

Research Article

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The Holobiontic Figure: Narrative Complexities of Holobiont Characters in Joan Slonczewski's *Brain Plague*

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Abstract: In this article, I propose to consider the *holobiontic figure* as a starting point for examining how literary narratives represent the holobiosis paradigm and its impact on narrative structure. A body of recent science fiction works is challenging the long-standing narrative of microbes as “bad germs” and the ever-evolving plot of the pandemic apocalypse by depicting humans as intricately interwoven with their microbial symbionts. The notion of the holobiontic figure, in this regard, serves as a point of reference for characters in the process of recognising themselves as holobionts. This article conducts a detailed exploration of the narratological aspects of the holobiontic figure through a reading of Joan Slonczewski's novel *Brain Plague*. On the basis of this novel, two essential characteristics of the holobiontic figure are proposed and discussed: *multiscalarity* and *multi-agency*. With this, the article aims to provide answers to the question what happens when the scientific concept leaves the scientific discourse and moves between materials: how does it relate to the social world, what structures does it contest, and what conflicts does it provoke?

Keywords: holobiont concept, multispecies characters, science fiction, complex narrative

Introduction

The discovery that symbiosis constitutes a key principle in the evolution of life profoundly challenged previous assumptions about the individuality of humans and other organisms in the life sciences and in the philosophy of biology. Starting with the work of Lynn Margulis in the 1990s and increasingly since the turn of the millennium, humans are no longer considered as single unitary entities, but rather as *holobionts*: multispecies conglomerates consisting of a host and their associated microbial symbionts. Our bodies harbour about as many bacteria as there are human nucleated cells (Sender et al.). Microbes inhabit every inch of the human body, from the nose to the vagina, the skin, and the gut (Reynoso-García et al.). Many of them have coevolved with their host and are essential to the functioning of the body, whether in terms of health (Ogunrinola et al.) or cognition (Dinan et al.; Tooley). Dysbiosis, the disruption of the balance between the microbiota and their host, may cause severe illness, such as inflammation, obesity, or cancer (Lozupone et al.), as well as cognitive dysfunction and impairment (Noble et al.). This intrinsic entanglement between multicellular hosts and their microbiota subverts the traditional notion of biological individuals as insular entities (Gilbert and Tauber). Many biologists and philosophers of biology have therefore argued in favour of revisiting the concept of biological individuality or getting rid of it altogether (Bouchard; Dupré and Nicholson; Gilbert et al.). In the face of these developments, it is not an exaggeration to speak of a *holobiosis paradigm*, which, as Scott F. Gilbert, Jan Sapp, and Alfred I. Tauber put it in their homage to Lynn Margulis, “asks new questions and seeks

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new relationships among the different living entities on Earth” (336). Echoing this paradigm shift in the life sciences, a body of recent science fiction works – including Slonczewski’s *Brain Plague* (2000), Premee Mohamed’s *The Annual Migration of Clouds* (2021) or David Walton’s *The Genius Plague* (2017) – is challenging the long-standing narrative of microbes as “bad germs” and the ever-evolving plot of the pandemic apocalypse by depicting humans as intricately interwoven with their microbial symbionts. The characters in these stories struggle with their multitudinous nature, their compromised agency, and their dependency on (unreliable) nonhuman symbionts. However, some of them overcome their fears, accept that their bodies are carriers for non-human others, and eventually bear the fruits of symbiosis. Such literary representations are crucial factors in the emerging cultural narratives of holobiosis for a broader public: they have the potential to present, explain, and illustrate the complexities of a new symbiotic understanding of life and individuality, but might also criticise, question, subvert, and even misrepresent or obscure this understanding.

In this article, I propose to consider *the holobiontic figure* as a starting point for examining how these science fiction narratives represent the science of holobiosis. The notion of the holobiontic figure, in this regard, acts as a point of reference for understanding characters that, like the examples above, are in the process of recognising themselves as holobiont entities. This article provides a detailed exploration of the narratological aspects of the holobiontic figure through a reading of Slonczewski’s novel *Brain Plague* (2000). Being both a microbiologist and a science fiction author, Slonczewski (they/them) permeate their work with the science that inspires it: host–microbe relations. *Brain Plague*, in this regard, serves as an exemplary case, containing numerous references to actual science and delving into the implications of recognising the role of microbes in the human body concerning cultural notions of self, agency, and personhood. Consequently, their work has attracted growing interest from scholars exploring the posthuman imaginary, discussing how *Brain Plague* articulates symbiosis as a model of “ideal human interaction” (Bollinger 45), posits a model of an “ethics of collaborative survival” (Vint, “Microbial Life” 112), or outlines a “symbiotic vision of posthuman viability” (Clarke 42). In *Bodies That Remember*, Thiess discusses how the *Elysium Cycle* (of which *Brain Plague* is the final novel) “presents a biological narrative in which naturally aging bodies and their marginalized positions call attention to the biological limitations of the human” (87). In *Sharing Humanity*, Dirk Vanderbeke offers a more critical perspective, arguing that the *Elysium Cycle* remains at the level of political fable rather than delving deeply into nonhuman alterity. While I generally align with these perspectives, my argument will focus specifically on the narrative representation of the holobiont concept, which I believe warrants special attention. I contend that *Brain Plague* offers a crucial example for exploring how narrative form conveys the science of holobiosis, and for contemplating how literary narratives might change our understanding of our relational being in the world – which, as current research indicates, is shaped by the “unseen majority” of microorganisms (Falkowski; Cavicchioli et al.).

