Aesthetics of Creating a Postnatural World:

Science and Art for a Pseudo Utopia

by

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Mini dissertation submitted

In partial fulfilment of the requirements for the degree

MASTER OF ARTS in FINE ARTS

Bks 895: Creative production and mini dissertation

SCHOOL OF THE ARTS: VISUAL ARTS

FACULTY OF HUMANITIES

UNIVERSITY OF PRETORIA

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November 2021

DECLARATION OF ORIGINALITY UNIVERSITY OF PRETORIA

I declare that: *Aesthetics of Creation for a Postnatural World: Science and Art of a Pseudo* Utopia

Is my own work, and all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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ABSTRACT

Along with the rapid development of technology and scientific in(ter)vention working towards the betterment of the human race, utopian ideas of the future are prevalent in contemporary society. However, as an artist, I question to what extent progress contributes to improving our lives on the planet. More specifically, how the scientific manipulation of living material (human, animal, and plant life) may evolve given its human-centred exploration. Living matter is steadily extracted from its natural context and then engineered based on the amelioration of life. However, postnatural, and the attendant sense of alienation and dislocation this may evoke, could work instead towards the disintegration of life on earth.

At the intersection of art and science, I consider the role of biotechnology in society and, more specifically, how artists may contribute to raising awareness of the potential future these developments may hold. In this paper and the accompanying series of artworks, I focus on humanity's embroiled relationship with nature by considering how an artist may 'inset' life into new postnatural contexts to allow the viewer to share the implications and responsibilities of human intervention in the environment. This research aims to uncover some of the aesthetic and affective strategies employed by artists to engage various subject positions in a postnatural world. Conducted from a Visual Arts perspective alongside the University of Pretoria's Institute for Sustainable Malaria Control (UP ISMC) in the Faculty Health Sciences, I interrogate the relationship between malaria, the use of harmful dichlorodiphenyltrichloroethane (DDT) pesticides, as well as their toxic long-term genetic consequences for both human and animal species.

KEY TERMS

Postnatural

Capitalocene

Biotechnology

Pseudo utopia

Dystopia

Bio art

Bioacoustic

Anopheles

Dichlorodiphenyltrichloroethane (DDT)

ACKNOWLEDGEMENTS

I hereby acknowledge the University of Pretoria's financial support, as well as the financial assistance provided by the National Research Foundation through the Innovative Bursary award. I would also like to extend my deepest gratitude to Dr Miles Warrington who assisted to compose the bioacoustic sound artwork *Anopheles*, Dr Richard Foss and Sean Devonport who assisted with the software engineering of the bioacoustic artwork, and Turekmusic who graciously loaned me the audio interfaces needed for the sound installation. I am most appreciative of all these contributions without which this study would not have been possible.

I would like to thank my supervisor, Dr Adéle Adendorff, who provided immense support and shaped me irrevocably throughout this process. Thank you for remaining patient among my vast and unending chaos. I would have been lost without you. Thank you also to my co-supervisor Professor Christiaan de Jager who embraced this collaboration with open arms. I thank you for your unwavering commitment to this project.

Dr Megan Riddin – thank you for your immense support and assistance with handling the mosquitoes and larvae. Dr Taneshka Kruger – thank you for always being a phone call away. Your advice and support remain invaluable. Hermann Venter – thank you for your help, advice and assistance in photographing the mosquitoes. I am truly in awe of the outcome.

Most importantly, I want to thank my family. Tristan Wallace, my phenomenal partner, thank you for your support, love and encouragement throughout this process. You remain a site of stability for me. My father, mother and grandmother, Danie and Lizelle Oosthuizen and Kowie White, your prayers gave me strength and you have shown me the deepest love, patience and kindness. Your advice and support remain unwavering. I love you all.

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INTRODUCTION

> Nature no longer exists apart from humanity. Henceforth, the world we will inhabit is the one we have made (Purdy 2015).

Humanity is rapidly progressing from a previous and stable ecology to an unanticipated and irreversible postnatural[1] world (Barnosky, Hadly, Bascompete, Berlow, Brown, Fortelius, Gez, Harte, Hastings, Marquet, Martines, Mooers, Roopnarine, Vermeij, Williams, Gillespie, Kitzes, Marshall, Matzke, Mindell, Revilla & Smith 2012:52). Powerful governments, influenced by capitalist[2] societies, have stretched natural capacities such as biospheric stability – climate and biodiversity above all – to its detriment (Steffen, Broadgate, Deutsch, Gaffiney & Ludwig 2015:14; Mace, Reyers, Alkemade, Biggs, Chapin, Cornell, Diaz, Jennings, Leadley, Mumby, Purvis, Scholes, Seddon, Solan, Steffen & Woodward 2014:2). Multiple planetary boundaries[3] are now being crossed or will soon be. Awareness of this challenging situation has been building for some time now as the conditions of life on Earth are fundamentally and rapidly changing. The reality of a *crisis* (understood as a fundamental turning point in the life of a system) is often brutal to anticipate, understand and act upon (Moore 2016:1). Crises are not easily

[1] Postnaturalism is a term coined to describe living matter that has intentionally, or over long periods (for example, due to chemical contamination), been altered by humans (Pell & Allen 2015:224). Postnaturalism also refers to a scientific process through which nature and organisms are often engineered or changed to fulfil a particular objective (such as crop engineering) (Pell & Allen 2015:[sp]). This has immediate consequences for altered organisms' evolutionary trajectory, as humans dismantle undesirable characteristics and leave intact only those that are culturally sought after (Pell & Allen 2015:224).

[2] When referring to capitalism, this study specifically alludes to aristocratic-capitalist structures. Aristocratic-capitalism is a term unique to this research. The term can be divided into two concepts namely: an aristocratic system and a capitalist system. An aristocratic system refers to small groups of people that have an over-abundance of power and influence (Merriam-Webster 2021:[sp]). A capitalistic system refers to the creation of private markets that provide individuals with the freedom to grow their own wealth and empires (Merriam-Webster 2021:[sp]). An aristocratic-capitalist system, in the context of this research, thus refers to small groups of people with fast amounts of money that exert immense influence over scientific and world-economic progress to shape society to their benefit.

[3] The 'crossing' of planetary boundaries refers to the use of living materials – human, animal, and plant life – that increasingly are being seen as devices for manipulation and capitalist advancement. Living materials and nature are being progressively exploited as humans strive to reach a new frontier in historical exploration. As a result, living matter is gradually becoming removed from its organic state and thrust into the realm of the designed, manufactured, and engineered (Zurr 2012:288). Many organisations use the fragmentation and mediation of these living materials to abstract and 'distance' life to the extent that they become mere 'matter' or a 'thing' that may be commodified, altered, and shaped for human consumption (Zurr 2012:288).

understood by those who live through them. Therefore, the Humanities and Sciences must collaborate to bridge the gap between scientific research and society's understanding. Issues of human intervention in the environment ultimately resonate in the humanities, where a reflection on the human condition and its relationship with the environment is necessary.

This research explores how nature and life[4] become raw materials for manipulation, which often carries problematic consequences. The study considers the use of harmful[5] pesticides in the environment and their toxic long-term trans-generational implications for both human and animal species; as well as the powerful influence of capitalism[6] on the extensive network system of class and power, anthropocentrism[7], dualist framings of *nature* and *society*, and the role of empires and states – all of which are recurrently bracketed by the overarching Anthropocene[8] perspective. The main aim of this study is to investigate humanity's entangled relationship with nature by considering how artists may 'inset' life into new postnatural contexts. By viewing life through a postnatural lens, the artworks discussed within the context of this study, as well as those I create as an

[4] The term 'life' and 'living matter' is used throughout this study to refer to forms of organic (living) matter such as human, animal and plant life. As one inevitably impacts the other, the effects of altering life will carry consequences for all living things on Earth.
[5] DDT is an insecticide used primarily for malaria control. The pesticide was employed worldwide until the 1970s when concerns about its environmental persistence, toxicity, and harmful concentrations in food led to the restrictions and prohibitions thereof (Brenda, Chevrier, Rosas, Anderson, Bornman, Bouwman, Chen, Barbara, de Jager, Henshel, Felicia, Leipzig, Lorenz, Snedeker & Stapleton 2009:1359). Despite its ban in many first world countries due to toxic exposure and long-term genetic consequences, DDT is still the go-to insecticide spray used in South Africa as it is a "cost-effective way of killing malaria mosquitos" (WHO 2006:[sp]). Enormous amounts of chemicals are released uncontrollably into nature, with many chemicals such as DDT inducing "unwanted biological effects" on humans and wildlife (Brenda *et al* 2009:1359). One such class of chemicals are endocrine disrupting chemicals (EDC). DDT and its breakdown product, dichlorodiphenyldichloroethane (DDE), are some of the most prominent publicised and researched EDCs by the UP ISMC; and its "metabolites have been considered to cause adverse effects" on entire ecosystems and human populations (Brenda *et al* 2009:1359).
[6] Capitalism is based on a political system that is founded upon the concept of private ownership, wherein private owners have control over their own private enterprises (Bekink 2018:24). Capitalist extremism refers to small, exclusive sections of the population who own vast sums of money. This gives them the ability to exert control over their capital investments, which often includes research funding. Frequently capitalist extremists have political influence allowing them not only to fund, but to control certain research and the use of biotechnologies. This helps to serve their own purposes while justifying their decisions with the promise of a utopic future.
[7] Anthropocentrism dictates that anything man-made or found in nature only has value if it serves human interests (McShane 2007:5).
[8] For more than a decade, Earth System Scientists had advocated for the notion of a new geological age. Coined by Paul J Crutzenas, the Anthropocene was adopted as a means to understand the systemic environmental changes happening to the Earth in recent decades.

outcome of this research, seek to break down the 'crisis of imagination'[9]. I intend to reveal the fragmented relationship present in human-nature paradigms to promote critical thinking through the development and artistic materialisation of tangible examples of postnatural, dystopian[10] states. The focus resides in persuasive methods employed in the art to prompt the viewer to share the implications and responsibilities arising from creating and manipulating living organisms for humanistic[11] purposes. I want to uncover some aesthetic and affective strategies that artists utilise to provoke audiences into rethinking their position in a postnatural world. I anticipate that a practice steeped in affect may prove a better approach towards understanding the unmediated tension between human control[12] and natural living systems. The scientific laboratory, aimed at biotechnological[13] progress,[14] operates within an extremist capitalist system that is driven for efficiency, utility and maximum profit and so cannot be viewed in isolation (Zurr 2012:288). The very existence of some biotechnological[15] outcomes calls into question

[9] A distinctive feature of life on Earth is the presence of ginormous objects that Timothy Morton (2013:1-3) calls "hyperobjects" – such as global warming or biological contamination – that society tends to think of as abstract ideas because of their inability to grasp the enormous presence of these hyperobjects. Consequently, these issues often remain a crisis of imagination for many individuals.

[10]Corresponding to the ideas of Lars Schmeink 2016, Michael D. Gordon 2010, Helen Tilley 2010, Gyan Prakash 2010, and Mark Featherstone 2017, this research offers a view on our natural world as progressively becoming dystopic, cautioning that the biological impacts foretold by progress may be morally challenging too. Dystopian theory suggests that scientific and technological advancements (driven by systems of capitalism and power) are destined to bring forth radical changes in the structures of nature and the biological structures of life itself (Schmeink 2016:3).

[11] Within the context of this study, humanism is a philosophical and ethical stance that emphasises the value and agency of humanity above all other living systems.

[12] Human control in the form of capitalism is primary to my argument that economic drivers have brought the ecology and biosphere to its current state of postnaturalism.

[13] The concept of biotechnology encompasses a wide range of procedures for modifying living organisms according to human purposes. These modifications reach back to the domestication of animals, cultivation of plants, and improvements to these through different methods that employ artificial selection and hybridisation (American Chemical Society 2021:[sp]). Modern usage also includes genetic engineering as well as cell and tissue culture technologies (American Chemical Society 2021:[sp]). The American Chemical Society (2021:[sp]) defines biotechnology as the application of biological organisms, systems, or processes by various industries to improve the value of organisms.

[14] Biotechnology involves the application and study of biological systems found in organisms – which include fungi, bacteria, viruses, animals, and plants – to make technological advances (Biotechnology Innovation Organisation 2021:[sp]). Biotechnology is the use of life forms to help solve human and non-human related problems through technology (Biotechnology Innovation Organisation 2021:[sp]).

[15] This study specifically considers the impact of experimental and dark biotechnologies on nature and humans through their altering of biological structures. Dark biotechnologies are associated with biological weaponisation and biowarfare where biotechnology is implemented to eliminate specifically targeted organisms. An example of this includes DDT sprays, used in the control of malaria in Africa.

deeply rooted perceptions of identity and life, the idea of self, and the position of humans in relation to their environment and other living beings (Zurr 2012:288).

I argue that the underlying problem inherent in manipulating and eradicating life is rooted in the perception that humans are privileged and distinct from other life forms on Earth. This notion primarily stems from Judeo-Christian and Classical worldviews originating in the West (Catts & Zurr 2015:167). Despite this human-centred philosophical viewpoint originating from Western religions and ideologies, its anthropocentric influence is also present in the broader South African context. According to Carla Van Rooyen (2016:23-26), over the years South Africa has adopted a more Western outlook grounded in anthropocentric notions. Evidence of this can be seen in the local lack of awareness around environmental regulations, which consist of an "anthropocentric approach to environmental management"[16] (Van Rooyen 2016:10, 27). Anthropocentrism situates "non-human species as legal *objects* and connotes that such species exist only for *human benefit*" (Van Rooyen 2016:27, my emphasis).

However, there is a growing global consensus driven to preserve the Earth for future generations. Most Commonwealth countries in the world have adopted so-called 'green rights'[17] into their constitutions to promote nature conservation. The Constitution of the Republic of South Africa, 1996, Section 24, for example, provides that every citizen is entitled to an environment free of harm to their health and well-being (South African Government 2021:[sp]). Additionally, international conventions exist for this purpose, such as the Paris Agreement[18]. While strides are made towards environmental conservation, I contend that anthropocentric reasoning still distorts society's ability to

[16] The South African Constitution provides that "everyone has the right to an environment that is not harmful to their health or wellbeing" and "all South African citizens have the right to freedom of belief in traditional and medical practises" (Van Rooyen 2016:29). According to Van Rooyen (2016:29) the focus here falls on human rights only, leaving behind the rights of non-human species.

[17] In recent years international governments started conferring rivers and mountains the same legal status as people. For example, in 2017 New Zealand granted the Whanganui river and ecosystem the status of a legal person that guarantees the protection of its health and wellbeing (Evans 2020:[sp]). Following the decision in 2017, all rivers in Bangladesh and the Yamuna and Ganges rivers in India also received legal rights – although, in India, the decision was later revoked (Evans 2020:[sp]).

[18] The Paris Agreement is an international agreement within the United Nations aimed at preventing and restoring the damage of climate change (United Nations Climate Change 2021:[sp]). This agreement requires social and economic transformation and works on an ambitious five-year cycle of climate action carried out by participating countries (United Nations Climate Change 2021:[sp]). The long-term goal of the Paris Agreement is to reduce greenhouse gas emissions by implementing a financial, technical, and capacity building framework for the different countries that form part of the United Nations (United Nations Climate Change 2021:[sp]).

deal effectively with the growing decline of the environment and the increase of biotechnology. Furthermore, anthropocentric beliefs support decisions concerning *manipulating* living systems (Catts & Zurr 2015:167). The social barrier that separates humans from nature requires urgent reconsideration, especially in the light of biotechnological developments[19] and problems related to the Capitalocene[20] that are shaking the very foundations of our being.

With this research, and particularly the artwork that stems from it, I hope to make audiences reconsider not only their perceptions of life, but also what the so-called utopian[21] futures brought forth by scientific progress and technology may hold. I suggest that one of the most critical tasks of contemporary artistic practices that focus on human-environmental relations resides in the artist's ability to shock audiences out of their comfort zones. For this purpose, I engage in the novel medium of bio art. Bio art is a creative art practice that draws on science and is inspired by the philosophical, environmental, and social impacts of recombinant genetics, biotechnology, and molecular biology (Yetisen, Davis, Coskun, Church & Yun 2015:724).

While artists' contemplation of the relationship between humans and their environment is not new, bio art is an umbrella term for practices that draw from fields such as synthetic biology, ecology, and reproductive medicine, combining art's creative processes and biology's pioneering research and innovations (Anker 2014:1). Many bio artists blur the lines between science and art through their interdisciplinary and collaborative relationships. Others foreground their reactions to emerging and contemporary life-science trends. Through considering the combination of bio art with scientific developments, the public could become more informed about science (Yetisen *et al* 2015:724). Artistic reactions to biotechnology also take on political activism in the form of cultural commentary (Yetisen *et al* 2015:724). Lastly, bio art may initiate new concepts for engineering and science, increase scientific literacy, and foster openness to collaboration (Yetisen *et al* 2015:724).

[19] Biotechnological developments include cloning, genetic modification, and tissue engineering.
[20] The Capitalocene views elitist capitalist structures as the drivers behind our current detrimental ecological and postnatural situation (Moore 2016:6).
[21] My study focuses on a utopia (the promise of a better future) that is falsely construed by functionaries that serve their own economic and political agenda. I allude to this false utopia as a pseudo utopia. In progressing towards this pseudo utopia, we have ended up at an unwanted and broken utopia. This unwanted 'broken' or postnatural utopia, in my study, is the dystopia that Lars Schmeink (2016:6) refers to as a bad place (Cf. section 2.1).

Bio art "presents opportunities for the recognition and synthesis of traditionally separate approaches" to artistic and scientific critical thinking (Yetisen *et al* 2015:1). During the twenty-first century, bio art arose as an academic and formal subject of study for artists. Bio art research institutions have become part of various universities and colleges globally. A summary of the programs, initiatives, and pioneers working at the interface of art and biology can be seen in Figure 1. This research primarily forms part of a more significant global attempt by bio artists to address such new concepts of life and self that contemporary society will face given the lasting consequences that biological adversity will have for humanity and the planet. Bio art may offer tangible examples of contestable scenarios and serve as a basis for a more comprehensive ethical and philosophical discussion.

