the images, its production and dissemination on the way to the screen. For example, in one moment in *Lucy*, the protagonist storms into an operating room during a surgery, kills the patient, and forces the doctors to remove the drugs planted into her abdomen. The X-ray vision on the side of the screen displays the characters in the scene and factual errors few audiences would be able to catch:

> Factual Error: When Lucy enters the operating room and kills the patient, she tells the surgeon that he was already doomed because the "tumor invaded the cortex at the right side of his spine." Had they been performing surgery on his spine, the patient would be lying on his front. Also, the scan on the wall was of a brain.[8]

The X-ray vision may allow viewers to see more like trained doctors than laymen. We approach this scene to dissect its images, as if we are diagnosing the truth or accuracy of the story, script, and accompanying visuals. What is lost, however, is whatever is happening on the far-left side of the screen, and with it the illusion that we are peering through a window into a world. The X-ray vision may be distracting to read in its entirety, since viewers must either pause the film multiple times or pay attention only to reading the information over watching the story. Viewers can also

click on any of these facts, which act as hyper-links to move you to another website with more information (such as IMDB). In other words, X-ray vision fits with many current descriptions of viewers' multi-tasking while watching or shifting between different screens, a different temporal structure to film that might again align more with surgeons, who have to balance a series of different diagnostic screens and information.

Figure 5.6: Amazon Prime's X-ray vision of *Lucy*

Filmmakers are starting to catch on, and indeed *Lucy* seems to know about new forms of streaming viewership, even building it into the story. Lucy herself gains an Amazon Prime-esque "X-ray" ability when encountering other characters in the film: whenever she touches someone or looks at them, a pulse flashes through their body, making them transparent and revealing meta-data about their health, history, and name, much like the information provided in the X-ray vision to viewers about what actors play each character, their names, and the previous films they have been in. Lucy, for example, touches her friend, whose body then goes transparent, revealing that her liver is failing. If Lucy is considered an evolved species in the film because of her ability

to see beyond mere appearances, then perhaps X-ray vision is the evolved form of spectatorship for the 21st century, though Lucy's death—she evolves too fast to keep her form—might be more of a warning for new forms of film spectatorship than an endorsement of it. Medicine's tools for examining the body are incorporated into cinematic practices, just as cinema and its digital age transformations help shape public understandings of medical practices for a general audience, and perhaps also for doctors in 3D surgeries. To look inside the body, to see it at its visible limit, its horizon, is a terrifying experience, but simultaneously inspiring for new cinematic experimentations.

Notes

[1] Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*, 172.

[2] Whissel, 173.

[3] Denise Grady, "Brain Surgery in 3-D: Coming Soon to the Operating Theater," *The New York Times*, January 8, 2018, sec. Health, https://www.nytimes.com/2018/01/08/health/surgery-3d-microscope-moyamoya.html.

[4] Grady.

[5] Cartwright, *Screening the Body*, 83.

[6] Grady, "Brain Surgery in 3-D: Coming Soon to the Operating Theater."

[7] Grady.

[8] *Lucy (2014) - IMDb*, accessed April 30, 2019, http://www.imdb.com/title/tt2872732/goofs.

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