In the first section, I elaborate on the motivations for choosing the moniker “the holobiontic figure,” justify its relevance, situate it within the wider framework of science fiction theory, and explain why Slonczewski’s work is pertinent in this context. I argue that the holobiontic figure functions as a cultural commonplace in the re-narration of bounded unitary selves. In the following three sections, drawing from Slonczewski’s “*Brain Plague*,” I propose two essential characteristics of the holobiontic figure: *multiscalarity* and *multi-agency*. These two characteristics form the foundation for a typology of holobiosis narratives, poised to be valuable in future investigations. “Microbial assemblages,” Schneider writes, are connected to “a host in a network of interactions in which the host is one of the organisms in the community but also its landscape” (1). In the second section, the concept of multiscalarity is explored, referring to this characteristic of being both an individual and a landscape. As Bruce Clarke points out, the *Elysium Cycle* gathers “temporal and spatial scalar variations into the multifarious detail of a prolonged exercise in incremental world building” (18). I argue that the temporal and spatial scalar variations that underpin *Brain Plague*’s worldbuilding strategies reimagine the human body not only as a world but also as a world for others that engage with and shape their environment. This prompts a shift from anthropocentric ontologies to recognising the significance of microbial worlds in the co-constitution of the “human.” The implications of this shift in the narrative structure are discussed in the third section titled “Symbiotic Ambiguity,” where I introduce the holobiontic figure as a *multi-agent character* – a character made up of multiple agents that together may act as one subject, but can also act as multiple subjects in the development of the plot. This mirrors the “network of interactions” that characterises a

holobiont's structure. While similar points have been raised by Sherryl Vint, discussing the ethico-political consequences of collective or shared agency among the “posthuman subjects” of Slonczewski's work (Vint, “Microbial Life”; Vint, “Theorising the Global”), I intend to delve deeper into this idea in the context of narrative theory, examining how the idea of “multi-agency” offers a reconsideration of the simplistic subject–object logic in narrative analysis without fully obliterating it. In the fourth section entitled “Interdependence,” I explore how the intricate interdependence among the various agents of the holobiontic figure impacts the story's development.

The Holobiontic Figure

Choosing the moniker “the holobiontic figure” is deliberate. I use the term “figure” to underscore the novelistic characterisation of holobiosis as both figurative and embodied: a trope that reconfigures the body as a figure of many figures. The holobiont concept is a radical idea: that what we think of as “the human body” is a complex of interacting organisms, both human and nonhuman. Whereas the human part of this conglomeration is regularly understood as the host, and the rest of all the other organisms are considered its microbiota, the holobiont concept suggests that all the organisms are equally integral to the whole and any sense of individuality is rather an emergent property of the complex relations between them instead of a mere product of the host (Suárez and Triviño). This has significant implications for how we understand “ourselves” and “the (nonhuman) other,” as well as for what constitutes the “human.” Despite the growing popularity of the holobiont concept in the life sciences, and the cumulating research on the human microbiome, there is a fundamental discrepancy between the scientific knowledge and the cultural frame of an isolated bounded individuality that dominates present-day Western culture (Mitman; Ferner; Elwick). As opposed to narratives that posit humans separate from the environment, holobiont research makes evident that we are already “ecological beings.” However, as Timothy Morton rightly remarks in *Being Ecological*, we need to find out “how to live ecological knowledge” (Morton 11). How can we alter our sense of self in a way that is consistent with the knowledge of macrobe–microbe interdependence? How can we move beyond binary ontologies such as human/nonhuman, body/environment, or object/subject and do justice to the complexities of nature? How can we re-narrate the human (hi-)story in a way that recognises the importance of these symbiotic microbes?

In addressing such questions, the holobiontic figure serves as a pivotal point of departure. The reading of fiction and the engagement with fictional characters influences the narrative simulation of our self – as shown by a variety of research that deals with the cognitive functions of literature (e.g. Mathies; Broom et al.; Zunshine) and narrative (e.g. Vice; Mathies; Ricoeur; Bruner). According to Samantha Vice, narrative is the “lens” through which our lives are experienced. Literary fiction, in its turn, “provides us with the great stories by which we so often do explore life and ourselves” (99). These “great stories” offer a narratological framework for constructing the narrative self. Jerome Bruner writes that “the tool kit of any culture is replete not only with a stock of canonical life narratives... but with combinable formal constituents from which its members can construct their own life narratives: canonical stances and circumstances” (15). Given these important insights, we can say that literary narrative can help us “to live ecological knowledge” as it provides a narrative framework for conceptualising the self.

Works of science fiction are especially interesting in this regard as they both narrate scientific knowledge (although far from unambiguously) and are generally concerned with questions of human *being*. One of the fundamental formal patterns of science fiction is the encounter with an alien species. This alien encounter confronts humankind with the question of what it means to be human, or as Carl D. Malmgren writes in *Worlds Apart: Narratology of Science Fiction*: “The encounter with the alien necessarily broaches the question of Self and Other” (Malmgren 54). When it comes to the holobiontic figure, however, the alien encounter becomes an encounter with the alien human self, the nonhuman within. This is a radical form of the traditional trope in which any reflective mirroring object is omitted. The journey to a higher level of knowledge – which constitutes the main plot of “complex” science fiction, as Hillary Duffield argues (Duffield) – is, in this case, a journey beyond false dichotomies of “man versus nature” and the common simplistic “externalization” of the ecosystem, into a better understanding of the human entanglements with its inner ecologies.