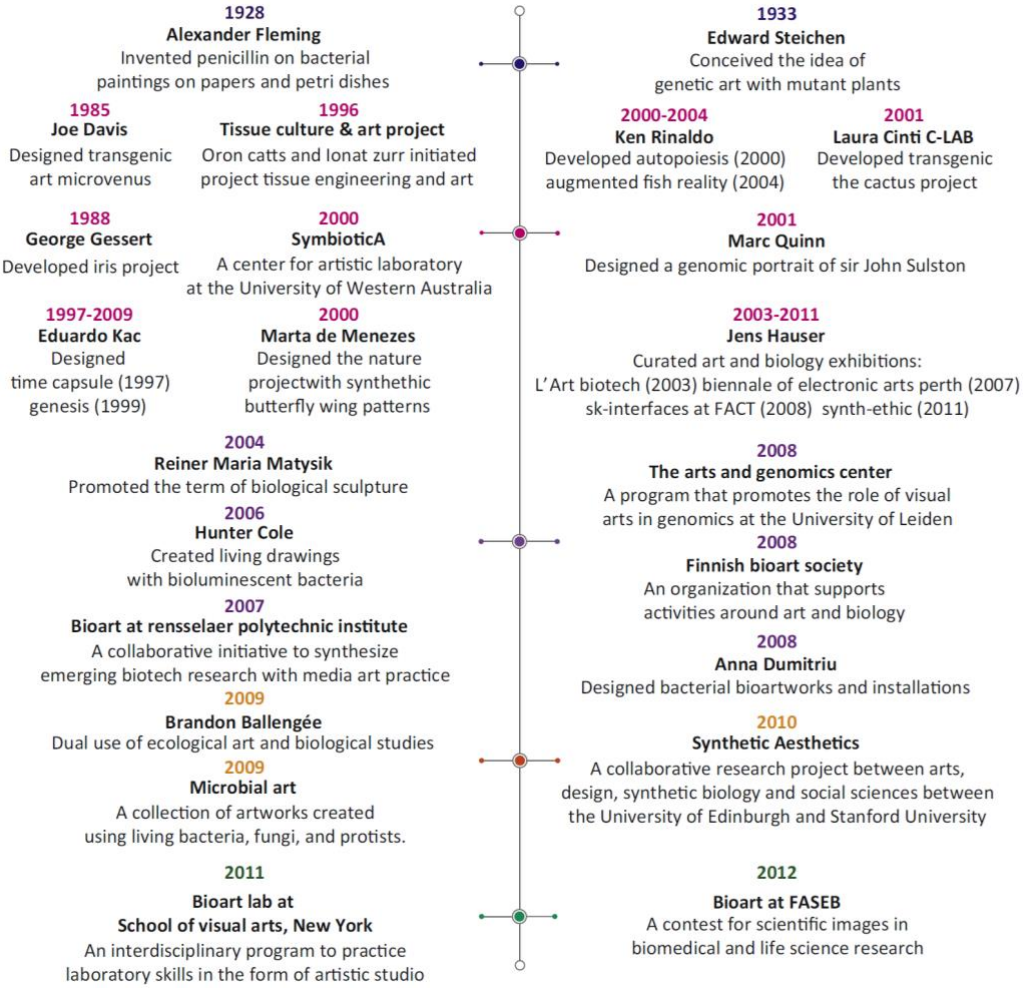

Figure 1: Evolution of bio art from 1928 to 2012. (Yetisen *et al* 2015:726)

Except for the works of a handful of artists[22], South Africa is mainly devoid of bio art practice and theory. As such, this gap in local art practice positions this study as both necessary and progressive. I contend that the shift in awareness occasioned in the viewer of bio art is significant in highlighting human influence (like world markets, empires, techno-scientific advances) and its relation to the web of life, and vice versa (Moore 2016:5). I assert that critical art practice, affective in nature, may prompt viewers to re-evaluate their perceptions of life through its tangible examples of the consequences of postnatural organisms brought forth by human intervention, and how they will have an impact on the natural world. To this end, my body of work produced in response to this research ranges from representing photorealistic to manipulated realities and includes media installations of living biological matter emanating from scientific research and exploration[23]. Therefore, this Fine Arts research is a transdisciplinary collaboration with the University of Pretoria Institute for Sustainable Malaria Control (UP ISMC)[24] and the School of the Arts[25]. The UP ISMC centre is engaged with ongoing scientific research on sustainable environmental well-being; thus, alongside the centre's vision, this transdisciplinary study explores the necessity of ecological sustainability above capitalist advancement.

1.1 Statement of Research Problem and Intent

I argue that bio art may affect viewers in such a way that they will share their new awareness of the implications and responsibilities that result from the influence of human culture and biotechnology on the environment. The research, as expressed through both this mini-dissertation and my creative practice, questions so-called utopian visions for the future. This false promise for the future is proffered by organisations involved with

[22] Locally, artists Leora Farber and Hannelie Coetzee are the only practitioners actively engaging in bio art. Their projects are discussed briefly in section 1.2 of this chapter.
[23] The artworks allow for reading into my own perceptions and research behind my subject matter. This all-inclusive approach to a diverse set of mediums and forms of expression coincides with Rosalind Krauss's (1999:11) "post-medium condition". The post-medium condition (Krauss 1999:11) dictates that the boundaries and specialisation of traditional mediums are replaced by an all-inclusive approach to new media hybrids, such as digital photography, installation art, or growing bacteria in Petri dishes. In this sense, art becomes purified of its "material dross" (Krauss 1999:11). The mediums and forms used to capture my artworks were selected to amplify and accommodate the specific scientific research and concepts that I wish to impart to the viewer.
[24] The research at the UP ISMC is conducted in three clusters, each focusing on sustainable developmental goals to eliminate toxic substances from the environment, and to ensure ecological and human health and prosperity whilst focusing on the control of malaria.
[25] The bioacoustic sound artwork *Anopheles*, 2021 was created alongside the Music Department as part of the School of the Arts, University of Pretoria.

technological advancement and is driven by capitalism without concern for the environment. I suggest that rather than engineering an ideal world, human intervention in the natural environment shapes a dystopian postnatural world.

The study is expressed in two parts. First, the mini dissertation offers research revealing some aesthetic and affective strategies that bio artists may employ for viewers to rethink various subject positions in a postnatural world. Then, as a direct outcome of the knowledge gained during the research process, the second part takes shape as a body of bio artwork that employs affective strategies to expose the toxic degradation caused by ill-considered biotechnology, environmental decline, and a dystopian postnatural world.

1.2 Need for the study

Given the critical concerns raised by bio art practices, I suggest that this focus should gain more attention in the coming years as technological advancements continue to lay claim to moral and ethical questions. The future intersection of technology, nature, and beings prompts philosophical debates that are complex – arguments that bio art could express and reveal in more digestible ways. In this sense, I wish to add to this ever-expanding and influential worldwide field of art production, both locally and critically within South Africa. Aligned to this, the study's focus on malaria, as well as its collaboration with local scientists, may offer new perspectives on biotechnological developments in South Africa, and specifically on the use of Dichlorodiphenyltrichloroethane (DDT) pesticides in the fight against malaria. The study draws attention to contaminations and influences that affect both human and non-human life. In addition, the research endeavours to emphasise the necessity of local environmental conservation.

Despite the considerable number of South African artists currently engaging in land art and environmental art[26], bio artists are few. Hannelie Coetzee is a local artist who works in this field. Her performance work, *Eland and Benko* (2015) (Figure 2), consists of a five-hectare controlled burn produced in collaboration with environmental scientist Sally

[26] Leading artists in the field of land and environmental art in South Africa include: Janet Botes, Pitika Ntuli, Willem Boshoff, Strijdom van der Merwe, Francois Knoetze, Porky Hefer, Fabrice Monteiro, Mbongeni Buthelezi, Heath Nash, Mwamba Chikwemba and Owen Milyoni Shikabeta. Collectives and organisations include: Greenpop, Site_Specific and Lalela.

Archibald. The burns, executed over several years, were superimposed later to form a visual archive or memory of the landscape. Here, Coetzee's work is intended to explore the relationship between humans and nature, relying on scientists and local participants to explore highveld ecosystems and environmental fluctuations brought forth by fire (Coetzee 2015:[sp]).

Figure 2: Hannelie Coetzee, *Eland and Benko* (2015). 5-hectare grass burn. (Coetzee 2015:[sp]).

Another key bio artist in South Africa is Leora Farber. Following her residency at the University of Western Australia's SymbioticA lab, she presented *Intimate presences / affective absences (or, the snake within)* (2020) (Figure 3). Farber's work uses cellulose fibre to create casts of domestic objects that carry associations with colonial legacies. During her residency, and as part of this body of work, Farber also created a series of bacterial drawings related to the patterns reproduced on these objects (Visual Identities in Art and Design Research Centre 2020:[sp]).

Figure 3: Leora Farber, *Intimate Presences/affective absences (or the snake within)* (2020). Gluconacetobacter and yeast. (Visual Identities in Art and Design Research Centre 2020:[sp]).

Apart from these two artists' contributions, bio art remains an unexplored practice in South Africa. This may be due to a lack of both funding and opportunities for artists wishing to engage in this field. The specialised training necessary for bio art and its

reliance on scientific expertise makes this a niche art practice. My research seeks to address this gap by showing how transdisciplinary relations between the humanities and sciences may allow for the exploration and growth of bio art. Moreover, bio art can provide a more visceral experience of bioethical issues, and of the chronic insecurities these issues cause in our deep-rooted perceptions of life, the self, and the position of humans *vis-à-vis* non-human others (Roijackers 2015:2). Additionally, whilst experiencing bio art, the viewer can discover her/his ethical role towards these issues (Roijackers 2015:2). This suggests that bio art could play a role towards democratising and demystifying science and biotechnology.

1.3 Research Purpose (Aims and Objectives)

This research intends to explore bio art to affect an audience to accept responsibility for and experience empathy towards the ongoing environmental decline. As the main aim of the study, I investigate bio art from a theoretical and historical position by considering the work of others; and from a practical stance as I produce a body of bio artwork. A secondary goal is to interrogate the pseudo utopian[27] future set forth by progress and capitalist extremism, while a third focuses on using affect theory as a tool for examining bio art. These aims serve to strengthen and inform my practical output. To realise the purpose of this research, I outline the objectives here:

- to define and contextualise bio art and its relation to affect theory within the frameworks of postnaturalism and the notion of pseudo utopia;
- to analyse bio artworks that resonate with postnaturalism, biotechnology and affect theory;
- to uncover the role of aesthetics, affect, and sensory perception in bio artworks and the way audiences may experience these;
- to produce a body of bio artwork that comments on our pseudo utopian, postnatural world with particular reference to the fight against malaria;
- to produce a body of bio artwork that engenders affect in an audience to realise their complicity in creating a postnatural world.

[27] According to the Merriam-Webster (2021) online dictionary, pseudo is defined as being apparently rather than actually as stated. Therefore, a pseudo utopia is a utopia that does not exist and will not reasonably exist.

1.4 A Review of Literature

1.4.1 Bio Art

In discussing bio art, Robert E. Mitchell (2010), Sian Ede (2005, 2002) and William Myers (2015) pay particular attention to bio artists' use of Medical and Life Sciences techniques and practices to transform interactions between medicine, the public, science, and nature. Mitchell (2010:61) explains, "bio art does not simply derive from our present, post-genomic era, it also foregrounds speculations" of what the future of human progress might hold. By envisioning new forms of biological utilisation and transformation (whether working within the sciences or simply being inspired by the sciences), bio artists' ideas become constitutive of our era (Myers 2015:7). Many of the works lean toward social reflection. They critique societal and political processes through a methodology which combines science and art to allow for the emergence of new concepts for bio artists to exploit in physical, digital, and computational forms (Myers 2015:7).

Considering the relationship between the artist and the scientist, Ede (2002:67) explains that bio art should not be seen merely as a tool for *communicating* scientific processes. Although bio art employs rational thinking and appeals to the intellect, "it is a sensuous, subliminal experience, showing peripheries, incidentals [and] non-sequiturs" (Ede 2002:67). Bio art can generate visceral effects (weakened knees, the prickling of hairs on the neck, and other bodily-emotional reactions). Given bio art's complex mode of communication, works of this nature are often not easily understood rationally (Ede 2002:67), but they may be experienced emotionally, affectively or perceptually. Thus, bio art may well confuse as much as it clarifies, exposing concerns as complex and in need of critical thinking. Ede (2002:67) argues that this trait is not negative since new scientific discovery *is* confusing and should not be oversimplified.

Taking the discourse and practice of bio art as a point of departure, I refer to important influences and outputs of selected bio artists, including Eduardo Kac, Natalie Jeremijenko, Carole Collet and Patricia Piccinini. I unpack their work throughout the chapters of this paper to expand my understanding of current approaches and expressions of bio art as they pertain to ideas associated with biotechnology and capitalism. The selection of artists' works discussed for this study oscillates between biotechnology's philosophical and theoretical intersect, touches on aspects of utopia and dystopia or the postnatural world theory, and investigates the emotional responses from

its audiences. The works are explored to foreground what the future of biotechnological developments may hold for life on Earth, as well as to guide my creative process.

1.4.2 Bioacoustics: A Meeting of Bio Art and Sound

Over the past few years, the increasing interest in the connections between musical, environmental, and biological issues has amassed to form a comparatively new field still in its infancy, namely bioacoustic sound art. Bioacoustics form a central part of my body of work. Bioacoustics is defined in Aaron S. Allen and Kevin Dawes (2016:5) as a cross-disciplinary practice that combines acoustics and biology. It typically refers to the study of sound - its production, reception, and dispersion – in animals (including humans) and micro-entities, and is also referred to as spectral balancing. Spectral balancing involves an anatomical and neurophysiological basis of sound detection and production relating to acoustic signals and the mediums through which they are dispersed (Sonible 2021:[sp]). The results provide cues on the evolution of nature's changes, and so are well-suited for a study with interest in mosquitoes, postnatural worlds, and biotechnology.

Bioacoustics considers the sounds of a changing world predicated by humans and technology – just as bio art explores what this world *looks* like, bioacoustics explores what it *sounds* like. Like bio art, bioacoustics does not present us with or shield us from a dystopian world or our imminent demise, but instead reflects the prospects that life holds for us within a postnatural future. Bioacoustic sound art has the potential to become an exceptional artistic medium to capture overlooked biological occurrences in the environment, affecting the viewer on an emotional, auditory level. Although it is a relatively new field, bioacoustics has been used in several contemporary artworks. I refer to a work by Jacob Kirkegaard that formed part of the exhibition *Everything was forever until it was no more* (2018) curated by Katerina Gregos as an example.

Everything was forever until it was no more[28] was the title of the first Riga International Biennial of Contemporary Art (RIBOCA) in 2018. Under the guidance of its curator, Katerina Gregos, RIBOCA investigated the phenomenon of change – how it may seem inevitable (especially in these relentlessly accelerating times) and yet still manages to

[28] In 2005, Alexei Yurchak published *Everything was forever until it was no more*. The book examined the political, social, and cultural conditions that led to the collapse of the Soviet Union. Yurchak (2005) argues that everyone was aware of the failing system, but because no one could imagine an alternative way of living, citizens and politicians maintained the charade of a functioning society.

take us by surprise. The works and artists selected by Gregos investigated capitalism, technological revolutions, migration, humanity's existential crisis, and the foolish destruction of the environment. One of the bioacoustic artworks at RIBOCA that embodied in the most distressing way the many threats and dimensions of the Capitalocene was Kirkegaard's, *Melt* (2016) (Figure 4).

Figure 4: Jacob Kirkegaard, *Melt*, 2016. Sound, audio interfaces, constructed environment, red lights and mist. (Kirkegaard 2016:[sp]).

Melt is a sound installation comprising collective recordings of the different stages of melting ice, ranging from trickling sequences and flows of water to the violent sounds of ice caps grinding against each other. These recordings were made by Kirkegaard during his 2013 and 2015 travels to Greenland wherein he captured the progressively melting[29]

[29] The ice sheet in Greenland contains about 8% of the Earth's freshwater (Borunda 2019:[sp]). Particularly vulnerable to climate change, the ice is melting at an accelerating rate not seen for more than 350 years (Borunda 2019:[sp]). This alarming phenomenon is causing a rise in the sea level, which directly threatens populations who live in or near coastal areas. It causes other

glaciers. *Melt* is showcased in a darkened, enclosed room with a red-light source emanating from a square structure which the viewer must enter to listen to the haunting sounds of melting ice. By taking away most visual stimuli with the exception of the red-light source, the artist forces the audience to engage with other senses, to listen to the sounds of the movements of the ice and feel the vibrations of these sounds. Outside the room, the red glow emanating from its interior serves as a warning for our current negligent actions. *Melt* conveys the temporalities of distant but still human-altered environments. The work makes both perceptible and dramatic a phenomenon that affects each of us, but that remains too often distant and abstract. By bringing the haunting sounds and vibrations of the melting glaciers so directly to the audience, the reality of climate change is made tangible, along with a pressing awareness of the consequences. The intensity of the artwork lies in the way it allows audiences to affectively, audibly, and in an embodied way respond to and understand the impacts of the Capitalocene.

Ontologically speaking, bioacoustics presents novel ways of re-approaching sound recording through bio art. It affects awareness of the more-than-human worlds that exist outside of everyday life and allows us to engage in the act of deep listening. Deep listening is a term coined by Pauline Oliveros in 1989 to describe the practice of radical attentiveness (Williger 2020:[sp]). Sound is not just about listening, reacting, or communicating. It is about becoming aware of inaccessible registers that are unfamiliar and maybe even monstrous (Kanngieser 2015:81). According to Rob Nixon (2011:2), by applying a postnatural lens to bioacoustic works, one *listens with* the consequences and effects of “slow violence”, hearing beyond the media-industrial appetite for instant spectacle. I apply this *slow violence* lens in the creation of my bio artwork as it responds to emerging postnaturalism in the environment as linked to malaria and the mosquito.

1.4.3 Postnature and the Capitalocene: A Pseudo Utopia

The theories around the impacts of postnature and the Capitalocene on the future of humanity and nature – which are integral to the purpose of my research – have been collected from several seminal sources. According to Claire Colebrook (2014:19), at its core, bio art is a reaction to both the erupting cultural dislocations that result from

secondary effects, such as changes in the global ocean circulation patterns and in the patterns of rainfall (Borunda 2019:[sp]).

ecological disintegrations, and the advances in research of the Life Sciences and their technological applications as areas such as synthetic biology[30], ecology[31], and biomedicine[32] progress, our shared fundamental cultural notions of nature, identity, and connection to the natural environment are changing. David A. Collins (2014:14) views the Anthropocene as an important backdrop to the transformations and "unfolding tragedies" of climate change, habitat destruction, and mass extinction. Jason Moore (2016:2-3) builds on Collins' work to suggest a broader outlook on history, which would also encompass theory, politics, ecology, economy, and culture, and he positions the term *Capitalocene* as more appropriate and encapsulating than *Anthropocene*. Moore (2016:1) exposes the roles played by capital, progress, and biotechnological advancement as culprits in the age of the Capitalocene. For the purpose, context, and arguments forged in this research, I will use the term Capitalocene when referring to the current period.

This "crisis of consciousness", to use Barbara Herrnstein Smith's (2018:28) phrase, is central to the practice of many artists – and more specifically, bio artists – as their works respond to the current epoch found within the Capitalocene. *Naturally Postnatural. Catalyst: Jennifer Willet* (edited by Hiebert 2017) puts forth an understanding of the concepts of postnatural and posthuman as intrinsically entangled, both imbued with the capacity to adapt to life without the historically usual boundaries. Nowhere is this more pronounced than in biotechnological contexts, where new ways of adapting to life are seen in the convergence of boundaries between humans, the engineered, and the natural.

The idea of a postnatural engineered and controlled environment is often presented to us as a utopia. The notion that a utopia[33] is an ideal place or state of life supports the premise of this study which suggests that humanity's over-zealous belief in science and progress (at the expense of the Earth) offers a utopian mirage. In *Biopunk Dystopias: Genetic Engineering, Society, and Science Fiction,* Lars Schmeink (2016:3) warns us

[30] Synthetic biology refers to an area of multidisciplinary research that seeks to redesign natural ecological systems by developing novel devices and biological parts (Biotechnology Innovation Organisation 2021:[sp]).
[31] Ecology is a branch of biology that investigates how organisms interact with other organisms and their environment (Biology Online Dictionary 2020:[sp]).
[32] Biomedicine is founded on biochemistry and biology and investigates the application and principles of the natural sciences (Merriam-Webster 2021:[sp]).
[33] The word "*utopia* or *outopia"* is derived from the Greek language and means "no (or not) place (*u* or *ou,* no, not; *topos,* place)" (Claeys & Sargent 1999:1). Thomas More coined the term in 1516, when he mocked the 'good place' proposition of *eutopia* (Claeys & Sargent 1999:1).

against such a historical biotechnological nexus. In place of the utopian promise presented by capitalism and progress, Schmeink criticises our contemporary reality as already dystopian in nature, warning that a future based on liquid modernity[34] will only get worse. Like two sides of the same coin, both utopian and dystopian imaginations function as reminders of the possibility for societal change (Schmeink 2016:6). The exploration of the notions of postnaturalism, pseudo utopia, and dystopia aids in establishing the thematic framework to situate my study.

1.4.4 Bio Art and Affect

In response to the limitations of deconstruction and poststructuralism, many cultural critics and critical theorists encouraged a turn towards affect during the early to mid-1990s (Clough 2010:206). According to Clough (2010:206), the turn to emotion and affect sprouted from cultural criticism and critical theory under deconstruction and poststructuralism, and extended discussions around the body, identity, emotion, empathy, subjectivity, and culture. This *affective turn* led by Massumi (Parables of the Virtual 2002), and Eve Sedgwick (Touching Feeling 2003) essentially returned cultural criticism and critical theory to bodily matter in an attempt to overcome the dualistic mind-body divide. Affect points to an immanent dynamism – the capacity of matter to be informational and self-organisation – inherent in the bodily matter (and matter generally), which according to Clough (2010:206), was the most enduring and provocative contribution made by the affective turn. Affects are a way of theorising about the social or artistic forces that trigger the body to respond in a certain way. This shift to bodily awareness has brought forth an increased theorisation on how art can potentially transform audiences by appealing to the body.

The term *affect* originally derives from the Latin *affectus*, which means passion or emotion. However, when we consider its contemporary use by the Oxford Dictionary (2021:[sp]), affect is described as an "emotion or desire as influencing behaviour". Donovan Schaefer (2020:[sp]) explains affect as an approach to politics, history and culture that focuses on non-linguistic forces, or affects. What makes affects different than

[34] The concept of a 'liquid modernity' was first coined by philosopher and sociologist Zygmunt Bauman as a metaphor to explain the constant fluctuation he sees in identities, relationships, nature and global economics (Mattiazzi & Vila-Petroff 2021:1). Instead of referring to postmodernity and modernity, Bauman saw a transformation from 'solid' modernity to a more 'liquid-like' social life that is "unable to keep any shape or any course for long and prone to change" (Mattiazzi & Vila-Petroff 2021:1).

feelings or emotions is they are neither under our conscious control nor even necessarily within our awareness (Schaefer 2020:[sp]). For a Deleuzian affect theorist like Brian Massumi, the distinction between affect and feelings implies that affect has no specific content or even meaning (Massumi 2015:x), rather affect can be seen as intensities or forces that allow us to understand experiences, as it oscillates between a sense of activity and passivity (Massumi 2015:vii). Therefore, affect must be understood as a sensation that precedes emotion, language and thought – a "non-conscious experience of intensity that is experienced as a visceral and intuitive mechanism" (Massumi 2002:22). We are affected by things that touch us, by seeing things, by smelling things, by hearing things – they are inputs into the body. Affect essentially presumes a range of abstract possibilities. Because affect occurs so quickly, sometimes without even being perceived, it cannot be fully accounted for, or even explained linguistically. This means that an object, such as an artwork, has the power to affect people in a multitude of different ways – it can influence our consciousness by increasing awareness of our "biological state or our material being" (Lauwrens 2020:6).

According to Deleuze (2013:313), we need to part with our deep-rooted conceptions of the idea that objects cannot elicit affect. We, and everything around us, are not fixed, unified subjects but individuated "assemblages" consisting of energetic affects. Daniel Smith, John Protevi and Marietta Radomska provide useful insight into Deleuze's assemblage theory. According to Smith and Protevi (2020:[sp]), the assemblage approach suggests a different set of metaphors for the social world: patchwork, mosaic, fluidity, heterogeneity, transitory configuration (Smith & Protevi 2020:[sp]). In assemblages, entities and forces are in a constant state of becoming (with each other) and are "understood as a creative processuality, which happens in-between and prioritises connections, relations, and linkages over individual components" (Radomska 2016:63). In other words, emotions, matter, and art are not autonomous and self-contained; instead, they influence each other and become entangled in the assemblages they form a part of (Radomska 2016:63).

The downside of thinking about the social world using assemblage theory is precisely the indeterminacy and indefiniteness it suggests for the composition relation (Smith & Protevi 2012:[sp]). Because it remains elusive, suggestive and metaphorical rather than discursive and analytical, assemblage theory poses a hard problem for explanation (Smith & Protevi 2012:[sp]). I therefore turn to Ahmed's theory of affect as "sticky". According to Ahmed (2010:30), "affect is what sticks" – what endures or conserves the

connection between objects, values, and ideas. She begins by perceiving affect as “the messiness of the experiential", relating bodies to different worlds and how we are affected by what we are near to. To take a practical example (keeping in mind that this is a mere illustration of Ahmed’s theory, and that objects affect/*stick* to different people in different ways): a viewer enters a room with an artwork. As the viewer moves towards the artwork and inspects it from different angles, she/he is affected by the materiality, and sensuousness of the artwork (perhaps unknowingly). The affect produced by the object sticks to the viewer and becomes a part of the viewer’s body, mind, subconscious, and past knowledge, never to disappear. The viewer’s thoughts and outlook on life will hereon be affected by the artwork, as it is stuck to her/his being. The experience of the artwork has become a potential actor for transformation. These unanticipated reactions to the artwork are the prefecture of affect – it is through this unexpected affective encounter that affect *sticks* and the transformative experience may occur (Lauwrens 6:2020).

As seen in the above example, affects often work in subtle ways to influence a person’s point of view. Thus, affect theory helps us evade the “linguistic fallacy”, the belief that power is primarily conducted by language and thoughts (Schaefer 2020:1). Instead, power is positioned as a “thing of the senses” that feels before it thinks (Schaefer 2020:2). It is hooked to our animality, not to our rational transcendent consciousness (Schaefer 2020:2). Perhaps most importantly, affect is premised on bringing movement into theory, to moving away from simply thinking about language and art as social constructs. Affect is important in thinking about fluidity, motion, material, biology, and language, and how our bodies and minds are moved by it.

These abovementioned theories are factored into my art practice to induce an affective response towards the mosquito. The intention of my practice is to use affect to challenge predetermined ideas about mosquitoes, malaria, and climate change through the art object. This is done by moving the audience’s understanding of the mosquito (and by extension, of biotechnology and climate change) through creating unexpected and transformative experiences using bio art.

1.4.5 Malaria and its Rippling Effects

Driven by a curiosity for discovery and progress (and fuelled by capitalist advances), biotechnology and science have made forward strides in modern-day science. In the

pursuit of better living, an inversely proportional relationship exists between nature and the advancements for humans; as the standard of living for humans advances due to science and biotechnology, the state of nature often regresses. Yet in our attempts to advance our well-being with certain biotechnological developments, such as pesticides, invariably we cause harm to human life in the process. Nowhere is this more relevant than what seems to be humanity's tautological battle against malaria[35] and, more specifically, the mosquito.

Malaria remains an international crisis and mainly affects tropical areas, specifically in the northern parts of South Africa. Malaria is a deadly parasite transmitted to humans by a vector (a female mosquito) (World Health Organisation 2021:[sp]). Against international standards, South Africa still uses harmful insecticides such as DDT to combat malaria. DDT has been given special favour as a pesticide because of the perception that it is often the only solution to controlling malaria (Wells & Leonard 2006:v). South Africa is one of the few countries calling for its continued use even though its effects on both humans and nature have been toxic and detrimental (Wells & Leonard 2006:v). The question that should be asked within the South African context is how best to protect citizens from this deadly disease both cost-effectively and without skilled labour. Paradoxically, in an attempt to save humanity from this deadly virus, we have imposed unwanted and unplanned transgenerational detrimental health effects onto the very population we set out to protect. The moral dilemma we find ourselves in here may be considered a postnatural[36] one – weighing the short term need to be malaria-free against the long-term need for the environment and its inhabitants to be healthy.

Apart from the local malaria crisis, another global one looms: global warming. This gradual increase in the Earth's atmosphere is a direct result of the Capitalocene. Global warming also contributes to certain unpredictable and dangerous effects on malaria and

[35] From 2015 to 2019 South Africa has had between 10 000 and 30 000 notified malaria cases each year (National Institute for Communicable Diseases 2019:[sp]). The National Department of Health plans to eliminate malaria by 2023 (National Institute for Communicable Diseases 2019:[sp]). Nevertheless, we still face increasing problems with "cross border malaria importation, vector control spraying programme delivery, vector insecticide resistance, and many health provision challenges" that prohibit the elimination of malaria (National Institute for Communicable Diseases 2019:[sp]).

[36] Our dilemma is postnatural because without postnatural intervention we cannot combat malaria. The subjective morality of this dilemma is also postnatural and paradoxical as it poses the question, do we save ourselves and destroy nature, or do we save nature and destroy ourselves. What makes this dilemma postnatural is the ensuing consequences: what is the purpose of a healthy ecology if there are no humans and what is the purpose of healthy humans if there is no ecology. Therefore, this dilemma is postnatural and paradoxical in its nature.

humans. As climate change continues to dictate environmental well-being, the rising levels of temperature and water distribution significantly affect malaria transmission, the environment, and mortality. The World Meteorological Organization (WMO) and the World Health Organization (WHO) have recognised mosquitoes as one of the species that will adversely be affected by climate change, naming studies[37] proposing that the increase in temperatures of 2 to 3 degrees Celsius will put several hundred million more people at risk of contracting the disease (Fernando 2021:[sp]). It is essential to scrutinise the gravity of the decisions made by scientists and governments, as well as the impacts those decisions will have on society and nature. This amplified crisis around malaria and its hosts, mosquitoes, forms the crux of my creative inquiry. My exhibition, *After Nature*[38], comprising several bio artworks, explores how bio art may be used to elicit affect in the viewer by sharing the implications and responsibilities that result from the influence of human culture and biotechnology on the South African environment. My artworks take a broader look at the history of malaria and malaria eradication as people strove to achieve the ideal of a malaria-free utopia. However, many of the works point to an intricate labyrinth of dystopias that are emerging as we continue down the path of perfecting this utopia.

1.5 Theoretical Approach

This research is positioned within the frameworks of Fine Arts and Science, emphasising the disciplinary overlapping in the form of bio art. The environmental humanities[39] offer context to bio art within postmodernism. The premise of the study aligns with postmodern and contemporary bio art practices located within the *third culture*[40]. This information is

[37] Studies include those by Sadie Ryan, Catherine Lippi, and Fernanda Zermoglio (2020) which outline a framework for planning and intervention as climate change affects the risks of malaria transmissions in Africa.
[38] The exhibition serves as the practical outcome of this research and comprises *Biocide* (2019), a four-channel video installation; *Memento Mori* (2021), an artwork that addresses global warming as it relates to malaria; *Khosi khadzi wa lufu* (2021), an artwork that superficially modifies the mosquito using a dusting compound used for scientific research; *Lufu kha a kovhela*, a photographic series; *Anopheles* (2021), a 24-channel bioacoustic sound installation; and *Tachycardia* (2021), a series of prints which use the soundwaves from *Anopheles* to comment on environmental rhythms.
[39] The Environmental Humanities is an interdisciplinary area of research that draws from numerous environmental sub-disciplines. Some of the prominent focus areas include environmental philosophy, environmental literature, environmental anthropology, and environmental history. The environmental humanities aim to help bridge traditional divides between the humanities and the sciences, as well as between Eastern, Western, and Indigenous ways of relating to humanity's relationship with the natural world.
[40] Third culture refers to a coherent movement within the arts and sciences that consist of experimental, exciting, and mutually enriching collisions. According to Arthur Miller (2014:5, 9,

contextualised to inform the discussions surrounding contemporary bio art practices situated in the overlapping frameworks of pseudo utopia, dystopia, affect, biotechnology, capitalism, and postnaturalism.

As noted earlier, the study relies on affect theory to inform my bio artworks. Affect theory resides in the philosophical framework of Phenomenology. Phenomenology examines embodied, interactive perception in which the "see-er" becomes one with what is seen (Hobbs 2001:18-19). Phenomenology is predicated on multisensory perceptions that involve the human body and its surroundings. In contrast to popular opinion, which locates mental states such as emotions and moods within our head, phenomenology regards affects as encompassing phenomena that connect the world, body and self (Hobbs 2001:18-19). Drawing from phenomenology, I use affect as a tool for informing my own and other bio artworks. Affect straddles social, cultural, and political discourse at the beginning of the twenty-first century. Jan Slaby and Christian von Scheve (2019:1) suggest that the realisation that capitalist economies are exploitative – not only of human minds and bodies, but also of human emotion and the impact of social media's prevalence for displays of affect – marks the current epoch with emotional reflexivity. The latter denotes a propensity to make sense of, and to represent, the social world via feelings and emotions (Slaby & von Scheve 2019:1).

I use affect theory (in combination with the terms aesthetics, and embodiment) to infuse my practice with aspects that may bring forth a physical or subjective experience in the viewer. Fostering an affective response in the audience is crucial when considering our ethical positions towards climate change, biotechnological advancements, technology, and the impacts of such on the environment. The framework presented by Utopian Studies considers the relationship between the scientific (and emotional) appeal of betterment offered by utopia, versus the manifestation of dystopias as these become apparent in nature. Utopian theory is used as a way of thinking about the future driven by biotechnological developments, a socialist speculative lens through which to view my research and artworks.

The research is located within a broader postmodern, poststructuralist framework. Poststructuralism can be defined in terms of plurality, multiplicity, and simultaneity. Since

71) the third culture transpires with ideas surrounding postmodernity, social art, conceptual art, and audience engagement, attempting to bridge the divide that once existed between the arts and the sciences.

bio art consists of many overlapping and adjoining areas, I use interdisciplinary approaches to examine multiple perspectives.

1.6 The Research Methodology

The research is qualitative and positioned within postmodern frameworks. The research is interdisciplinary and draws on knowledge and ideas from fine arts discourse, art history, scientific studies, phenomenology, and speculative theory. I approach this study by synthesising ideas from both practice and theory as the one continually informs the other. However, for clarity I discuss these two components separately.

The research commenced with qualitative interpretations of various texts ranging from artistic, scientific, and philosophical disciplines, which I analysed and interpreted critically. Critical visual and textual analyses were deconstructed to inform my argument. Due to bio art's corporeal nature, I analysed bio art following its aesthetics and affect from a phenomenological angle. Because most of the artworks discussed are biologically living entities such as plants or animals, the artworks establish a closer connection to the viewer, creating a unique relational aspect. From here, the works were contextualised and located within a postnatural framework to question the so-called utopian outlook of the future offered by science, capitalism, and technology. Throughout this process, experimental practice-based artmaking fundamentally served as a research method during creation (Marshall 2007:23). A fundamental aspect of this practice-based research process resulted in a creative outcome where the practice was undertaken as a critical method for generating meaning (Niedderer 2007:13).

Exploratory research was applied in the production of my creative work. The final result of the artwork is not based on a distinct planned outcome but is the result of the investigative process of experimentation and praxis. My art practice takes on an "anthropological practice", to borrow Susan Hiller's term (Myers 2015:130). In other words, the artist's role is to excavate, probe, articulate, and unveil research that exists but is perhaps not yet understood by the broader society (Myers 2015:130). This anthropological practice ultimately results in a practical body of work that is both tangible (physical) and intangible (auditory) in nature. This is all employed in support of a central argument or theme expressed in the artwork. A wide range of media and materials are engaged in the practical work, each chosen to best express and realise the concepts that underpin the work and with the purpose to potentially evoke an affective response.

In the catalogue, I have documented the works that form part of the exhibition. I outline the conceptual foundations and theoretical framework that support each artwork and provide a short history of how they evolved from my collaboration with the UP ISMC and School of the Arts. I explain my choices of material and media by detailing how the content could offer possible readings of affect.

1.7 Ethical Clearance

This study does not pose any ethical concerns. Despite working with living biomatter (mosquito larvae and adult mosquitoes), no ethical clearance is required. In addition, all living biomatter is handled, manipulated, or transported by qualified scientists from the UP ISMC.

1.8 Outline of Chapters

Chapter One serves as an introduction to the study, supported by a focus on the research question and a literature review. The chapter also offers a background to the study and provides a brief outline of the chapters to follow.

In Chapter Two, I unpack the emergence of the Capitalocene as it relates to postnaturalism. I draw connections between postnaturalism and the pseudo utopia engendered by capitalism. I explore how capitalism's false promise of utopia inevitably offers a dystopia. I interlace the chapter with examples of bio artworks to illustrate bio artists' practices as they touch on aspects of the Capitalocene, postnaturalism, and the pseudo utopia.

In Chapter Three, I explain the creation of my postnatural world in the exhibition *After Nature.* I unpack affective framings of some of the works. I move on to discuss my bioacoustic sound installation – for me, the most significant aspect of my body of work. I discuss affect in bioacoustics and unravel the intention of my artworks alongside the possible affective readings that I anticipate. I conclude the chapter by pointing to new directions for art and science through bio art.