Inner ecologies are central to the work of Joan Slonczewski. In their Elysium series, symbiotic host–microbe relations are a natural part of the various human-like species that inhabit the Elysium cosmos. In the first book, *A Door into Ocean* (1986), we meet the Sharers of the planet Shora who live in interdependence with “breathmic-robes” that allow them to store oxygen. This host–microbe relation has enabled the Sharers to live on a water-covered planet. *The Children Star* (1998), the third book in the series, reads as an analogy to the discovery of the abundance of microbial life and its importance to multicellular organisms as (potential) symbionts. The story starts on the planet L’li, which is troubled by a plague called the “creeping.” Brother Rod is on a mission to find orphans for forming a colony on the newly discovered planet Prokaryon, which is a tremendously alien world: All its life-forms are prokaryotes, whether unicellular, multicellular, plant-like or animal-like, consist of ring-like structures and feed mainly on arsenic, a component highly toxic to humans and most organisms on earth, except for some specialised bacteria. In the course of the story, an interstellar corporation proposes to terraform the planet to make it habitable for everyone. According to the laws of the Fold, a multiplanetary political union, this is only acceptable when no sentient life can be found. As this does not seem to be the case for Prokaryon, soon plans are made concrete. But then, scientists discover sentient and highly intelligent microorganisms inhabiting and “steering” the giant “tumblerounds” (large animal-like creatures). What follows is a rat-race between the scientists, trying to prove the microbial sentience and intelligence, and the interstellar corporation, pushing through its plan.

In *Brain Plague*, the last book of the series, host–microbe relations are central. In the novel, we re-encounter the intelligent microbes of Prokaryon, now used as brain-enhancers on the planet Valedon. Whereas at the end of *The Children Star* humans have become infected by the intelligent microbes, the human “carriers” in *Brain Plague* choose their strains and keep them in order by various control mechanisms, such as a population growth limit, constant check-ups by other carriers and nanotechnological monitoring systems. Chrysoberyl, the main protagonist, an artist, is offered a specific strain of microbes well known for their creativity and artistic expertise: the *Eleutharians*. She agrees to let them inhabit her arachnoid mater as they help her improve works of art and offer a constant new flow of inspiration for new works. Whereas *The Children Star* reads as an allegory to the history of microbiology and the discovery of macrobe–microbe symbioses, *Brain Plague* compels us to the complexities of macrobe–microbe interactions – which is explored in further detail in the following sections.

In the next section, I reflect on the part scale and world-building play in the development of the plot in *Brain Plague*. As we look at the scientific model of the holobiont, we can consider its entire structure (the “whole” holobiont), its host, its microbes, biofilms, or microbiomes (such as those in the gut, or the tongue). Each different scale acquires a different approach, a different “language.” When scientists talk about biofilms, they talk about communities and their unique characteristics (e.g. Diaz and Valm; Grobas et al.). As far as “whole” holobionts are concerned, most scientists study the interactions among their constituent parts (host and microbiomes) and question how these interactions contribute to emergent properties such as immunity or the “holobiont mind” (e.g. Bazin et al.; Palacios-García and Parada). When it comes to individual microbes, the question is “who does what, when, where, and next to whom” (Kreft et al. 18027). Holobiosis scientists, therefore, are particularly adept at what Timothy Clark calls “scalar literacy,” i.e. shifting between different scales to understand complex phenomena: they turn to the microscope, in order to “zoom into” microbial worlds, and subsequently drift their eyes back to the holobiont that is their object of study (Clark). In the following section, I discuss how *Brain Plague*, in a manner similar to the holobiont researchers’ scalar strategies, achieves its world-building objectives by shifting between two scales: the human protagonist’s scale and its microbial worlds.

Multiscalarity

Microbiome research has recently found an increase in projects that focus on the “mapping” of the human microbiome, which has become easier and faster due to the recent development of DNA sequencing technologies. This idea of “mapping” is accompanied by a wide variety of metaphors such as “neighbourhoods”

(“Mapping the Neighborhoods of the Gut Microbiome”), “microbial desert,” “lush microbial forest,” or “hedgehog” for a microbial community of dental plaque (e.g. Woo). Through this use of language, we come to experience our body as a world of its own, with its own “denizens” and places, a microcosm that is continually being inhabited and shaped by millions of microorganisms. This scientific world-making has triggered new forms of science communication, such as the “human microbiome Minecraft map” in which one can explore the human body and its microbial inhabitants through video game visualisation (“Human Microbiome Minecraft Map | AMNH”), as well as inspired performance art (Lapointe). Experiencing our own body as a world of its own, a complex ecosystem teeming with life, is a radical act of world-building in which science becomes enmeshed with imagination. Taking this into consideration, we might ask whether the narrative is a suitable strategy for modelling a world in which microbial symbionts take on prime significance, as narrative is said to foreground the human scale of experience and therefore has the potential to distort nonhuman worlds (Fludernik). Despite this ingrained anthropocentric bias of narrative, various scholars have discussed narratological strategies that make nonhuman worlds narratable (e.g. Herman; Caracciolo). David Herman writes in *Narratology Beyond the Human*, that “even though [narrative] is grounded in and optimally calibrated for humanscale phenomena, [it] furnishes routes of access to emergent structures and processes extending beyond the size limits of the lifeworld” (252).

In *Brain Plague*, we encounter what Herman calls a multiscale narration type A, which means that the “meso-level source domain” (human-level) is projected onto the “micro-level target domain” (255). In other words: the narrative maps microbial society in terms of human sociality. To make clear which scale we inhabit in the storyline, parts of the text are cursive to mark the “microbial scale.” Through the perspective of the Eleutherians, we encounter an alien world that is all-too-familiar (yet defamiliarised, as discussed below): our own skull. What seems to us as only a body part, counts for the microorganisms as a complete world: “The arachnoid, with its cross-branches of fibroblast cells, stretched forever between the two outer linings of the brain” (Slonczewski, *Brain Plague* 31). The arachnoid is the web of tissue that encases our brain. It is part of the blood/brain barrier that helps to prevent the invasion of pathogens into the brain, and it is precisely here, in this liminal space between what is usually thought of as a sterile place (the brain) and the rest of the body, that the micros thrive. In the cisterna magna, the largest space of the subarachnoid space, the Eleutherians have built their city teeming with libraries “of triplex DNA” that store all the “learning of Eleutheria,” night-clubs that flash with “light-producing enzymes” and singing halls in which children tumble, “ripe for breeding, their filaments tasting each other” (40). In this fantastical microworld, we as readers follow the adventures of individual microbes:

The current of plasma whipped the two micros through the blood, tumbling among the disks of erythrocytes, dodging the more dangerous macrophages. Fern’s filaments explored the lining of the vessels for traces of neurotransmitters. At last she tasted the entrance. She helped Aster out, into the very core of the brain. (61)

Such a description leads us to imagine travelling through our human bodies as if we were microbes ourselves, thinking about the possible encounters (the erythrocytes and macrophages) and places to dwell (blood vessels and brain core). The language used in the microscale text parts gives the illusion of perceiving this world through microbial senses (the entrance is “tasted”) and perception (the macrophages are “dangerous”), while the anthropomorphic projection creates a kind of familiarity with the alien world – and this feeling of familiarity is what permits us to immerse ourselves in it: we can relate to the idea of a library or a city, and we can feel sympathy for its inhabitants who, despite their alienness, appear to be all-too-human. Whereas the social lives of nonfictional microorganisms are largely ungraspable to the human observer – and also unnarratable if adhered to scientific objectivity – we are able to engage and immerse ourselves in a fictional nonhuman “model”-world through narrative absorption. That this does not necessarily lead to a productive engagement with nonhuman alterity has been discussed in detail by Dirk Vanderbeke, who writes that the nonhuman “invariably appears as an analogy or, occasionally, a parody of the human, and, in consequence, the challenge is not to accept and tolerate difference but rather to recognize that all sentient beings in the universe ultimately converge on the same” (315). I generally agree with this criticism, especially in the way the novel situates the human as “model” for nonhuman sentience. However, I must counter that for narrative

absorption – a crucial prerequisite for fostering empathy and recognising nonhuman otherness – a minimal degree of familiarity is necessary (Hamby et al.), presenting us with a fundamental impasse that should not result in disengagement with nonhuman alterity. A way out of the impasse is presented by what ethologists call *critical anthropomorphism*, that is, “showing awareness of the inevitable anthropocentric bias of one’s interpretation while at the same time doing one’s best to put oneself ‘in the animal’s shoes’ as it interacts with its environment” (Weik von Mossner 113). The question remains: Is *Brain Plague*, with its microbial nightclubs and singing halls, genuinely concerned with putting oneself “in the bacterial shoes,” to rephrase the definition above? Or does it indeed remain at the level of a bacterial fable?

While I refrain from providing a definitive answer to this question within the scope of this article, I assert that *Brain Plague* illustrates that generating familiarity through anthropomorphic projection can, at the very least, effectively stimulate critical reflection on anthropocentric ontologies. The narrative in *Brain Plague* portrays a crucial deviation from Herman’s multiscale narration type A in that it not only projects the “meso-level source domain” onto the “micro-level target domain,” but, in an alternating manner, also narrates the meso-level. Whereas the strategy of multiscale projection only facilitates the game of make-believe that microbes are sentient and human-like social beings, first through collation with the human scale of experience there is potential for comparison (what are the differences? What are the similarities?) and reflectivity (what do these differences or similarities tell us?). The micros, for example, live 10,000 times faster than their carriers. In the hospital, Chrysoberyl, also called Chrys, contemplates her decision for a moment as she holds the patch containing the symbiotic microbes in her hand before inoculating herself. Too long, as she is told by the doctor: “you just made them wait two days. Would you like to sit in a lightcraft that long?” (24). And when Chrys sleeps too long, not yet acquainted with the consequences of microbial timescales, a microbial “dark age” settles in (64). Microbial timescales warp human’s experience of lived time, akin to the deep times of evolution. In *Brain Plague*, it is the micros that demonstrate a non-species-centric awareness of time, having adapted to the different timescales they depend upon. As Thiess writes, for the micros, “because their cycle of living and dying is so brief, and because it stands in such direct contrast to that of their human hosts, they must develop a strong collective memory” (102). Or with the words of one of Chrys’ symbionts: “Memory... is the most sacred light of Eleutheria. Memory marks us worthy of the Blind God’s promise; worthy to dwell with a new god, for whom our generation lasts but a day. Tell the children: Always remember” (Slonczewski, *Brain Plague* 18). To ensure this, the Eleutharians “write” their history, laws, and identity into their chromosomes, making remembering an act of embodiment.

As far as the similarities between the human and microbial worlds are concerned, the depiction of microorganisms as cognitive beings and sentient organisms presents a major challenge for the human characters. Throughout the storyline, the carrying characters experience and refer to their symbionts as “people.” This has moral and ontological ramifications, as follows: “Do these ‘people’ have...legal rights?”, Chrys asks one of her fellow carriers, Daeren. “They ought to. I’ve spent enough hours at the Palace on their behalf,” he answers (29). But they have not, and legally they’re the plague, she is told: “the octopods [policing robots] can wipe her micros without a thought” (ibid.). The ambiguity of this ontology remains a pivotal subject throughout the storyline: “When machines first... claimed sentience,” a doctor tells Chrys, “the Fold Council set a lower limit for size at ten cubic centimetres. Nothing smaller could be a “person,” with “personal rights.” “What?” Chrys exclaims, “How can you just decree what’s a person and what’s not?” (44). What is disclosed in these fragments is, of course, the anthropocentricity of the moral ontology that underpins the fictional society in *Brain Plague*. In a figurative sense, we, as readers, might come to reflect on the anthropocentricity of our present society, essaying the question of how our moral ontologies might crumble in the face of, say, microbial sentience.