By way of conclusion, in Chapter Four, I reflect on key insights and findings derived from the study. I consider the arts-based research component concerning the outcome of the

research and propose that it is within these understandings that the value of the study lies.

CHAPTER TWO
PORTRAYING PSEUDO UTOPIA: BIO ART, THE CAPITALOCENE AND OUR NEW EARTH

This chapter contextualises bio art while exploring correlations between postnature and pseudo utopia. Commencing with a brief overview of bio art, I discuss how bio artists foreground the Capitalocene, as well as forewarn of the dangers of many ill-considered scientific interventions developed in reaction to the upsurge of natural disturbances. This upsurge is considered to be caused in part by new materialism[41] which has become associated with ecological change/disruption/regression and technological growth. Although I discuss the main concepts surrounding the Anthropocene, I consider key factors that are often neglected within its recognised definition, such as the economic drivers of capitalism. Thus, discussions regarding the Anthropocene epoch encompass more meaning if discussed alongside that of the Capitalocene. I explain the birth of postnaturalism as a product of aristocratic-capitalist structures and consider its positive and negative aspects in the progression of science and biotechnology. Throughout the chapter, visual images and artworks are interlaced to demonstrate the ideas discussed.

2.1 Bio art, the Capitalocene and a Pseudo Utopia

What classifies bio art as a valuable aspect of contemporary art is not its qualities shared with other genres (such as environmental art), but its contribution of a novel art form. Differentiating bio art from other strands of art production is its emphasis on the fundamental interconnected processes of life, its exploration of biotechnological media[42], and its engagement with genetics. Bio art not only creates new art *objects* but also, more

[41] New materialism is a philosophical ferment that approaches art through a different lens, as a complex "material-discursive" process that engages different senses and sensibilities and develops from a number of tangled relationalities (Barad 2003:801). Approaching artmaking practices from a new-materialist perspective requires one to abandon the idea of thinking about art as a purely representational practice. It allows one to think about art beyond representation and focuses more carefully on the material dimension of artistic activity. It is a commitment to the existence of an atomical world.

[42] Regardless of the potential of biotechnology and genetic technology for increasing quality of life and health benefits, the larger impacts are not completely foreseeable. This can lead to uncertainty in the public sphere about the implications of emerging technologies for human and environmental health, drug and food safety, eugenics, bioengineered replacement of natural systems, worldwide agricultural monopolies, the involvement of multinational corporations with genetic propriety, and the prospects for biotechnological weaponisation (Yetisen *et al* 2015:724). Bio artists find the above-mentioned compelling as subjects for their bio art practices.

suggestively, new art *subjects*. Unlike conceptualism, which stressed the use of documentation of events, language, and ideas, bio art highlights the relational and dialogical (such as interspecies communication, cell interaction, social intercourse, and cross-pollination) as much as the formal and material qualities of art (like the patterns on a butterfly's wings, the shape of a frog, bioluminescence, and the colour of flowers) (Kac 2007:19-20). While contemporary art produces events (telecommunications exchanges, happenings, performances), objects (ready-mades, sculptures, and paintings), immaterial works (digital pieces and videos), and environments (land art and site-specific installations), bio art has as its main concepts and materials the *evolution* of species (phylogeny) and the *development* of an organism (ontogeny). In addition, bio art is open to the gamut of entities and life processes, whether utopic or dystopic, ranging from the evolutionary lineage of the largest mammal to the minor deoxyribonucleic acid (DNA) molecules and viruses (Kac 2007:20).

Through their collaborations with the sciences, some bio artists enable public debate by creating works that provoke expressions of controversy and discord (Yetisen *et al* 2015:724). Bio artists also use their work as aesthetic, cultural commentaries to form disquieting and speculative scenarios around the risks associated with genetic engineering (Yetisen *et al* 2015:724). Also, with or without focussing on science, capitalism, and technological concerns, all bio artists peruse questions about social paradigms (Yetisen *et al* 2015:724). In the context of this study, the paradigms under investigation concentrate on power and capitalism, pseudo utopias, and the postnatural world. In response to these issues, bio art has created an "abundance of hallucinatory realms, bizarre plasmic substances, indiscernible beings, and an array of odd prostheses that mutually modify each another" (Stafford 2007:379), whether brought forth by decomposition, multiplication, mutation, or metamorphosis. A new ambiguity characterises bio art through its joining of technology to the postnatural and engineered (Stafford 2007:379). Such artistic ambiguities originate from an uncertain future, initiated mainly by the dominant Capitalocene epoch and the unfolding of the influences of human culture and biotechnology on the environment. In this section, I discuss the Capitalocene, and show how bio artists react to the increase of biotechnology in the environment.

In our era, humans are asked to grapple with the phenomenon of the Anthropocene as neither a singular event nor a known threat, but as something that falls into the context of possible events. The Anthropocene presents many descriptions of the current world situation but fails to explain how this situation developed. Within the context of this study,

I refer to the Capitalocene rather than the Anthropocene as the current ecological epoch from which bio art was born. The Capitalocene locates our present era in history as the age of capital and progress (Moore 2016:6). The Capitalocene views capitalism as the configuration of nature through technology and influence by human organisations – such as markets, empires, and classes – to contrive specific environments (Moore 2016:7). It is a world-ecology that binds together the chase for power with capital influence by establishing man's dominion over nature (Moore 2016:7).

Justin McBrien (2016:116) highlights the connection between capitalism's perceived drive towards utopia and the rate of extinction from a world-ecological perspective. According to McBrien (2016:116), extinction stretches further than a "simple biological process suffered by other species". For him (McBrien 2016:116-117), it also implies extinguishing what can be deemed natural in the environment – thus the de-naturalisation of the environment can be attributed to being a by-product of science and modern-day developments in biotechnologies, entwined and opposed within the webs of capital accumulation and imposing power (McBrien 2016:116-117). Jedediah Purdy (2015:2) extends McBrien's narrative by stating that the Capitalocene finds its most radical expression in its acknowledgement that the traditional divide separating humans from nature is no longer accurate or helpful. Because we mould everything to comply with our needs and strive to accumulate power and capital, humans and nature can no longer be distinct from each other (Purdy 2015:2). Consequently, capitalism blinds us to the continuous de-naturalisation of the environment and, in turn, the de-naturalisation of ourselves.

The fruits of progress, coupled with biotechnological development, are often viewed as an elegant solution to many issues faced in the contemporary world, from environmental to medical solutions (De Menezes 2007:216). At the same time, there exists widespread anxiety about how the future may look if accompanied by an increase in biotechnology and postnaturalism. When biological entities are manipulated in an atmosphere of capitalist-driven competition, the long-term results may be disquieting[43] (Catts & Zurr

[43] One example is the potential extinction of bees caused by the widespread use of pesticides that has severely reduced pollination. Now postnatural "materially engineered artificial pollinators" are developed to fill the vacuum left by the decline in bee populations (Chechetka, Yu, Tange & Miyako 2017:224). Such unanticipated consequences demonstrate the disturbing effects of the 'myth of progress': "for every seeming forward motion of the drill bit there is a backward gyration" (Morton 2016:7).

2006:232). In this narrative, nature often suffers the consequences of our strive towards utopia.

Utopia is a powerful Western cultural trope that refers to a better, simpler place in which our current conditions and problems are transcended or resolved (Noble 2009:12). Yet ironically, in Ancient Greek 'utopia' means 'no place' (Noble 2009:12), a place imagined, but *not yet realised*, the "shining empire on the hill" that shows up the limitations of our own world (Noble 2009:12). The emphasis here on the *not yet* realised[44] but oft-promised future implies the way our current political and economic systems – that are habitually self-serving – often present us with the notion of utopia to justify their activities. Since these systems exert influence on the development and use of biotechnologies for self-profit, their promises of utopia are unrealistic and false. I refer to these false utopias as pseudo utopias. According to Michael Gordin, Helen Tilley, and Gyan Prakash (2010:1), the concept of utopia carries with it the "trappings of an elaborate thought experiment", a type of contest for capitalist structures to set themselves the task of designing the perfect future for humanity.

Furthermore, unanticipated, unwanted situations often manifest while progressing towards these false utopias, which in themselves become inherently dystopic. The contemporary notion of dystopia enables the many anxieties and fears that accompany advancement. Gordin, Tilley & Prakash (2010:1) state that despite its name, a dystopia is not simply the inverse of a utopia. The real opposite of a utopia would be a place that has not been planned or is planned to be a horrible failure (Gordin *et al* 2010:1). However, a dystopia is neither of these – instead, it is a utopia "that has gone wrong" (Gordin *et al* 2010:1) or a utopia that is desirable only for a distinct portion of society.

Enabling a critical utopian[45] viewpoint, I question the future vision set forth by progress, capitalism, and technological advancement by referring to certain dystopias as they begin to appear in the postnatural world. Bio art requires us to consider many of the same questions proposed by dystopic literary texts around what the future may hold if driven

[44] Effectively and objectively, throughout history many utopias have been realised. In the mathematical sciences, physical science, chemical science, and other scientific disciplines, utopias have been reached through the objective achievement of goals – such as building rockets, moon landings, developing long-distance communicating mechanisms via cellular phones, etc. However, in attempting to further push boundaries and engineer new discoveries, once a set utopia is achieved, humans will always push forward again for the next utopia.

[45] Engaging capitalism through a critical utopian lens is important to expose the difficult problems and consequences that society and nature may or may not be able to solve (Claeys & Sargent 1999:2).

by capitalist influence. Such storylines usually project forward into the future so as to critically look backwards at our present and near future. In structuralist terms, this narrative device is also known as prolepsis (forward looking) and analepsis (backwards looking) and serves to provoke self-reflexive questions around how humanity has emerged at this current point in history (Stock 2012:[sp]). Although bio art provokes a more straightforward proleptic imaginary view by projecting a future governed by exploitation and manipulation, it shares with dystopian fiction the critical capacity to highlight how current practices and existing trends could soon have vast implications (Stock 2012:[sp]).

2.1.1 Let Man Have Dominion: Prolepsis/Analepsis

Here I bring my discussed theory into art practice by showcasing the influence of the Capitalocene (the dominion of man over nature) on the bioengineering of life, and how this engineering aesthetic is resulting in a pseudo utopia. I first consider G*FP Bunny* (2000), a controversial bio artwork presented at the *Ars Electronica* in Linz, Austria by Brazilian-American artist Eduardo Kac. The work shows how biology and technology are connected and illustrates our anthropocentric relationship with nature. I additionally refer to another of Kac's works, *Genesis* (1998–1999) whereby he took the biblical sentence "let man have dominion over nature" as inspiration for his transgenic artwork that interrogates the complex relationship between belief systems, biology, technology, ethics and trans species interaction (Kac 2020:[sp]).

Figure 5: Eduardo Kac, *GFP Bunny*, 2000. Genetically engineered rabbit. (Stracey 2009:498).

Kac is recognised as one of the foremost pioneers of bio art. His artwork G*FP Bunny* (2000) (Figure 5) is a genetically altered live rabbit (Kac named her Alba) that glows bright green under ultraviolet light due to combining a Green Fluorescent Protein found in jellyfish genes with Alba's DNA. This work has become the primary exemplar of bio art in the different 'histories' that trace the emergence of the art genre (Kac 2020:[sp]). Illustrating an early form of techno-genesis, Alba raises questions as to what creation and creativity precisely entail. When Alba was displayed in 2000, Kac received immense backlash from both animal activists and scientists, and the scandal of an artist using biotechnology on a live – though healthy – rabbit solely to create an artwork for exhibition drew much shock and sensationalist reporting (Jagodzinski 2020:274).

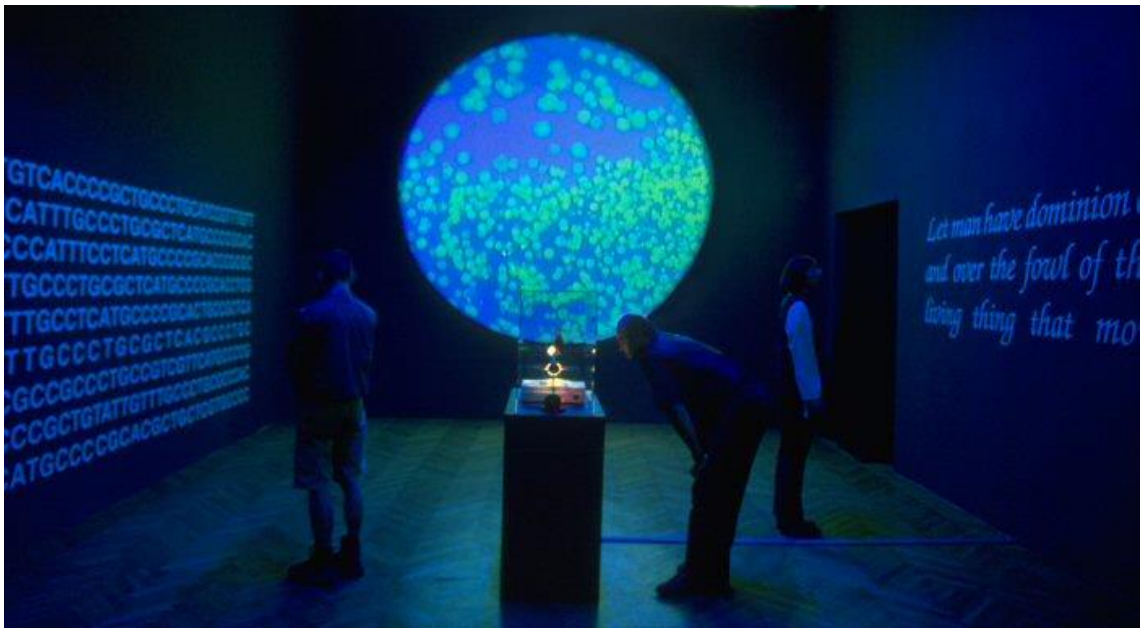

Figure 6: Eduardo Kac, *Genesis*, 1998–1999. Biblical sentence, morse code, synthetic DNA, ultraviolet light, computer interface. (Kac 2020:[sp]).

What became significant was Kac's exploration of ethics and questions as linked to the development of postnatural creatures through the complexity (yet wide accessibility) of DNA sequencing along with its ability to sculpt biomorphic and mutant postnatural organisms. By creating a chimerical animal that does not exist in nature Kac addressed issues around normalcy, heterogeneity, hybridity, purity and otherness, as well as public respect and understanding of the postnatural 'other'. As with *GFP Bunny*, many of Kac's

other artworks investigate the boundaries between technology, humans, and animals[46]. Prior to creating his *GFP Bunny*, Kac started experimenting with recombinant DNA[47] – a method whereby different life forms are combined to form a mutant collage – to create his renowned installation work *Genesis* (1998–1999) (Figure 6). *Genesis* revolves around three developments of coded translation, which are then reversed (Kac 2020:[sp]). The development of *Genesis* unfolded in the following way: a sentence originating from the Biblical book of Genesis was translated into Morse Code (Kac 2020:[sp]). The Morse Code was converted into synthetic DNA (Kac 2020:[sp]). The synthetic DNA was subjected to ultraviolet light, allowing the synthetic DNA to mutate or die according to how the participant-viewer controlled the ultraviolet light (Kac 2020:[sp]). Then this full process was reverse-coded back to form a newly altered Biblical sentence to illustrate non-anthropocentric humanity (Kac 2020:[sp]).

The sentence from the Biblical Book of Genesis chosen by Kac is "Let man have dominion over the fish of the sea and over the fowl of the air and over every living thing that moves upon the earth" from the English Version of the Old Testament (Kac 2020:[sp]). This sentence highlights the core aspect of anthropocentrism which has defined our species by enabling us to consider ourselves at the apex of all life on Earth. The second stage was to translate this Biblical sentence into Morse Code, a binary code system consisting of a series of dots and dashes (Kac 2020:[sp]) – this step was taken because in this context the Morse Code represents the dawn of the biotechnological and information age (Kac 2020:[sp]). Thirdly, the resultant Morse Code was transformed into a synthetic DNA sequence comprising a GATC genetic alphabet (Kac 2020:[sp]). GATC is an arbitrary code within molecular biology that uses capital letters to function as a textual shorthand for a DNA molecule's four nitrogenous (chemical) bases (National Human Genome Resource Institute 2021:[sp]). These bases are guanine, adenine, thymine, and cytosine (National Human Genome Resource Institute 2021:[sp]).

According to Kac (2020:[sp]), what emerged from the transcribed DNA-sequenced text was an "artist's gene" or "Genesis gene". This 'gene' was arbitrary, artificial, and synthetic, intended to mimic the postnatural ecology that we are sculpting using biotechnology (Jagodzinski 2020:276). The next development involved molecular

[46] My study considers the relationship between the human and the (post)natural, and how humans exploit these boundaries to achieve a utopia.
[47] Recombinant DNA is not only used in Kac's *GFP Bunny* but also in other life forms such as transgenic fish, plants, bacteria, and mice that can be found in his artwork *The Eight Day* (2000–2001).

cloning, where the "Genesis gene" was placed in a petri dish next to an ECFP protein – a protein that responds to ultraviolet light by emitting a fluorescent cyan glow (Kac 2020:[sp]). Ultraviolet light and live stream video projector were placed above the petri dish for viewers to see both the inter- and intra-generational movement of *Genesis'* genetic sequence as the bacteria replicated and mutated (Kac 2020:[sp]). From the live stream recording, viewers could monitor how the bacteria retained or lost their respective colours, as well as how they produced a hybrid cyan glow. Additionally, participant-viewers could log into the installation's ultraviolet light source and manipulate the amount of radiation emitted. By switching the ultraviolet light off and on, the DNA sequence was disrupted in the plasmid. This meant that participant-viewers had control over the 'life' of the gene – either to let it mutate and expand, or stagnate and die (Kac 2020:[sp]).

Aside from the bio art-performative act, Kac's installation also had an ethical purpose. He wanted the work to question the dominion of man over nature, as well as exploit a different outlook on nature founded in harmony. Kac achieved this by reversing the whole process, translating the modified DNA of the "Genesis gene" back into Morse Code, and finally back into English (Kac 2020:[sp]). The new sentence read: "Let *aan* have dominion over the fish of the sea and over the fowl of the air and over every living thing that *loves ua eon* the earth" (Kac 2020:[sp], my emphasis). Through this reversal process, the original Judeo-Christian sentence is altered. *Man* is replaced with a nonsensical signifier. This small change (which carries much significance) transforms the sentence. It was Kac's way of questioning the 'god-complex' presented by bioengineering and the aristocratic-capitalists who control it (Jagodzinski 2020:277).