As Darko Suvin has famously argued, what gives the genre of science fiction its “formal framework” is the narration of a “novum” (a literary hypothesis) with scientific rigour (Suvin and Canavan). In the case of *Brain Plague*, we have the novum of microbial sentience (or intelligence, for that matter) that clashes with anthropocentric modes of thought, as discussed earlier. This “factual reporting of fictions,” according to Suvin, has the significant effect of defamiliarising us from our usual assumptions about reality – an effect which he calls *cognitive estrangement* (ibid.). Mindful of Suvin’s typology, we can say that the constant shifting of meso- and microscale generates such an *estranging effect*: “Her body; a landscape familiar, yet now subtly estranged,”

Chrys remarks after “travelling” through her own body, experiencing it not only as a human “landscape” but also as a world for nonhuman others (Slonczewski, *Brain Plague* 37). In a similar way, we as readers zoom-in and out between meso- and microscale and experience that what happens to be a world for thousands of microbial “individuals” is also part of another individual (Chrys). The Matryoshka doll-like nesting of worlds is nothing new to science fiction. In the famous movie *Fantastic Voyage* (1966), for example, an expedition team is miniaturised to travel another humans’ bloodstream and repair damage to his brain. They attract the attention of white blood cells and are nearly killed by antibodies. What the expedition team doesn’t encounter are the trillion nonhumans that inhabit and coshape this “inner space.” Instead, it is an empty world, an exclusively “human” place. In contrast, *Brain Plague* depicts the human body not only as a world but also as a world for others that engage with and shape their environment. This is a crucial difference, as the autonomy of the body becomes contested, *estranged*. That which is so familiar to us, our own body, is experienced as an ecosystem, co-created by the many (microbial) parts that build cities and libraries, mingle with dopamine-levels, or chase pathogenic intruders.

Depicting bodies as multi-agent realms has further narratological consequences that are discussed in the following two sections. In both sections, I examine the holobiontic figure as a *multi-agent character*, that is, as a character made up of multiple agents that potentially serve as subjects in the development of the plot. These microbial agents may disrupt the causation of the hosts’ desires and goals, which results in a sense of self-dissolution. The narrative of *Brain Plague* illustrates this particularly well, as discussed in the following section entitled “Symbiotic Ambiguity.” Contrary to an archetypal hero, who faces obstacles on his quest, or Greimas’ subject, who faces an opponent to reach his object, Chrys faces the fact that nonhuman symbionts are inhabiting her body and demote her agency in a most disturbing way: They are capable of “steering” her by interfering with her cognitive processes. The agency of the human subject, which is the principal subject in the anthropocentric storyline, is compressed by its nonhuman symbionts. Considering this, we must ask, who is, therefore, the subject of the story?

Symbiotic Ambiguity

Due to external events, such as stress, sickness, or diet, the stable ecosystem of a holobiont can be disturbed, destabilised, and pushed towards a state of dysbiosis in which the diversity of microbes decreases. Some opportunistic pathogens linger in the shadows and wait for their turn on the stage. *Enterococcus faecium*, for example, is a normal inhabitant of the gastrointestinal tract of humans and animals. The (over-)use of antibiotics has, however, favoured “the selection of an enterococcal subpopulation, complex-17, with enhanced antibacterial resistance, virulence, and ability to spread” (Willems et al.). Moreover, former mutualistic symbionts can become pathogenic, which has been termed “The Rasputin effect,” named after the notorious confidant of the last Russian Tsar’s family (Hurst). *Staphylococcus aureus*, usually a commensal inhabitant of the human skin and nose microbiome, may become pathogenic and cause infection. However, when exposed to commensal *Corynebacterium* species *S. aureus* can shift again back to commensalism (Ramsey et al.). There is no such thing as either an exclusively mutualistic or a parasitic microbe; relationships are always in flux and subject to renegotiation (Overstreet and Lotz; Méthot and Alizon).

This ambiguity leaves an unsettling note – which has shown to be especially fruitful in terms of plot development in Slonczewski’s *Brain Plague*. Chrys, initially sceptical of the microbes’ goodwill, is soothed by her new skills and the obedience of her symbionts. They call her a “God” and praise her willingness to take them in: “Such a beautiful, untouched wilderness for our children to settle,” they tell their host, “We will make wise use of your world, and sing your praises forever” (Slonczewski, *Brain Plague* 35). The power relation between Chrys and her microbes seems to be settled: As she offers them a world, a place to live, they promise her “obedience, for we live or die at the pleasure of the god” (17). Shortly after gaining her brain-enhancing microbes from a doctor, however, Chrys discovers that they are affiliated with the “brain plague,” a strain of microbes who turn their hosts into mindless “vampires”: “Brain plague or brain enhancers. They’re genetically the same ... but the good micros protect you from the bad ones” (20). This reflects a common narrative concerning the human microbiome: the good microbes keep out the bad ones. However, as discussed above,

there are no such things as inherently good or bad microbes. Or in the words of the doctor that offers Chrys her strain of microbes: “any growing thing can go bad” (21). “What keeps them from infecting your brain and making you sick?” Chrys asks her doctor after implantation. “They stay within the arachnoid layer,” he tells her:

‘just outside the cortex. They never touch your neurons. They’re only allowed a population of a million.’

That sounded like plenty. ‘How can you be sure? You can’t control a disease.’