According to Jan Jagodzinski (2020:278), when the participant-viewers were placed in a "disembodied position" via their virtual computer-mediated presence, their interactions with "living material forces an immediate encounter". This prompted strong affective resonances and solicitated feelings of bewilderment, awe, sympathy, disgust, or anxiety. Kac's bio art brings together a convergence of physical life, technology, and meaning. In this case, meaning is found less in the bio art installation itself (as in representational epistemological discourses), but more in what it *does* – how the bio artwork installation affects the way the viewers think about humans' control over nature, and how this experience may change their understanding regarding our species' impact on, control over, and ultimate responsibility for nature.

When Kac created the synthetic "Genesis gene" he essentially took on the role of God – combining different natural elements to create something entirely new using biotechnology. Once the audience was given control over the 'life' of this gene (via the ultraviolet light) they became the embodiment of capitalism and 'man's dominion'. The choice to live or die was no longer dependant on the gene's or organism's own (post)natural evolutionary trajectory but was decided on by the participant-viewers.

2.1.2 Taking Tadpoles for a Walk

In Section 1.1.1, I described Kac's approach to bio art within the context of his creating a tangible demonstration on a micro-scale of the way that contemporary anthropocentrism has steered humans – in particular, capitalists and governments – into establishing dominion over nature in various ways.

In this section I consider life as art, specifically how bioengineered life may foreshadow a future deeply influenced by notions of pseudo utopias. A leading New York-based bio artist and academic Natalie Jeremijenko converges human interaction, inhuman (biotechnologist), and nonhuman agencies (minerals, plants, animals) to form assemblages of affect that make a difference to the health of the environment, and to our species in general. Her work aims to show the value of life in an attempt to hinder unwanted dystopias as they begin to manifest in nature.

Jeremijenko set the criterion for the reversal of anthropocentrism in her art performance *Tadpole Bureaucratic Protocol* (2007, 2009). Many bio artists, including myself, have strived to further develop her approach to a reversal of anthropocentrism in our work, reasoning that we humans must listen to the voices of the nonhuman and postnatural others, and learn to co-habit with them in healthy ecologies. The tadpoles that formed part of Jeremijenko's artwork were treated as a "companion species, each named after a local bureaucrat of the Department of Environmental Conservation", whose decisions affect water quality in New York (Dissette 2014:[sp]). In other words, each tadpole was given an identity, personality, and personhood (Dissette 2014:[sp]). A "tadpole walk"' ensued, whereby the tadpoles were placed in a glass container (Figure 7) and taken for a stroll through the city. In response to queries regarding the local water quality, a sample was collected by the tadpole walker for a tadpole to live in (Dissette 2014:[sp]).

Figure 7: Natalie Jeremijenko, *Tadpole Bureaucratic Protocol,* 2007, 2009. Tadpole and container with New York sampled water. The tadpole's reaction to its environment is used in environmental data analysis as an indicator for toxic water levels. (Dissette 2014:[sp]).

Tadpoles have extremely sensitive biosensors that respond to endocrine disruptor compounds (EDC), which are also found in mosquito insecticide sprays. EDC originate from industrial and biotechnological contaminants and t3-mediated hormone emulators – these are canned food and plastic BPAs, ingredients that are found in cleaning and personal care products, hormones given to farming animals, and antibiotics, to name a few (Viljoen; Bornman & Bouwman 2016:1-2). Toxins from these substances spill into local water supplies, food crops, oceans, animals, and eventually into humans too.

In South Africa, adverse responses to the use of insecticides for malaria elimination have also been noted in the biosensor responses of amphibians. In 2016, researchers from the UP ISMC found various deformities in an array of amphibian species in the Limpopo region. These postnatural deformities were generated by biochemical contaminations and insecticide sprays released to kill off 'nuisance' insects such as mosquitos (Viljoen; Bornman & Bouwman 2016:1-2). The deformities included male amphibians turning into

females, amphibians growing up to four extra limbs as well as other internal and external deformities, and their developing malignancies (Viljoen; Bornman & Bouwman 2016:1-2). Figure 8 illustrates a tangible example of disrupted organisms brought about – unintentionally – by humans intervening in the environment with the intention to make the world better for themselves. These postnatural amphibians represent the manifestation of a pseudo utopia.

Figure 8: Example of deformities found in amphibians exposed to high levels of DDT and EDC. (Lannoo 2008:[sp]).

Jeremijenko's seemingly unorthodox action of taking tadpoles for a walk left many passers-by curious and confused (Dissette 2014:[sp]). When they asked about the purpose of her undertaking, the tadpole walker would problematise the issues around the quality of the city's water supply in that location. Because humans and tadpoles (nonhumans) have similar endocrine systems that mediate hormones and immunity, a connection is formed between the two species – their health becomes as important as our own. If they suffer, it means that we are likely also suffering (albeit in a different way). For example, endocrine disruptors found in the water quality is linked to various bodily

changes in young girls, such as obesity, breast cancer, and the falling age of puberty, etc. (Bornman, Aneck-Hahn, de Jager, Wagenaar, Bouwman, Barnhoorn, Patrick, Vandenberg, Kortenkamp, Blumberg, Kimmins, Jegou, Auger, DiGangi & Heindel 2017:1-3). Once a social network of tadpole walkers and tadpoles was formed, and the health of the tadpoles living in the collected water samples had been assessed, enough data was produced to approach the New York bureaucracy with concrete evidence to demand a change in environmental policy (Dissette 2014:[sp). Significantly however, the tadpoles were not merely instrumentalised for human and scientific purposes, but they were given "agential powers" (Jagodzinski 2020:284) – they *affect us* because they represent small versions *of us*.

Jeremijenko's ethico-political stance is quite unlike that of Kac. While with *Genesis* Kac aimed to affect people by allowing them control over life and death through their manipulation of the quantities of ultraviolet radiation emission, Jeremijenko affected her viewers by allowing them to observe and discuss the dystopic influence of capitalism over nature, as detected in their immediate water supply through her "tadpole walkers". Through different strategies, both artists shed light on the impacts that humans and biotechnologies are having on the natural world, and by extension on the Capitalocene, via the influences that extreme capitalism and governmental power have on scientific discovery and implementation. In the next section, I discuss how the promise of utopic living is implemented as a façade, blinding us to the ever-increasing state of postnaturalism in the environment.

2.2 How the pseudo utopia led to postnaturalism

In the above section, I explained how the promises of pseudo utopias by capitalists are resulting in unanticipated effects on natural organisms, as seen in the Capitalocene. In this section, I further unpack how the notion of pseudo utopia is antagonising the instinctive flow of nature and causing results that may be viewed as unnatural or postnatural. According to Richard W. Pell and Lauren B. Allen (2021:2), postnaturalism comprises "a full range of living organisms that have been intentionally, unintentionally and heritably altered through processes" such as domestication, selective breeding, synthetic biology, and genetic engineering. Unlike historical specimens found in natural history museums, postnatural organisms such as laboratory animals, pets, and food crops "play an additional role as artifacts of the cultures that produce them" (Pell & Allen

2021:224). They become the living embodiments of human desires and fears, heritably accumulated over time (Pell & Allen 2021:224). These modifications may also extend to the way we irreversibly change or exterminate certain species. I use the example of the mosquito since it relates to my creative practice.

Humanity has been waging an ongoing war against the Anopheles mosquito using mechanical, chemical, and other means of extermination. Recent developments in Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) biotechnology – a gene-editing technique whereby the genomes of a living organism may be modified (Natureplants 2018:233) – have allowed for the creation and release of hordes of sterile male mosquitoes designed to minimise population numbers by mating with natural female mosquitoes (James 2005:64). Also, mosquitoes that contain “gene-drives” were recently developed in an attempt to wipe out malaria (James 2005:64). Gene-drives essentially accelerate the process whereby an organism passes an engineered mutation onto the next generation (James 2005:65). While not all biotechnological intervention is bad, it is inevitably still postnatural and may carry postnatural consequences.

Figure 9: Tuur van Balen and Revital Cohen, *Pigeon d’Or*, 2010. Release of the genetically altered pigeons (Ku Leuven 2010:[sp]).

Research into bettering nature for humanity's benefit now continues beyond altering the biology of the mosquito. Ecosystem services, defined by the International Union for Conservation of Nature (2021:[sp]) as priority services that aim to preserve nature by implementing technology to ensure the survival of *humans*, are being developed and gradually becoming new commodities for the capitalist global economy to sustain itself. Increasingly, researchers strive to develop novel ways of releasing mechanical agents such as bioengineered postnatural organisms into the wild[48]. Take for example, *Pigeon d'Or* (2010) (Figure 9), a bio artwork that is bracketed within the vision of ecosystem services. *Pigeon d'Or* was created by artists Tuur van Balen and Revital Cohen (2010:[sp]) by genetically altering the gut bacteria of pigeons so they would only defecate soap.

Regarding the Capitalocene, vast amounts of environmental control practiced by aristocratic-capitalism (along with the promise of utopia) have resulted in nature being instrumentalised. Perhaps the fastest growing area (also closely linked to ecosystem services) is biomimetics[49] where species are bioengineered to ensure a more productive role within their ecosystem (Jagodzinski 2020:280). Carole Collet's bio design project *Biolace* (2012) (Figure 10 & Figure 11) explores the future of genetically modified plants. Her project blurs the distinction between the gallery space and the natural environment, focusing on the genetic possibilities encapsulated within the postnatural. It foretells the possibility of postnatural plants that could act as platforms for manufacturing several high-value products simultaneously, for example *Strawberry Noir* (*Fragaria fusca tenebris*), a plant programmed to grow roots of lace while producing jet black fruits. Although here the berries would no longer need a bright colour to entice seed-spreading animals, they would have enhanced levels of Vitamin C and antioxidants to support *human* health (Myers 2015:63).

[48] An example of a bioengineered postnatural organism is "heat-resistant zooxanthellae (the photosynthesising symbiote of coral polyps)" that are slowly being released into the terminally declining ecosystem of the Great Barrier Reef (Veron, Hoerh-Guldberg, Lenton, Lough, Obura, Pearce-Kelly, Sheppard, Spalding, Stafford-Smith & Rogers 2009:1428).
[49] Examples of biomimetics include genetically modified organisms (GMO's) such as grain crops and the creation of new plant and animal species that are engineered using GFP to act as 'pollutant sensors'. This enables them to glow whenever high levels of pollution are detected (like the proverbial canary in the coal mines indicating dangerous levels of gasses).

Figure 10 and 11: Carole Collet, *Biolace plants*, 2012. Genetically engineered plants. (Griffiths 2013:[sp]).

Given that vegetables and fruits are already genetically designed to resist pests, look more appetising, and survive on considerably less water, one could easily imagine that the features of the *Biolace* plants may soon be developed on a large scale. Works like Collet's plants show how designer capitalism has begun to aestheticize the Earth, commodifying anything based on nature's design that may be sold for a profit (Jagodzinski 2020:280). The developments of both biomimetics and ecosystem services are based on this principle, and although not all should be dismissed, many have been built for profit and patent rights[50] rather than for common wellbeing (Jagodzinski 2020:280).

Like Collet's *Biolace* plants, many postnatural organisms that are specifically created for bio art exhibitions – by combining technology and biology – are characterised by a time

[50] According to Dominique Lestel (2002:276) "we must take into account the less glorious possibilities that [many] artists [and scientists] are being manipulated – and not necessarily consciously either – by technicians and multinationals; that they are serving to legitimise practices that our cultures otherwise find it hard to accept''. Whether bio art will manifest itself as a new movement in art, a method for social criticism, or a lobbying effort to warn humanity – or perhaps a combination of all the above – is yet to be seen (Lestel 2002:276). Nevertheless, there is no

limit or, as Jagodzinski (2020:281) terms it, a "process of duration". This is the case with my own artworks since the mosquitoes and larvae die after a few hours spent outside of their controlled laboratory environments. The metamorphosis and transformations that characterise life show that it is uncontrollable, unbound, and unpredictable. In my own work, I experienced the uncontrollable nature of life when a section of the mosquito population died a few weeks before the exhibition opening, resulting in last minute restructurings of the bio artworks.

As in dystopian literature, many errors occur during the process of making a bio artwork. Since the lives of the organisms used by bio artists in their exhibits have "no scripted outcomes", the "feeding, breathing, metabolizing, and multiplying/growing that are specific in each case [of art] are not always consistent with those imagined by the artist" (Radomska 2016:166). This understood aspect of instability in bio art provides a counterbalance to the false sense of control over living materials presumed by the capitalist-biotechnological industry (Willet 2006:5). Despite extensive planning and preparation, the bio artwork seldom produces perfect results, even if exact procedures are followed[51]. What makes bio art unique as an art form is that it undeniably establishes death as destiny. Life is "always already in the state of becoming waste", always ageing, and always degrading (Radomska 2016:183). By the hand of *nature* or the hand of *mankind*, living organisms may present uncontrolled outcomes.

Patricia Piccinini is a multi-disciplinary artist whose work explores the kind of uncontrolled outcomes that may originate from biotechnologies. Her artworks reveal images of hybrid mutants positioned somewhere between the non-living and the living, and between the inorganic and the organic. They seem to be uncompleted part-bodies. Piccinini's spectacular mutant sculptures could be viewed as the projections of a future governed by the postnatural implications of pseudo utopias. A new category of life emerges when

denying that bio art is indeed sculpting wider public/social knowledge about reproductive technologies and genetic influences.

[51] For example, during the showcasing of the artwork *Victimless Leather* (2004) by the Tissue Culture and Art Project (TC&A) in an exhibition in Tokyo, a foreign fungi invasion in the cells of the artwork proved unstoppable, forming a "flower-shaped excrescence" on one of the sleeves (Radomska 2016:163). The host museum staff had to restart the artwork from a cellular base to recreate a new skin suit that was acceptable for viewing. In another display of the same artwork at the New York Museum of Modern Art, the biological containment was successful, but the cells "grew over the scaffold and then continued beyond until the arm was falling off and the incubator was clogged" (Cogdell 2011:27). The Museum staff was forced to switch off the incubator, thereby killing the artwork. Although from one perspective, the reconstructions were pivotal to creating an aesthetically well-displayed exhibition piece, they did serve to detract from the interlayered meanings inherent in a postnatural bio artwork.

technology alone can sustain life, namely, the occurrence of “life beyond life” or a “suspended death” (Jagodzinski 2020:282). Catts and Zurr (2003:16) call this a “meta-body” or an extended body, a fragmented body surviving only through technological means. Probing the darker aspects of biotechnology, Piccinini creates her own postnatural worlds, comprising an uncomfortable array of combinations of the plausible and grotesque which she thrusts into the consciousness of her viewer. Her sculptures consist of life forms that humans might one day breed, engineer, or simply imagine, and which cross meaningful psychological thresholds (Myers 2015:54). Her artworks confront the viewer and provoke a combination of fear and intrigue for which there exists no vocabulary. In essence, she creates her versions of imagined dystopias, the products of biotechnology, or “a contemporary god” (Myers 2015:54).

Figure 12: Patricia Piccinini, *Doubting Thomas,* 2008. Silicone, fibreglass, human hair, clothing, and chair. (Myers 2015:53).

Piccinini’s artwork *Doubting Thomas* (2008) (Figure 12) refers to the part in the biblical story where the sceptical apostle Thomas needed to touch the wounds of Christ to

believe in his resurrection. The allusions to the original story can be read as the mutated or engineered blob of tissue becoming a symbol for Christ which the boy must touch to believe in its exitance (Myers 2015:54). Here, the boy Thomas reaches towards the fleshy lump of matter with an open mouth. The viewer becomes anxious for the boy who seems to be in danger by his imminent engagement with what appears to be an inadvertently created scientific mutation – yet he seems more curious than fearful. Piccinini achieves a level of anxiety as to what a future driven by biotechnological advances may hold through using the figure of a young, innocent boy rather than an adult and seeming to expose him to a creature that she implies has resulted from the influence of humans tampering with the environment. This provokes thinking around how future generations will live alongside the postnatural environments we have created – whether they will be frightened of or empathetic towards these engineered bodies.

The aesthetics imbued in Piccinini's artworks are intended to trigger thoughts about biotechnologically engineered deformities and disabilities. Their hyper-realistic nature suggests an ambiguous sense of embodiment, creating the impression that they are bodies both living and dead, repellent yet fascinating, and equally naturally organic and synthetically inorganic. As the viewer is affected by curiosity yet repulsed, a space opens to consider the question: 'what do I actually think about the future of biotechnology?' (Dalgarno 2017:[sp]).

Piccinini's fearsome aesthetic translates further into her work *Eulogy* (2011) (Figure 13). This work presents a sorrowful image of a species fallen victim to human industry and can be clearly read as an indication of the mindless exploitation that characterises part of the nature/culture relationship (Myers 2015:55). The blobfish (*Psychrolutes marcidus*) has been brought to near extinction by the crabbing industry. Unlike, for example, the colourful peacock, the blobfish lacks human aesthetic appeal so its disappearance from the environment would not be mourned by most of us. Though not directly addressing postnaturalism, *Eulogy* highlights the dystopic, invisible consequences of much of human activity.

Figure 13: Patricia Piccinini, *Eulogy*, 2011. Silicone, fibreglass, human hair, clothing. (Myers 2015:54).

The relationship between humans and such postnatural entities sculpted by art, science, technology, and capitalism (either intentionally or by accident) is paradoxical, ambivalent, and complex. From one perspective, these postnatural entities signify a beneficial engineering approach for human life through progression and technological mediation (Catts & Zurr 2013:104). Yet from another there is a threat as these organisms could literally and symbolically bite back[52], re-vitalise, and re-animate matter (Catts & Zurr 2013:104). By creating postnatural entities (either intentionally or by accident), science and technology are also creating "a new class for exploitation, as it further abstracts life and blurs the boundaries between the living and the non-living, the subjects versus objects" (Cattz & Zurr 2013:108-109). Consequently, there is the potential for an

[52] 'Biting back' is a term used to emphasise that the living environment is biocatalytic (Hiebert 2017:5). Biocatalysis is an acknowledgement that catalytic change has real effects, material effects, reminding us that there is no metaphor involved (Hiebert 2017:5). We and nature are as much the medium of change as we are its subjects (Hiebert 2017:5).

outcome that holds multiple possible futures and the origination of an infinite number of postnatural states.

While this onward journey into the future of progress and technological advances has been unavoidably set into motion by past events and decisions, a new awareness that we are progressing into the unknown is vital because it means we can expect and envision new worlds (Dixon 2008:637). Through sculpting possible postnatural worlds, art can allow viewers a more embodied understanding of how we are shaping our environment, of how our environment is shaping us, and that the changes we make to organisms can have consequences for human behaviour. In several cases, human interference in an environment has pushed back against humanity and caused unintended changes to the human constitution[53]. Currently, the notion of the postnatural is tangled up with both the end of the anthropocentric world and new (genetic) possibilities for engineered life.

[53] For example, the impact that DDT and EDC have had on the development of young girls Cf. Section 2.1.2.

CHAPTER THREE: *AFTER NATURE*

> The role of the artworks is no longer to form imaginary and utopian realities, but to actually be ways of living and models of action within the existing real (Bourriaud 1998:13).

Bio artists expose ethical boundaries and generate tangible future scenarios by confronting their audience with biotechnological tools and materials. Resonating with science, ethics, and politics, these artworks challenge traditional views on art and aesthetics. According to Robert Zwijnenberg (2009:xvii), bio art can move beyond presenting merely factual information about biotechnological research by providing the viewer with a visceral experience of its ethical complexities.

To take advantage of the tangible aspects of bio art, I draw on a concept incapable of ready containment, namely affect. Since the concept of affect has propelled divergent trains of thought within many disciplines, this chapter offers an insight into certain philosophical and artistic approaches towards interpretations of affect. With the purpose of this study to infuse my body of work with affect I wish to establish how this approach may make audiences complicit to the Earth's ongoing decline.

This chapter unpacks the artworks that form part of my exhibition, *After Nature*. In my discussion my attention is not merely fixed on the visual impact of the artworks. In my work, the auditory experience of the artworks and their affective reception plays an equally important role in the understanding of the piece. The affective quality of the artworks is integral to their interpretation, positioning the viewer as an embodied spectator rather than a disembodied eye.

3.1 Art for the Postnatural

Titled, *After Nature,* the exhibition draws on Jedediah Purdy's thought-provoking book by the same title published in 2015. In *After Nature: A Politics for the Anthropocene*, Purdy (2015:[sp]) argues that "nature no longer exists apart from humanity. Henceforth, the world we will inhabit is the one we have made". Purdy (2015:3) argues that problems relating to the Anthropocene present themselves as questions for politics and capitalism. Throughout his books he endeavours to develop politics for the postnatural world we

shaped (Purdy 2015:iv). Mimicking Purdy's attempt to develop new ways of thinking about life on Earth that follows after nature, my exhibition strives to make visible the consequences of our acts against the biotope. In my work, *After Nature* then offers an alternative view of our South African ecology through aesthetic and affective means. In particular, the exhibition considers the ecosystem which has been ravaged by mosquitoes, malaria, and insecticides.

In *After Nature,* the artworks comprise photographs, sound, prints, moving images and living matter. The decision to include living matter is geared at encouraging a more intimate connection between the artwork and the audience, creating a unique relational experience as our human lives collide with the lives of the non-human. The artworks in *After Nature* set the stage for sensory participation as a way to offer connections. When theoretical research that expounds on the variety of impacts of malaria and humans on nature fails us, then art may foster a different kind of encounter – one where our perceptions of the world integrate with the artworks to enable an affective understanding of our role in forming dystopia.

Humans and materiality, and human and non-human bodies are fundamentally entangled in a shared ontological network structure where all exist in a mutual, constituent relationship. *After Nature* wishes to expose the materialisation of this entanglement within social and political everyday human reality. The body of work aims to anchor the viewer in an imagined postnatural space where the boundaries become blurred between subject and object, and body and thing – a space where the individual could (re)negotiate their position in the world and towards nature.

In what follows, I put forward several underpinnings for the works on display. I also touch on the methods I used to frame affect to "illuminate the intensification of the relationship between the [art]works' emotionally charged surfaces and the viewer's body" (Thobo-Carlsen 2017:99). Though each artwork was conceptualised and constructed to evoke specific reactions or affects, I acknowledge that affects are *sticky* – to use Ahmed's (2010:30) term – and that affects *stick* differently to different people. Hence, I envision that each viewer will have a unique affective experience when confronting the artworks. I also acknowledge that the interpretations that follow are my own and do not offer a closed or fixed interpretation of the exhibition – rather, it is offered as a starting point whereby in-depth engagement with the work may be possible.

3.1.1 *Biocide*

Figure 14: Danielle Oosthuizen, *Biocide*: *Specimen I and Specimen IV*, 2019. Four screen video Installation. Photograph by Carla Crafford.

Biocide[54] (2019) (Figure 14) is an installation that consists of four large screens, each with a digital projection of one of four videos. In each work the effects of DDT on four living specimens (a bee, a small bird, abstracted plant life, and food crops) are amplified and enlarged. The works expose the often-unseen effects of biotechnology and their effects on life. Collectively, the films depict the impacts of toxic DDT to control mosquitoes. By enlarging these often-unnoticed life forms to a human scale the work plays with mass to change the viewers' perception of our anthropocentric place within the world. We are no longer the apex of nature; we simply form a fragment of the larger whole.

[54] The term biocide refers to biotechnologies used towards malaria eradication. Biocide is a chemical substance or microorganism intended to destroy, deter, render harmless, or control any 'harmful' organism (Safeopedia 2017:[sp]).

Figure 15: Danielle Oosthuizen, *Biocide*: *Specimen I*, 2019 (Still Image). Video art, 3min 58sec. Image by author.

Figure 16: Danielle Oosthuizen, *Biocide*: *Specimen III,* 2019 (Still Image). Video still, 3min 58sec. Image by author.

In the first screen (Figure 15), the viewer is exposed to the distressing sight of a small bird suffering from the effect of the intake of large amounts of insecticides. We watch as the animal struggles for breath and eventually lays down to die, giving in to the effects of the toxins. The effects of DDT on birds and other small animal life is acutely toxic. These pesticides effect the health of animal life directly and indirectly. What leads to eventual death is often a combination of different causes, such as organ failure. Other long-term health defects are also noted in their offspring (Cox 1991:2). These effects are worth our attention and action as they warn us that our own health or the health of our ecosystem is threatened. The death of the bird corresponds the metaphor of the 'miners canary'[55]. As soon as the animal draws its last breath, the entire process of suffering is replayed on an endless loop, denying the viewer the relief of escaping the trauma imposed by the sight of a dying creature.

The third screen (Figure 16) concentrates on a bee labouring in the same situation as the bird. The bee is one of the most important, yet fastest declining, creatures due in part to the effects of insecticides such as DDT. Here, the bee fights for its life as its tiny body tries, without success, to fight off the chemicals designed to kill *only* mosquitoes. The irony is evident as we see more than just the mosquito suffer a painful demise in both these screens. With the mass die-outs of bees, we are already starting to see its implications for nature[56]. With as many as 40% of insect species in decline, insects are facing extinction rates that are eight times higher than those found in vertebrates (Sánchez-Bayoa & Wyckhuys 2019:8). Both insecticides such as DDT and climate change are drivers of this kind of mass extinction.

At its core, the projections on screens one and four place us in dialogue with another being that is suffering. Research on mirror neurons explains how sadness, pain, or anxiety can be experienced by an individual who sees the suffering of another (Piechowski-Jozwiak, Boller, & Bogousslavsky 2017:4). When seeing the trauma experienced by both these creatures, the same neural networks in our brains are activated as would be if we were experiencing the same anxiety (Piechowski-Jozwiak,

[55] In the past miners would use canaries to indicate high levels of methane gas in the mines. When the canary dies, the miners would know the environment is no longer safe and would retreat from their workplace.
[56] According to the Food and Agriculture Organisation of the United Nations (2021:[sp]) approximately two thirds of the crop plants that feed the world rely on pollination by bees and other animals to produce healthy produce for human consumption. Since the dawn of the industrial age, we have started to see mass die-outs of bees. With many countries now starting to rely on robotic pollinators to replace bees in pollinating crops for humans (Kimbrough 2020:[sp]).

Boller, & Bogousslavsky 2017:4). This pre-rational response could operate at the same level of affect, potentially enabling a profound encounter with the artwork (Lauwrens 2020:22).

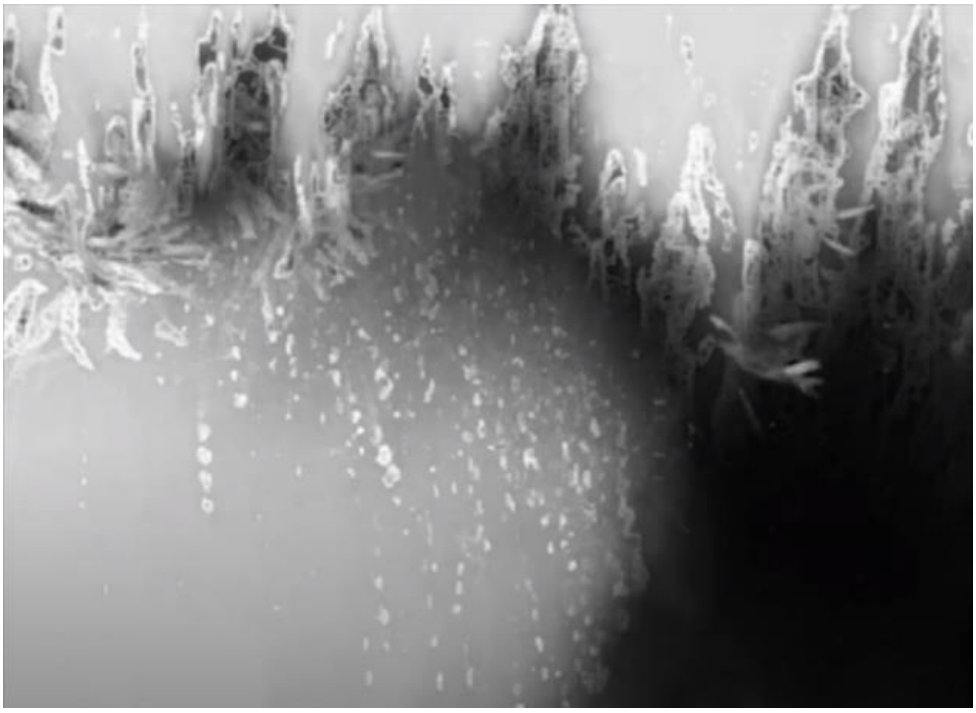

Figure 17: Danielle Oosthuizen, *Biocide*: *Specimen II*, 2019 (Still Image). Video still, 3min 58sec. Image by author.

The second screen (Figure 17) uses archival footage from DDT campaigns launched in the 1940s which documented the release of vast amounts of DDT into the environment. During the initial release of DDT, a 1947 campaign claimed that the chemical was "so safe you can eat it" (*DDT so safe you can eat it* 1947). This utopian ideal quickly rebounded when evidence of the pesticide's detrimental effects began to emerge a few years later. As a result, many countries, except for South Africa, banned DDT (Wells & Leonard 2006:1-2). In this screen, we see footage of the chemicals raining down on the landscape, metaphorically eroding or 'eating' away at the projected scene. On the fourth screen (Figure 18), the focus of the footage falls on flora. The content makes visible the biological structures of a plant as it absorbs the biotechnological particles into its roots and leaves, becoming consumed by the contaminants. Many plants and water sources

still contain traces of these pesticides which are consumed by both non-humans and humans (Bornman *et al* 2017:1-3). We see the cancer cells replicating quickly as the DDT particles finds its way into the body of its host to cause sickness and death. In attempts to create a utopia free from pests, inadvertently we have caused a negative impact on human health – our destructive acts enter into the vast cycles of the earth, and in time will return to bring hazard to ourselves. Or as Rachel Carson (1962:18;35) terms it, "if humankind poisoned nature, nature would in turn poison humankind".

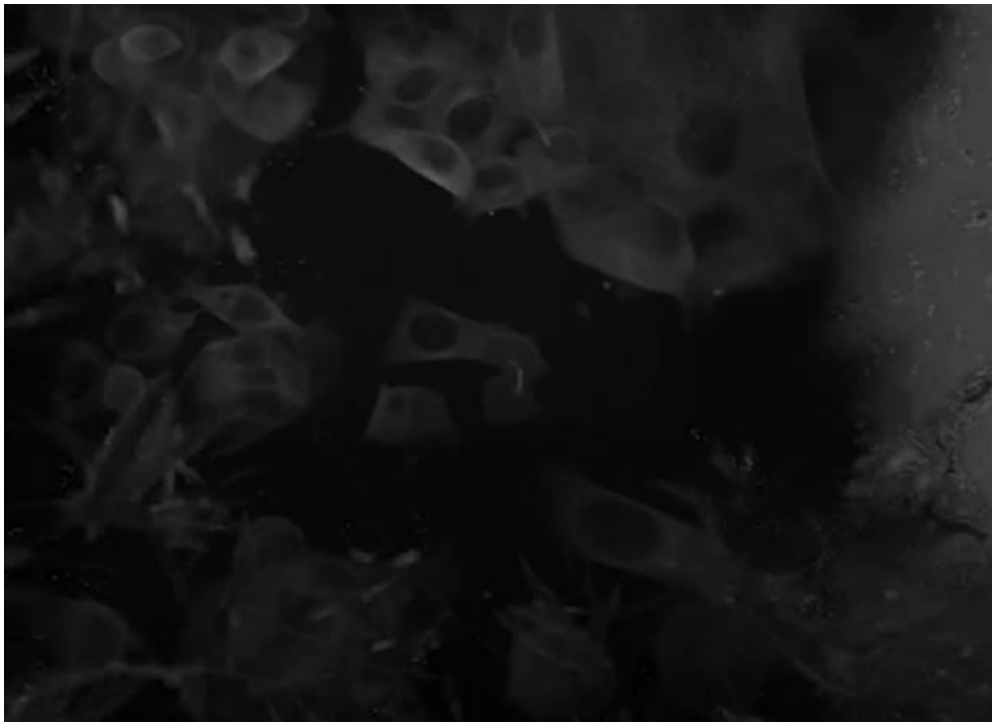

Figure 18: Danielle Oosthuizen, *Biocide*: *Specimen IV*, 2019 (Still Image). Video still, 3min 58sec. Image by author.

The above passages loop continually to comment on the perpetual struggle between man and nature, revealing just how intricately connected we are to the holobiont. The Holobiont theory by evolutionary theorist and biologist Lynn Margulis 1991 rejects the narrative of the survival of the fittest (Baedke, Fábregas-Tejeda, Delgado 2019:149). Instead, same as Carson, Margulis suggests that nature decides who lives and who dies (Baedke, Fábregas-Tejeda, Delgado 2019:149). Humans are no longer at the apex of the world order but form part of an intricate system in which each of their actions has

repercussions. This hypothesis leads to the realisation of how microbiological contaminants spill over into our food and water sources and become a part of us. We often do not realise biotechnology's effects until it is too late, and dystopia has already manifested.

Layering each screen are projections of mosquito larvae replicating quickly, almost as quickly as the footage of cancer cells spreading over the four different screens. The replication of the mosquito larvae points to research on insecticide resistance[57] whereas the multiplication of cancer cells bring into conversation the many health concerns caused by DDT, cancer being one of them (Bornman *et al* 2017:1-3). Microscopically, cancer cells, pollutants, and larvae resemble gems, raindrops, or even highly detailed diatoms. Despite the horror of their existence, they are visually beautiful, but foretell an ecosystem on the verge of collapse. Through artistic techniques, the work creates a means to confront the horrors of these unfolding tragedies aesthetically.

The artwork assists in constructing social awareness around the reality of capitalism, postnaturalism, and biotechnology, as well as the roles they play in our shared environment. In doing so, the implications of our actions and outputs become visible, affective, and tangible through the construct and content of the videos. An affective encounter with the artwork does not intend to prescribe what each person *should* feel, but rather strives to bring the audience together in a shared experience where each feels and contemplates differently depending on her/his own life experiences. In this way, the work constructs – to the extent that I have access to it – a democratic space open to all viewers to sense, feel, think, and act within themselves while being confronted with research and facts around the topics addressed (Thobo-Carlsen 2017:108).

3.1.2 *A Dangerous Game*

Despite unprecedented diplomatic efforts, concentrations of greenhouse gasses and the effects of climate change have increased year upon year. According to Lenfest-Earth Institute Professor of Natural Resource Economics at Columbia University, Scott Barrett,

[57] Feedback from the UP ISMC on the 2014 Multimalarial Initiative on Malaria (MIM) Conference highlighted the emergence and spread of drug/vaccine/insecticide resistant mosquitoes (UP ISMC 2014:[sp]). The necessity to develop new tools specific for elimination of infection rather than control were addressed as essential to combat the adaptable nature of the mosquito (UP ISMC 2014:[sp])

many countries have pledged to avoid the dangerous implications of climate change, but many of their actions virtually guarantee them breaching the limits they warn us against (Barrett 2015:[sp]). Throughout much of Barrett's career he contends that we (humans) are playing a *most* dangerous game with the Earth's ecology (2015:[sp]). Echoing Barrett's concerns, the title of the installation, *A Dangerous Game* (2021), spotlights the impacts of global warming on vector proliferation and the effects it will have for the future of both humans and non-humans.

Figure 19: Danielle Oosthuizen, *A Dangerous Game, 2021*. Six glass boxes, water, mosquito larvae, fluid mechanics, installation view. Photograph by Carla Crafford.

The installation comprises six plinths with a glass box – filled with varying levels of water – on top of each (Figure 19). As with most bio art, living matter is an essential feature here, and for *A Dangerous Game*, I place infant mosquito larvae[58] into the six glass boxes. The artwork becomes a performance where the water levels in the different glass

[58] Working with living biomatter – such as mosquito larvae – that often carries hostile rhetoric, forces the viewer to engage with a substance that evokes a sense of unwanted nearness or, as Winfried Menninghaus (2003:1) terms it, disgust. She states (2003:1), the experience of unwanted nearness "or intrusive presence is the fundamental schema of disgust". Sara Ahmed claims (2004:86), "[to] be disgusted is to be affected by what one has rejected". In her attempt to answer what it means to designate something as disgusting, Ahmed (2004:86) argues that disgust is ambivalent since it also involves desire and attraction.

boxes change using a system of fluid mechanics. This slow shift in water levels showcases the unpredictability in the dispersion of weather as global warming effects the proliferation of vector-borne diseases. According to Sadie Ryan, Catherine Lippi, and Fernanda Zermoglio (2020:2), accelerated rainfall is beginning to occur in some areas where there were previously droughts, while other areas known for frequent rainfall are experiencing drought-like conditions. These unstable weather patterns may result in an increase in the dispersion and breeding of Anopheles mosquitoes in previously malaria-free areas, while other areas may become malaria-free due to a decrease in breeding (Ryan *et al* 2020:1-2).