‘Your Plan Ten nanoservos monitor your brain. Besides, the micros control themselves. Even ordinary microbes, without intelligence, usually limit their occupation of animal hosts’. (27)

There is a regular insertion of such nonfictional trivia about microbes in the narrative of *Brain plague*. Later, while discussing the microbial reproduction cycle, we learn the following, again from the “doctor”: “At first,” he tells Chrys, “they have only three hundred juveniles to breed; the rest, all elders, cannot produce offspring ... A common population structure, for microbes,” he says. “Only a few reproduce, while the others stay active enough to maintain the environment – viable but non-culturable” (33). This is the lag phase of the bacteria’s life cycle, during which they adapt to their surroundings, metabolise, and prepare for division. It is followed by the exponential or log phase: “The population will rise steeply for the next two weeks... at two weeks, you reach a critical point where nearly half the population are children” (ibid.). This, Chrys learns, is a dangerous period. Microbial children are inexperienced, rebellious, and do not recall the important memories of the Eleutharians yet. Despite having their collective memory encoded in their chromosomes, the children need to be “educated” as they do not remember as well as the elders do. But the “elders will keep things in hand,” the doctor assures Chrys, “Once you get past the second week, elders outnumber children again, and the population stabilizes at a million” (34). Finally, in the Stationary phase, the growth of bacteria slows down due to waste accumulation and the lack of space.

What happens when this microbial order recedes, we learn when Chrys sleeps for a long time, as some of her younger symbionts decide to take over her dopamine producing neurons: “We will find the places of consciousness,” the leader of the insurgent micros declares, “the source of pain, and gently shut them down, then turn on the dopamine. Then the god will sleep in joy forever, while we make wise use of our world” (60). Whereas the rogue microbes fail to succeed and Chrys is eventually saved, an important lesson is learned: order is crucial for the health of the community. The self-interest of microbes does not always coincide with the self-interest of the greater whole, the holobiont, or that of the host, and opportunistic microbes linger in the dark.

Later on, Chrys is infected by a “vampire,” and some brain plague microbes find their way into the arachnoid mater. Chrys decides to keep them, convinced of being able to transform them into beneficial microbes. This is how she learns about the “ideology of Endless Light.” The “Enlightened” do not believe that hosts are gods. Instead, they are convinced that they know better how to “steer” the human body: “Gods are a fiction. All talks of gods is the people’s cocaine. You are a mortal human host, destined to serve us” (116). They try to convince Chrys of the existence of a utopian place, “the world of Endless Light” (117), where micros and hosts live in constant ecstasy by the achievement of microbial management. These brain plague microbes are convinced that turning up the dopamine supply completely will be mutually beneficial. At the end of the story, Chrys discovers this world of Endless Light, full of starving people. Because their dopamine-levels were too high, the hosts no longer eat or drink, both starving themselves and their brain plague micros.

In light of Greimas’s actantial model, we may think of Chrys as the subject, wanting to self-improve (the object) by means of brain-enhancing microbes (the helpers). The “ideology of Endless Light” is the prime opponent to this goal, as it turns the former mutualistic microbes into ravaging parasitoids. As Chrys defeats this ideology at the end, she is also the receiver of the object. For the sender, we can account different actants: Daeren, who acts as literal “sender” of the microbial strain, or the holobiontic cooperation between Chrys and her sentient microbes, which acts as indirect “sender” of the goal to be achieved. However, this interpretation on the basis of Greimas’s actantial model is problematic: The microorganisms are subjects themselves, aiming to achieve propagation and cultural flourishing (objects). For this, they need a host (helper). This host can also be their opponent by limiting the potentialities of development. Another reading may posit the host as the main objective, as they “grant the microbes a world to live in.” Contrary to such readings, I propose the

holobiontic figure as a *multi-agent character*, that is, as a character made up of multiple agents that together may act as one subject, but can also act as multiple subjects in the development of the plot. How does this change the analysis?

The Greimasian actantial model is not inherently anthropocentric as it does not exclude the possibility of a nonhuman subject. However, as Marco Caracciolo has argued, it is still deeply committed to the subject–object binary which in light of human–nonhuman entanglements blurs complexities: “his structuralist model rests on a syntactic system – transitivity – that is fundamentally dualistic and closely bound up with anthropocentric assumptions” (186). The holobiontic figure offers no solution that “straightens” nonhuman with human agency. It neither fully surpasses the subject–object divide. Instead, it goes in the other direction and complexifies the human subject. Let us shortly return to the specificities of the holobiont concept. A holobiont is thought of as both an individual and an ecosystem (Suárez and Stencel). According to the OED, an ecosystem is defined as “a biological system composed of all the organisms found in a particular physical environment, interacting with it and with each other” (“Ecosystem, n.”). Thus, from the ecosystem view, it is quite apparent that the holobiont assembly consists of a multitude of agents (“interacting with it and with each other”) found in the particular physical environment that is the host’s body. When narrating an ecosystem, it is apparent that all agents are potential subjects in a story: The stork (subject) eats a frog (object), while this frog (subject) was eating a fly (object), while the fly (subject) was feeding on an overripe apple (object), etc. What makes the holobiont concept unique in this regard is that the “physical environment” is the macrobe body, which is the host, the human, the anthropocentric subject. And similar to human subjects in the Anthropocene story, the microbial subjects that make up the holobiont ecosystem do not only interact within the environment (as if it were a background to the story, so to say) but also shape or influence their environment (that is the human host).

So, following this, we can think of the host as a subject in an anthropocentric storyline, which becomes contracted by microbial subjects in microcentric storylines. Such a host subject is never the sole proprietor of its own actions. Its agency is always compressed by its (nonhuman) symbionts. This changes the analysis of a story, as Gilbert recognises:

You can see history in terms of the holobiont. The conquest of the Western hemisphere during the great Columbian Exchange was done not by the armed forces of Pizarro or Cortéz. It was done by diphtheria, cholera, smallpox, rubella, and Salmonella ... The context determines the relationship. The European travelers brought with them all these microbes, which they had learnt to live with. The American Indians had no experience of these microbes, and it is estimated that 85 to 90% of the Indigenous American community was wiped out by European microbes. (Gilbert 81)

This short passage shows how the analysis changes if one acknowledges the agency of symbiotic microbes, albeit in this case the human agency is fully compressed (which is questionable, especially in a retelling of colonial history). A similar “dramatic perspective” on this is represented by the brain plague microbes: the host loses all its agency and is fully subject to the power, and grace, of nonhuman actants. However, the brain plague micros also need their host to be healthy and functioning for their survival. “In cooperating systems there is the possibility of free-riding or cheating, which may subvert the collective’s efforts,” Godfrey-Smith writes. But, he continues, “if you subvert your host, the host is unable to reproduce, and your reproduction is tied to its reproduction, then your subversion will perish with the subverted host” (Godfrey-Smith 32). In this sense, what the brain plague symbionts fail to recognise is that they depend on the health of their host. The zombie-like condition they induce in their victims haunts them as well. They are as entangled in the holobiont symbiosis as their hosts are – which brings us to the following section on macrobe–microbe interdependency.

Interdependence

Holobiontic communities are a good example of how symbiosis can evolve into staggering complexity and interdependence. The removal of a member of the community will alter the entire holobiont. Large-scale elimination or diminution of healthy commensal microbes always results in dysbiosis. This has become especially important in the face of research on the impact of antibiotics. Due to the overuse of antibiotic

agents, increasing antimicrobial resistance has become a serious threat to human health (Jernberg et al.). In general, due to diet and lifestyle, the diversity of our microbiome has diminished, which has been linked to an increase in post-modern illnesses such as obesity and asthma (Blaser and Falkow). But what about the microbes? As most research focuses on the health benefits of the microbiome, and we scarcely look at the human host-microbiome interaction from the perspective of the microbes, this question is much harder to answer. However, generally, we can say that the human host offers microenvironments attractive to certain microbes. This attractive microenvironment consists of, for example, a constant temperature, protection from predators and provision of abundant nutrition (Rosenberg 4). In the course of coevolution, these host-residing microbes often give up their generalist way of life to specialise to particular human hosts, which breeds dependence on the side of the microbial symbionts to their specific environments (Kwong and Moran). Moreover, the more diverse the composition of species is, the more resilient the community (Shade et al.). So, diversity in the human microbiomes is beneficial not only to the human host but also to the microbial symbionts, and in this sense, most constituents of the human holobiont depend on the diversity of their co-constituents. Interdependence becomes a characteristic of both host and microorganisms as their existence becomes inextricable with that of other beings. In this sense, when taking the concept of interdependence seriously, interdependent things or beings should be recognised as *mutually constituted*: they only exist due to their dependence on each other (refer to Sharma for an extensive discussion on this).

The micros in *Brain Plague* need a human body to survive and breed. Outside of their hosts, they would quickly perish. Even more, they have specialised to evolve and adapt to the unique environment of the arachnoid. They have to be especially careful not to breach its structure, as it would attract the attention of the brain's defenders, the microglia (Slonczewski, *Brain Plague* 31). They are an extremely specialist species, due to their narrow niche as well as their specific needs in order to survive. The microorganisms live and die at the mercy of their host, who grants them their essential mineral arsenic, as well as azetidine, which does for the micros "what dopamine does for us" (34). In turn, the microorganisms offer their "service" to the host, helping with anything the host is occupied with – a mutualistic service-resource relationship, as symbiosis research would classify it. In the case of Chrys, this means enhancing her artistic skills, to the extent of becoming one of the most celebrated artists as the story progresses. Chrys learns to live with her symbionts, and she slowly accepts her new multitudinous being: "Daeren came in to flash his irises one last time. 'How do you feel?' he asked. 'Anything I need to know?'... 'We're okay,' Chrys said, puzzled by his question. A quick smile crossed his lips. 'You're talking plural already.'" (37)

What at first seems to be a clear two-way win with clear boundaries between the two individual symbiotic partners, gradually evolves into something less distinct. At the end of the novel, Chrys can no longer detach herself from the Eleutharians. When she has to give them away for a short period of time to other carriers, Chrys lingers in distress and is unable to function normally: "Tumbling forever, falling through space; it was so unbearable, she thought she would die. But the tumbling went on... Chrys could not even shake her head. Empty and dark, her mind was an abyss" (290). What should have been a subtle brain enhancement developed into a deep interdependence, physiologically, professionally, but foremost emotionally. Like an addict, she can no longer function without her Eleutharians. This "addiction"-analogy is widely explored in the novel, calling into question the idea that brain enhancement is necessarily a good thing. The micros are like "smart cocaine" (39), and the characters that "use" it cannot function without it anymore after their symbiotic relationship deepens.

Chrys reflects at the end of the story on how she would do everything for her micros: "I would have taken the false ones – anything. The virgins are right; we are addicted." 'Independents,' Daeren corrected, without turning around. 'They're addicted to oxygen.'" (265) As Daeren points out here, the addiction analogy may not be the best way to describe their relationships with the symbiotic microbes. Rather, it is like needing oxygen to survive: the microbes are a fundamental part of the human metabolic system. In *Brain Plague*, this is only hinted at, much as it is hinted that microbes play a significant role in the human immune system: "We travel throughout the veins of the god, trapping savage microbes, pruning deadly cancers," one of the micros remarks (60). "We will serve you better than any nanoservo built by the gods, patrolling your veins forever" (37). As Gilbert et al. write: "To obey the immune system is to become a citizen of the holobiont. To escape immune control is to become a pathogen or a cancer" (Gilbert et al. 332). The brain plague micros disobey the

homeostasis of the holobiont community of which they are part, becoming “pathogens or cancer.” Contrary to the brain plague micros, the Eleutharians are aware of their entanglement in the cobwebs of symbiosis. They are, to say it with the words of Gilbert et al., “citizens of the holobiont.”