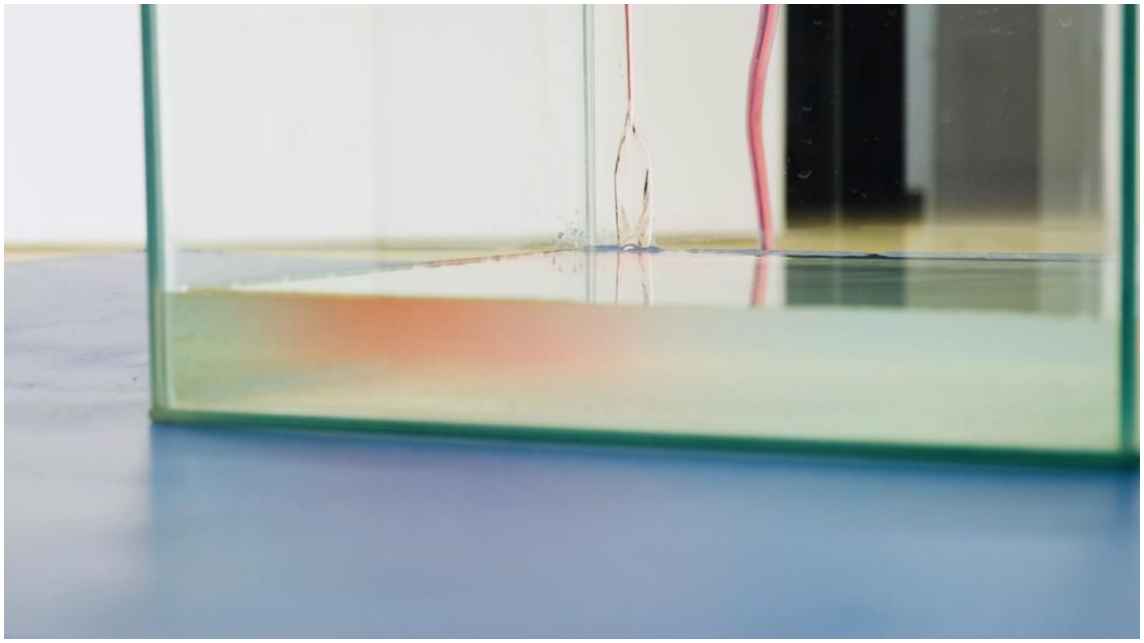

Figure 20: Danielle Oosthuizen, *A Dangerous Game, 2021*. Six glass boxes, water, mosquito larvae, fluid mechanics, installation view. Photograph by Carla Crafford.

As the water fills up certain glass cases (killing the larvae)[59] while draining water from others (allowing them to breath and thrive), the work enacts, at a micro scale, the shift in more significant global temperatures impacting the spread of malaria. The periodic and engaging nature of the installation integrates the audience visually with the artwork, as they witness some larvae die while others thrive. In this way, the work "forces the artist

[59] Larvae thrive in 24 cm deep water. Because they must return to the surface to breath, they cannot survive in waters that are too deep. As soon as waters increase in depth, the larvae die by drowning.

and the viewers" into an active role in the cycle of life and death – the same role which capitalism partakes in (Catts & Zurr 2004:[sp]). By revealing how capitalism and politics have brought us to our era of climatic and ecological unpredictability, I relate the installation to another of the Capitalocene's effects – water pollution. While the murky tinge water refers to studies discovering accelerated mosquito breeding in polluted water (National Institute for Communicable Diseases 2019:[sp]), the two red cases imply danger. Red is an affective and emotionally charged colour, often imbued with different meanings related to fear, intensity or warning. The red aims to foretell of the dangers associated with the changing climate as we progress into our shared future. According to Mentzel, Schücker, Hagemann & Strauss (2017:1) the colour red has been shown to affect behaviour, psychology and physiology. The larvae-ridden red and brown waters mix as the performance unfolds (Figure 20).

Figure 21: Danielle Oosthuizen, *A Dangerous Game, 2021*. Six glass boxes, water, mosquito larvae, fluid mechanics, installation view. Photograph by Carla Crafford.

The deliberate use of mosquito larvae (Figure 21) for this work stretches further than simply illustrating the symptoms of crisis and shifts in vector proliferation of malaria. Although many viewers may consider the larvae disgusting or repulsive, something in the artwork also attracts attention. Ahmed (2004:86) describes this paradoxical

mechanism as an involuntary movement of pulling away as if our bodies were thinking for us, yet simultaneously being drawn towards the thing that disgusts, a force that "opens [our bodies] up to the bodies of others". This 'opening up' results in a linkage between the *disgusting* object (the mosquito larvae) and the *disgusted* subject (the viewer). We become connected to the tiny life forms. They start to represent our own fear and struggles for survival as the world around us changes. The material dimension of the bio artwork aims to stage an unsettling encounter with research on climate change – to affect the viewer to understand our compliancy in the biological and ecological disturbances brought forth by our actions.

3.1.3 Khosi khadzi wa lufu

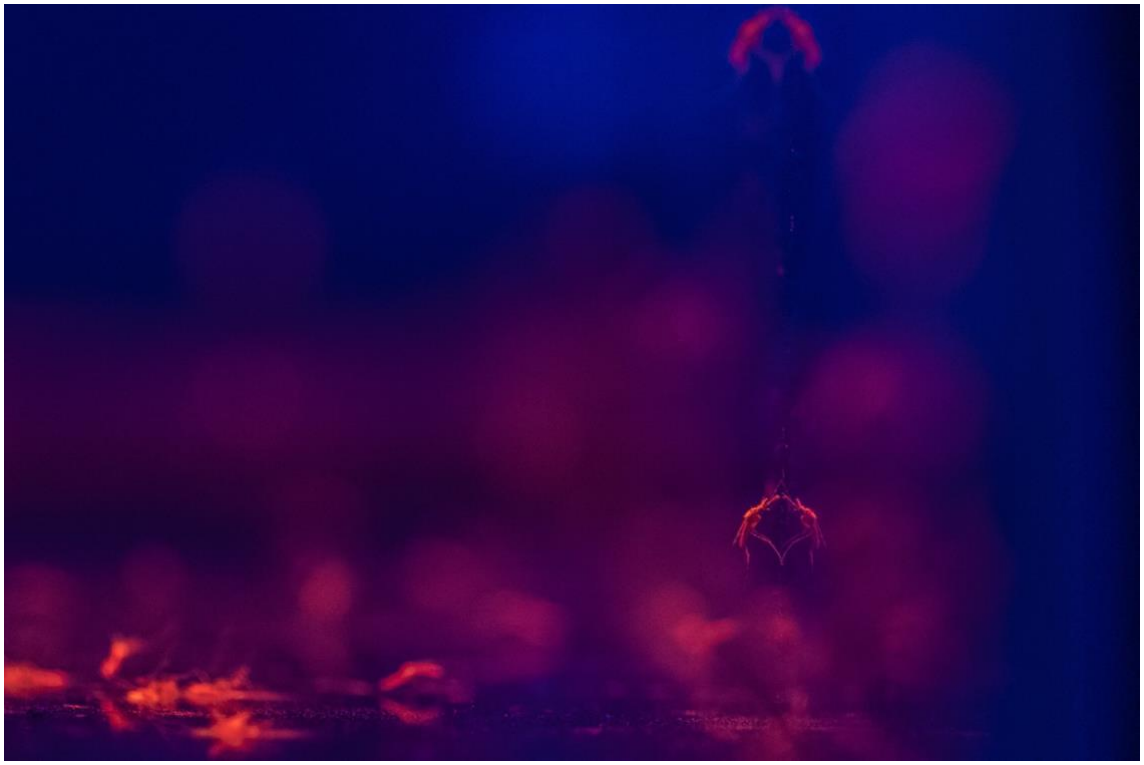

Figure 22: Danielle Oosthuizen, *Khosi khadzi wa lufu, 2021*. Fluorescent dusted Anopheles mosquitoes and undusted Anopheles mosquitoes, installation view. Photograph by Carla Crafford.

Through a real-time experience with artwork, bio art provides a novel canvas for the viewer to explore her/his conflicting emotions around laboratory/industry operations, and personal/cultural beliefs. The title of the work *Khosi khadzi wa lufu* (2021) is derived from

the local Venda[60] name given to the female Anopheles mosquito, translated as 'Queen of Death'. The cultural stories of the Venda people functioned as an archive[61] and inspiration for *Khosi khadzi wa lufu*. Though *Khosi khadzi wa lufu* draws inspiration from local African and Venda folklore, its aim is to probe more serious concerns relating to biotechnology. This is achieved by curating a space for the viewer to engage with something that appears to stem from another world – luminescent mosquitoes (Figure 22 and 23).

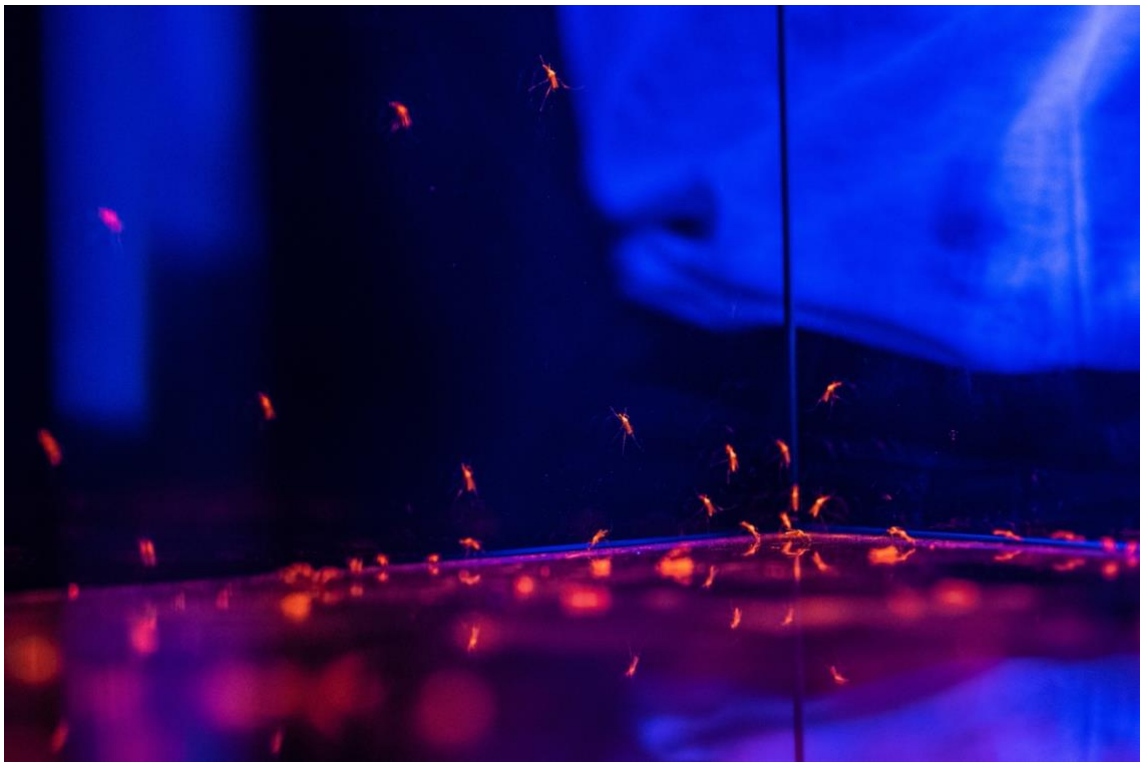

Figure 23: Danielle Oosthuizen, *Khosi khadzi wa lufu, 2021*. Fluorescent dusted Anopheles mosquitoes and undusted Anopheles mosquitoes, installation view. Photograph by Carla Crafford.

[60] The Venda people, who live in Thoyondou, have been important for research conducted by the UP ISMC. Research often revolve around understanding the effects of malaria on the community and their surrounding ecology. Located in the Limpopo province of South Africa, Thoyondou is a hotbed for malaria. Based on conversations with scientists from the UP ISMC who engaged with individuals from Venda, stories emerged around the local peoples' views, beliefs and naming of the disease. These served as inspiration for the naming of *Khosi khadzi wa lufu* and *Lufu kha a kovhela.*

[61] Research around African belief systems concerning malaria and the mosquito do not directly form part of this research. However it did play a tremendous role in the creation of both *Khosi khadzi wa lufu* and *Lufu kha a kovhela.* By investigating different views and legends surrounding the mosquito, the artworks adopted additional meanings and entry-points for engagement.

As one enters a darkened room, the glowing silhouettes of colour-dusted mosquitoes under ultraviolet lights stand out among the other, seemingly normal (undusted) mosquitoes. The glowing specimens become the 'artwork' or 'light' within the dark room. Using a scientific dye technique whereby the mosquito is frozen, coloured, and then released, the small insects become the visual amplification of biotechnology. They embody chimaeras, postnaturals, or even monsters. We start to see the effects of these alterations – although minor – to the dusted mosquitoes as they start to drop dead after approximately four hours into the exhibition[62]. At the end of the exhibition, we are no longer mesmerised by hordes of glowing airborne mosquitoes but horrified by hundreds of dead bodies scattered over the base of their glass box (Figure 24).

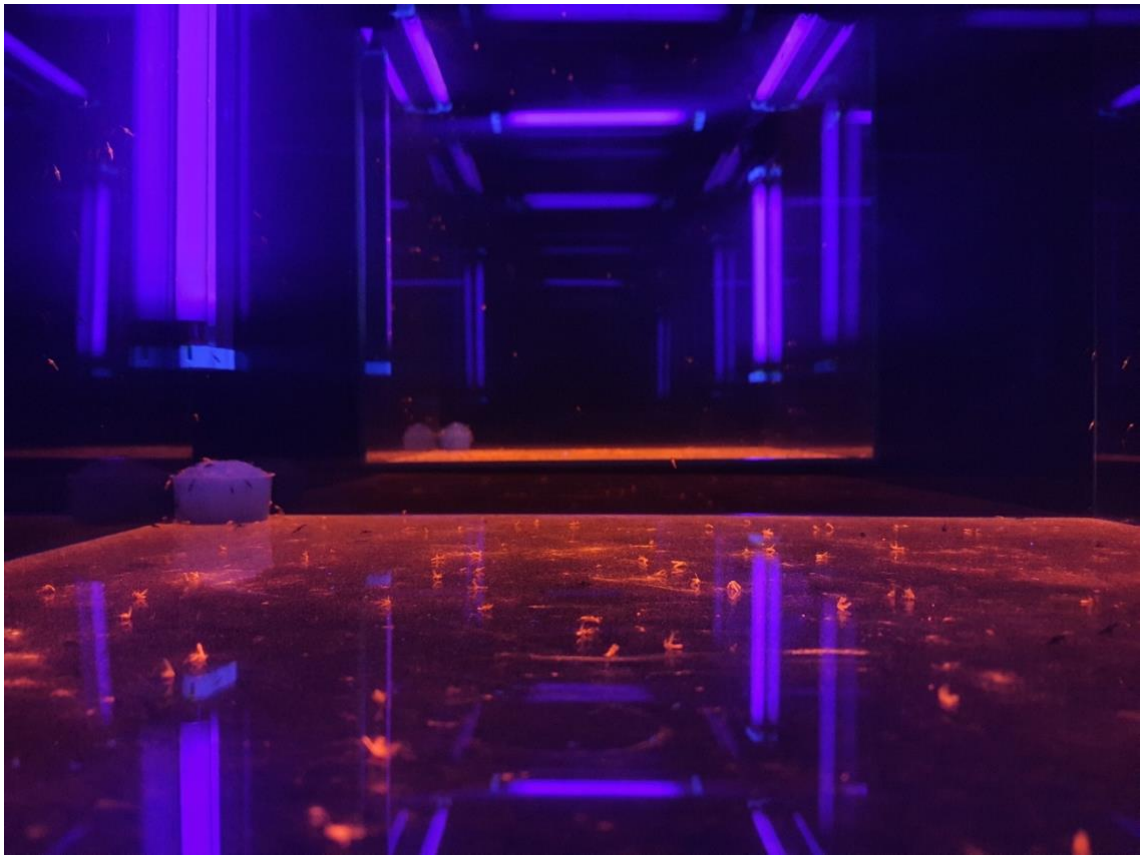

Figure 24: Danielle Oosthuizen, *Khosi khadzi wa lufu (2021)*. Fluorescent dusted Anopheles mosquitoes and undusted Anopheles mosquitoes, installation view. Photograph by Author.

[62] The performance was inspired by genetically engineered mosquitoes whose biology was altered to pass on infertility genes, wiping out entire generations of mosquitoes (James 2005:46).

Gleaned from an affective angle, the death of these ostensibly postnatural creatures cause distress and unease. Grounded on empathetic projection, the artwork examines both the beauty and the messiness of the postnatural. We start to feel sorry for these tiny glowing creatures who are weighed down by the luminescent powder and eventually lay down to die. The framing of the artwork sets the stage for a visual meeting between the audience and the artwork, where the focus falls on each viewer's physical experience and her/his attempts to visually decode the glowing mosquitoes' aesthetic forms and possible meanings. Here, the affective aim is to disrupt meaning and raise questions. The ontology of the affect is uncertainty, to provoke a reminder of the uncertainties encapsulated within the Capitalocene. This is the unambiguous, critical potential of bio art – to create an affective environment in which living matter is staged in such a way that the viewer can participate and contemplate this constructed situation.

Although it is important for artists to address problematic matters that influence our (and nature's) way of life, I am not under the impression that art alone can combat the larger system of change brought on by the Capitalocene. For this reason, in *Khosi khadzi wa lufu*, I show the natural interweaved with the unnatural – a reality that we must accept as we move into our shared future. According to Morton (2010:27) we "need to stay with what is broken, abject and negative", accept the damages already done by capitalism and world empires, and take these damages as a backdrop, as a caution for promises made in the name of utopian betterment (2010:27). *Khosi khadzi wa lufu* aims to plant seeds of co-existence[63] in the mind of the viewer by showing the glowing mosquitoes (an ode to biotechnology and postnaturalism) inhabiting the same space as the natural unmarked mosquitoes. The essence of the work functions as a visual interweaving of the natural with the engineered. Acknowledging that certain damages have already been done and that we must proceed with caution when manipulating the ecology around us.

Khosi khadzi wa lufu's sister artwork *Lufu kha a kovhela* (2021), translated from Venda to mean 'death after sundown' is comprised of a series of photographs taken in the laboratory while experimenting with different dusting compounds for *Khosi khadzi wa lufu*. These photographs were taken using a micro lens on a slow shutter to capture the

[63] According to Morton (2010:10), the value of both art and literature in environmental crises lies in their capacity to deal with what is shameful, painful, and lost. These are "seeds of future ways of being together" (Morton 2010:123).

ghostly trails left by the mosquitoes as they fly around their enclosure. The photographs carry a double meaning. From one perspective they tell the story of a local African legend that believe mosquitoes originally came from the ashes of a giant creature or demon that was sent to plague mankind[64] (Constantine 2011:49-50). From another angle the work draws parallels between the increase in malaria and global warming. *Lufu kha a kovhela* achieves this by visually juxtaposing the images of flying mosquitoes (Figure 25) with that of solar flares emitted by the sun (Figure 26). Due to the thinning of our atmosphere, we are gradually falling victim to rising temperatures emitted by the sun's rays.