Following the analysis in the previous sections, three stages can be identified in the process of recognising oneself as a holobiont entity: first, the character experiences its own body as a multiscalar entity, as a spatial object that, for the microbial symbionts, counts as a world. Second, the character experiences its body as a multi-agency entity: these symbionts demote its agency as they interfere with cognitive processes, disrupting the causation of the hosts’ desires and goals. This provokes a sense of “body-horror”: the object we call self, which we usually experience as an autonomous agent roaming an “outside” environment, is an ecosystem itself, with multiple agents that influence their environment. The clear borders between human and non-human, body and environment, subject and object are shaken. This perturbation of the binary ontologies that underpin our Western thought can result in feeling lost as one needs to search for a new ontological understanding of the world. The last stage is a potential acceptance of this and a search for such an ontology.

In *Brain Plague*, this last stage is only partially realised. Despite Chrys acknowledging the presence and influence of her symbionts and experiencing dysbiosis as a loss of self, in the fictional society of *Brain Plague*, one still actively chooses to be a carrier and the micros still need to be actively “implanted” instead of transmitted. Contrary to some interpretations (Vint, “Microbial Life”; Vint, “Theorising the Global”; Bollinger), there is no final symbiogenesis-like (e-)merging of biological individuals. Furthermore, the existence of non-carriers, referred to as “virgins” (as in “virgin worlds”) or “independents” (as in not dependent on micros), indicates that the idea of symbiosis as a natural part of the self has not yet been fully realised. Instead, Chrys and the other brain-enhanced characters in *Brain Plague* are pioneers of a new narrative: They represent a small, avant-garde group that recognises the potential benefits of integrating symbionts into their bodies, much like present probiotic advocates. However, the narrative of human progress, with humans as the central actors, continues to be perpetuated: They enhance themselves by the inoculation of symbiotic microbes, much like a technological or cybernetic enhancement as in most transhumanist imaginations (Laguarta-Bueno; Burdett for extensive discussion on this). Albeit Slonczewski’s *Brain Plague* is fascinating in its narrative complexities of macro-microbe interactions, as has been outlined in this article, it also reproduces the problematic myth of human-initiated progress. The novel’s unique twist, however, lies in the recognition that this progress can only occur through a symbiotic relationship with microbes. In other words, in order for humans to progress, they must recognise their entanglements with nonhuman others. In the course of the story, what started as an enhancement becomes a mutual dependency. This is an interesting, more complex take on the human progress myth, one that acknowledges the importance of nonhuman entities in co-shaping our human future.

We are left to wonder how the story of the *Elysium Cycle*, of which *Brain Plague* is the last book, would continue if another follow-up book would be written: is the last stage in the recognition of holobiosis established? Have Chrys and her fellow brain-enhancers evolved into beings who fully recognise their holobiontic nature? Do they speak only in plural? How would this further inflict the development of plot and conflict? How would a society look like that fully acknowledges the intricate interdependencies of macrobes and microbes? In what ways would this change, or increase, the complexity of the narrative? These questions open new avenues for investigation, and more research is needed to fully comprehend the interplay between the far-reaching influence of holobiont concept and the all-encompassing cognitive instrument of narrative form.

Conclusion

This article has explored how the *holobiontic figure* can help us to understand the narrative complexities of the holobiont concept. Building upon Slonczewski’s novel *Brain Plague*, I have argued that the holobiontic figure is characterised by (at least) two key features that have major narratological consequences: multiscalarity and multi-agency. As discussed, these two key features relate to the characteristic of the holobiont as being both a biological individual, an emergent property of the host and its microbiota, and an ecosystem, consisting of

multiple agents that interact in intricate and ambiguous ways. As such, this article demonstrates that fictional narratives have the potential to convey at least some of the fundamental properties of the holobiont concept in a productive way – and that the narrativisation of the holobiont concept, in its turn – resulting in what I have designated “the holobiontic figure” – offers a compelling avenue for enriching narrative complexity. In *Brain Plague*, the multiscale of the main protagonist Chrys complexifies the narrative through world-building strategies. Chrys’ body is depicted as a world in and of itself, complete with bustling cities inhabited by microscopic characters. This microworld is made familiar to the reader through its mapping in terms of human(-like) society. By collative narration of the meso-level world, however, this mapping strategy also generates an estranging effect: what is perceived as a human body is *also* a thriving ecosystem co-created by minuscule “people.” These microbial beings interact with the body in intricate and often disturbing ways. Thus, I have argued that the holobiontic figure introduces a new perspective on narrative structure that upends the conventional understanding of the subject–object relationship, since the human subject is transformed into a complex ecosystem of multiple agents, each with its own set of “objectives.”

With this, the holobiontic figure reminds us that we are never fully in control of things, that we are woven into a tight web of various cause-and-effects, of which only a fraction is of human derivation. As in the storylines of dramatic plagues and mass infections, this emphasises our ambiguous positions as humans within an unfolding narrative. It shows that although we are the main subject in an anthropocentric storyline, we are always a potential object of someone else’s storyline as well, whether human or nonhuman, cognitive or inert. Contrary to the common trope of human-wrecking plagues and mass infections, which perpetuates a clear self/nonself-distinction, the holobiontic figure presents a more complex perspective on infection and health that goes beyond easy binaries. Holobiont characters prompt us to reassess the traditional notion of human beings as independent and self-contained entities within an environment composed of (inanimate) objects, and to leave behind the exceptionalist perspective of humans as prime agents in the narrative through which we come to understand ourselves and the world around us.

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