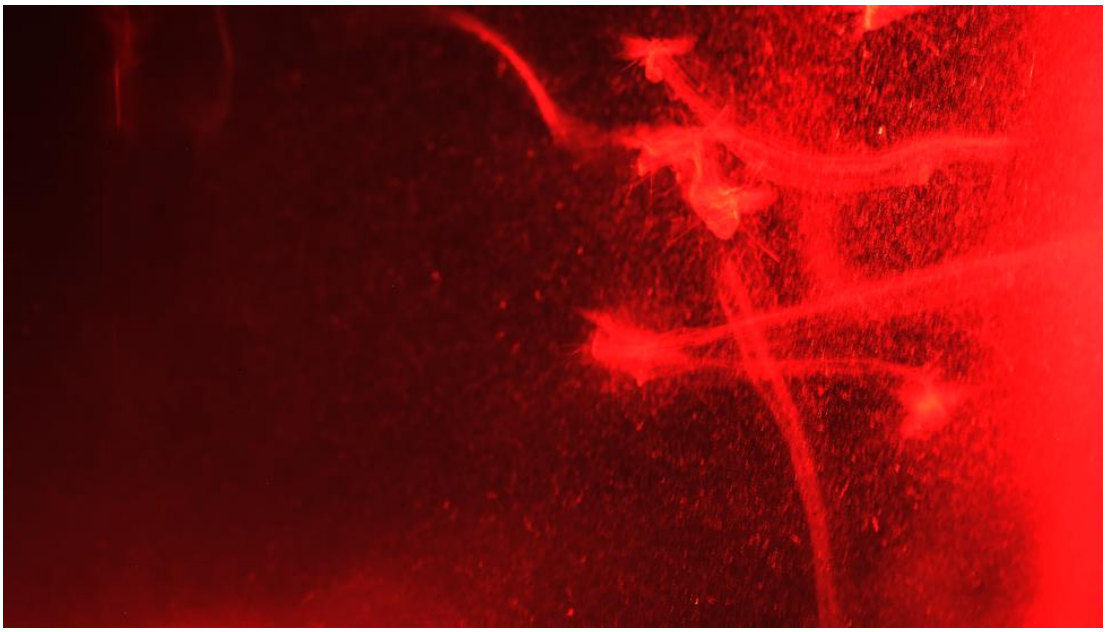

Figure 25: Danielle Oosthuizen, *Lufu kha a kovhela*, 2021. Giclée on archival paper, 540mm x 360mm. Photograph by the author.

[64] Another belief relating to the origin of the mosquito and malaria stems from an ancestral curse. According to Asahngwa Constantine (2011:49) each year elders from different East and West African communities make a pilgrimage to the ancestors. During this meeting they can either bring back curses or blessings to their communities (Constantine 2011:49-50). It was during one of these pilgrimages to the ancestors decades ago that mosquitoes arrived as a curse (Constantine 2011:49-50). The story goes that during an encounter with the ancestors, the elders took their blessing which was destined to maintain good health (Constantine 2011:49-50). As they readied to leave with their luggage, a person from another opposing community came to steal their blessing in exchange for a bad parcel which contained a curse – mosquitoes (Constantine 2011:49-50) The elders were unaware of this and brought back their luggage with the mosquito curse (Constantine 2011:49-50). Since then, mosquitoes and malaria has plagued several regions across the continent of Africa.

Figure 26: An image showcasing the sun's solar flares. (Maewar 2020:[sp]).

Through the use of colour and composition the photographs were created to be "sensorily evocative", influencing one's consciousness and interoceptive awareness (Esrock 2010:228). Introspection refers to our sensing of "inner bodily" states. These may include feelings of heat, pain, touch or thirst, to name a few (Craig 2003:500). When opening oneself to the effects of the artwork, your body may become activated to experiencing the heat (for example) as if it was physically emanating from the surface of the object (Freedberg & Gallese 2007:201). Through its physicality, the mosquitoes awaken powerful stories, meanings and significance through the work of art. Even though each viewer may respond completely differently to *Lufu kha a kovh* and *Khos khadzi wa lufu* each will inevitably be compelled to reflect on their own political, philosophical and cultural relationship to nature, technology, life, death and their opinion of the mosquito.

3.2 Soundscapes for the Postnatural: A Mosquito Sonata

Building on ecological sound art (also termed acoustic ecology, environmental sound art, or eco-sound art), this section investigates the expansion of bio art into the realm of

sound, alternatively termed bioacoustic sound art[65]. Bioacoustic sound art draws together biology, technology, and sciences to express the hidden ecological sounds and concerns that are typically inaudible or unnoticed by humans[66]. I use bioacoustics to express the hopes, disasters, and possibilities of living in this age of radical transformation.

Using the recordings of approximately 100 Anopheles mosquitoes captured across two sessions, *Anopheles* tells the story of the tautological battle raged by man against malaria, and by extension, the mosquito. The sound installation is made using 24 audio interfaces, each playing a distinct 11-minute composition which (when standing in the middle of the installation) merges to form a complete symphony. Imbued with emotional upheavals, the work follows the narrative of an endless and haunting conflict. By incorporating electroacoustic[67] techniques, the sound of the mosquito is transformed from natural to unnatural. This is achieved by stretching the original acoustic parameters of the mosquito's sound to sculpt an artificial mosquito melody. By manipulating the raw sounds of the mosquito, the composition builds a sense of discomfort and eeriness. The sound can be seen as having an alluring texture and a sonic splendour that complicates our limited preconceptions of the mosquito as a living being. In doing so, the work urges the audience to listen to the hidden structures within nature and beyond the immediate sense of irritation and prejudice often invoked by these insects. As soon as the audience begins to realise what the sound is caused by, their perceptions may alter and take on a new meaning. In this way, the work creates a space where the audience may feel closer to that which they usually alienate.

[65] A bioacoustic approach is centred around forging new listening practices, which can directly engage issues of agency, power, and ethics (Wright 2017:6). By aligning with science, bioacoustics can capture that which usually renders itself inaudible. This function might be summed up as the making visible of the invisible, making perceptible of the imperceptible or, as Guattari and Deleuze (1994:164) term it "the harnessing of forces". This harnessing of forces may prompt an affective awareness of the more-than-human worlds around us.
[66] Bioacoustic sound art owns a power that is unique to the medium. Unlike an image or artwork experienced and perceived as something beyond the body and apart from the self, listening to sound is an intensely affective and intimate experience. It infiltrates the listener's body and burrows into the mind (Gilmurray 2016:77). We can be transported by sound, bathe in it, and become immersed by it (Gilmurray 2016:77). Sound does not just tell a story of the environment, but also what is happening in the environment.
[67] Electroacoustics is defined by the Oxford English Dictionary (2020:[sp]) as "the technology of converting acoustic energy into electrical energy and vice versa".

Figure 27: Danielle Oosthuizen, *Anopheles,* 2021. 11-minute bioacoustic sound installation, 24 speaker interface, mixing board, installation view. Photograph by Carla Crafford.

Falling into the framework of ecolistening[68], the sound composition is based on the idea that the limitation of sight is overcome by the sense of hearing which enacts the ultimate environmental principle of all-inclusive interconnectedness, according to David Ingram (2010:59). A work such as *Anopheles* assaults the senses. Through a multimodal and multisensory experience, the sounds penetrate the body to allow for an affective engagement with nature. This may foster more empathy towards our impacts on nature and vice versa. The installation (Figure 27) makes use of binaural panning[69] to mimic the natural flight of the mosquito around the viewer. With various sounds 'hitting' the body from multiple different speakers and angles, the audience becomes immersed in the artwork and the concerns its sister artworks lay before us.

Through careful sound design the composition makes allusion to mosquitoes dying out and re-emerging more violently – an elegy to our age long battle against the mosquito; the crashing of water made to reference unpredictable vector proliferation and global

[68] Ecolistening is based off ecocriticism, meaning to listen to an environment impacted by humans and vice versa (Ingram 2010:59).
[69] Binaural panning is defined by the Oxford Dictionary (2020:[sp]) as "of, relating to, or involving the simultaneous use of two ears or the presentation of the same audible stimulus to both ears".

warming; mosquitoes morphing to echo the screams of humans; and biotechnology – turning our nature into a technological simulation. However beautiful the composition may sound at its peak, the noise of a nature ensnared and transformed by technology represents the ultimate pseudo utopia.

According to Don Idhe (1974:45) listening is a complete bodily experience: "your feet are just as involved as your ears". Idhe proposes that one does not only listen with one's ears but hears with one's entire body (1974:45). Listening to *Anopheles* moves your entire body. As an intense affective encounter, *Anopheles* is difficult to translate into words. Because it represents abstract ideas associated with Capitalism, postnaturalism and pseudo utopias, it avoids following a clear narrative and instead falls within the scope of numerous abstract possibilities and meanings. Echoing earlier discussions on bio art, bioacoustic sound art challenges conventional understandings of life and its meaning. Both bio art and bioacoustics are concerned with exposing an ontology of life. Among other questions and issues, this includes what life is, how do we listen to its hidden structures, and see or hear its 'unseeable/unheard' fragments; as well as where the living forms part of a multitude of relations with its milieu – humans, world empires, climate change. By collating biology and sound, *Anopheles* provide a space where Western ways of thinking about life are questioned in a playful yet explicit way (Radomska 2017:378).

Born from *Anopheles*' sound composition I made *Tachycardia* (2021) (Figure 28). *Tachycardia* is a series of prints that visually extract the soundwaves from *Anopheles* to mimic the familiar rhythms of a heartbeat as captured by an electrocardiogram (ECG). The work draws its name from the medical term Tachycardia, a term that describes a heart beating at an unhealthily fast pace (Oxford Dictionary 2021:[sp]). The series metaphorically relates this fast-paced heartbeat to the rapid development of technology and how our environment struggles to keep up. By juxtaposing the rhythms of *Anopheles* with that of a heartbeat, the work comments on the responsibility that humans should have towards maintaining and growing the Earth in a healthy way. *Tachycardia* further comments on the delicate balance between humans, nature, and technology. For every action or new development that we thrust into nature, there is a consequential reaction that influences both humanity's and nature's well-being.

Figure 28: Danielle Oosthuizen, *Tachycardia,* 2021. Giclée on archival paper, 440mm x 387mm. Installation view. Photograph by Carla Crafford.

In essence, *After Nature* (Figure 29) is premised on the act of creating postnatural worlds that rethink subjectivity – postnaturalism as a new form of nature, a decentring of humanist anthropocentrism, and serious questioning of speciesism to provide an understanding of ontogenesis (the processes of *becoming*) instead of being fixated on ontology (the states of *being*). In *After Nature*, the senses do not operate in isolation. Rather the artworks work together to elicit affects and experiences that are premised on different sensory modalities. In my curation of the exhibition, I use an approach of multisensory stimulation to evoke empathy, uncertainty, perhaps even fascination, as well as other unpredictable emotions. Rather than prescribing the 'right' way to experience the art, I concur with Ellen Esrock (2010:293) that each person has a unique affective experience. Our analysis of how art functions should not be limited but should strive to distinguish "bodily awareness" (Esrock's 2010:293).

Figure 29: Danielle Oosthuizen, *After Nature*, 2021. Installation photograph (2021).

Although not all viewers would necessarily view or engage with *Anopheles'* sister-artworks in the gallery, they cannot escape the overwhelming impact of the soundscape's texture that penetrates and mediates the gallery space. The dominating nature of the sound artwork was designed to amplify the viewer's experience of the sister works. Each artwork uses affect in different ways, but with the same goal – to provide viewers the opportunity to experience something potentially transformative. In the words of cultural theorist Jenni Lauwrens (2020:18):

> There is no guarantee that everyone will accept the invitation offered, nor that this transformation will be the same for everyone; the artworks merely offer a possibility [for] people [to] think differently about the[se] topics.

The exhibition probes the critical transformative potential of art and sound within the space of a postnatural world. By enfolding the viewer in a constructed postnatural universe, I hope to show how our bodies are inexorably connected with the physical world around us. This cognition aims to influence moods, perceptions and perhaps even affect a change in the viewer's cultural outlook and context from which they perceive malaria, and the mosquitoes in relation to other influences of climate change,

biotechnology and the Capitalocene. Through the act of meaning-making art is able to shape an intimate engagement with the above addressed topics – the mosquitoes become imbued with powerful meaning and significance. They draw attention to our responsibility and relationship with the environment.

3.3 New Directions for Art in Science

In the above section I deconstructed the meanings, intended affects and theories that informed the production of my creative output. For this section I delve into the experiences, thoughts and processes that arise from working alongside scientific partners to convey complex messages through the practice of art. I reflect on my own art-science collaboration by arguing for the convergence of the two – often thought of as separate – practices.

For me, there exists a symbiotic relationship in the art-science collaboration. By incorporating the artistic mind into this process of discovery and communication, a significant 'opening up' of thoughts and discussions may occur. Through employing continuous interaction with the public, scientists and artists can develop and learn new ways of understanding the issues at stake. Through creating aesthetic and affective experiences that combine scientific and artistic knowledge, a more inclusive knowledge can be achieved: or as Claudia Schnugg (2019128) sums it up: "where science states meaning, art expresses it".

Artworks, such as those found in *After Nature*, emanating from art-science collaborations do not exist for the pure purpose of accurately translating knowledge and fact to illustrate scientific ideas: rather, they are shaping far-future visions, raising questions about life, creating unforeseen connections, posing ethical insinuations, and triggering emotional reactions and feelings (Schnugg 2019:158). Art allows for the freedom to creatively search for future worldly possibilities and dream of *what-if*. Bio artist Oron Catts (2015) points out that art is not bound to the evidence of scientific outcome but rather is the creator of fiction. In the same vein, Dumitriu (quoted in Schnugg 2019:158) argues that "art can raise questions, but art does not have to provide answers".

Bio art is a mode for encapsulating knowledge and affect, and enabling discussion based on art's societal role. Art is allowed to provoke, be contradictory, break boundaries, and confront viewers with paradoxes (Schnugg 2019:160). This involves the responsibility of

open and accurate communication for all actors involved in the art-science discourse (Schnugg 2019:160). Just as science does not have all the definitive answers and is often left with numerous open-ended questions, so too does art have many different interpretations. Art may aid in allowing the public to understand that the scientific pursuit to answer the unanswered questions, and its recurrent processes of discovery, frequently lead to more new questions (Schnugg 2019:160).

Another critical aspect of the oscillation between art and science is to enable a cross-cultural understanding, namely, how could more expansive interpretations and approaches be unearthed through experiential investigations of bio art to aid in our current understanding of science. Both artistic and scientific research and publications are often situated within pre-visual, theoretical terrains. However, artists possess a "visual fluency which sways between that which remains highly conceptual" and that which can be experienced (Chung 2019:[sp]). Art can make highly conceptual and theoretical data communal, affective, and observable. Artists' expertise lies in their creation of a desired, sensible experience in aesthetic expression. The artistic practice allows for a unique range to explore questions and facilitate dialogue.

Considering a further argument for the convergence of art and science, Schnugg (2019:116) states that placing too much focus on one single "kind of knowledge", like science or art, may result in "habitual blindness" because the primary method for thinking and researching can lead to the overlooking of other critical perspectives or outlooks which lie beyond that singular kind of knowledge. A "two-eyed" vision, Ernst Cassirer (1944:13) argues, is essential to ensure a more comprehensive outlook on things, environments, or the objects that are being investigated. Cassirer (1944:13) proposes that science and art form two sides of the same coin: two perspectives on the truth. Both have to be accounted for to capture a true reflection of the world (Cassirer 1944:13). He argues that to be open to both artistic knowledge (the creation of information about how the world is shaped, interactions, relationships and meaning) and scientific knowledge (which employs methods like analysis, deduction and reduction, and classification) can lead to an enrichment of research and human-nature values (Cassirer 1944:13). This "two-eyed" vision would thus serve to intensify experiences in place of categorising and reducing them. Susanne Langer (1957:3) equally argues in favour of the practice of art as not merely a different mode of knowledge, stating that aesthetics can forge artistic forms that can embody, evoke, or represent the human experience. Thus, bio artists contribute to the hard facts of science by unfolding a bigger picture of the relationship

between the subject investigated, its impact on the bigger picture of the world, and the human experience thereof.

The biotechnological consequences of past, present, and future decisions is a complex reality that we must start to face, one that inflates our sense of mastery over the biological world while at the same time complicating our sense of kinship with it. One way to comprehend the difficulties brought forth by the increase of biotechnologies in the environment is to look towards the imagination of artists as they dream up or expose what the present and future, governed by biotechnological discourse, may come to look like. The rhetoric of imagining a possible future, whether it be utopic or dystopic, may well resist conclusions and instead suspend us in a thoughtful stasis, emphasising the difficulty of a situation rather than quick ways out of it (Simoniti 2019:196). In bio art, evocations to living presence may be crucial to achieving this stasis (Simoniti 2019:196).

In this chapter, I attempted to outline a new fabric of thought brought forth by bio artists as we take biotechnological manifestations of the present and weave them into a speculative future. As we progress into an unknown future, it is important for artists to allow audiences to see what this unknown 'utopic' future presented by capitalism may hold. *After Nature* brings together a convergence where physical material life (biology), video and image (information, code, patterns), sound (bioacoustics), and affect interweave to produce a realisation that nature and humans all form part of the same symbiosis. The exhibition's postnatural approach seeks an uglier and messier intimacy with nature than we might be comfortable with – a non-mimetic and non-innocent ecopoetics (Ronda 2014:102;105).

CHAPTER FOUR: CONCLUSION

4.1 Conclusion

By reflecting on the current world's ecological and postnatural state, my research frames bio art as symptomatic of other, more significant changes happening in technology, society, and evolution in response to capitalism, the promises around pseudoscience and pseudo utopias, and biotechnological developments. In this narrative, my research suggests that bio artists actively seek to uncover the implications for humanity and nature as defined by biotechnological developments, whether utopic or dystopic, natural, or monstrous. Consequently, bio art does not simply derive from our present, post-genomic era; it is concerned with the future, what the future might come to look like, how it might change, and what implications it may hold for both humans and nature. It explores the boundaries between the non-living and living, and the inorganic and organic; the relationship between the non-human and human; as well as the various thresholds of the living.

To immerse the viewer in the concerns addressed by my art, my research draws on theories of the Capitalocene, postnaturalism, pseudo utopia, dystopia, and affect theory. My bio art practice intends to forge pluralistic approaches to materialism. This was done by creating interdisciplinary- and transdisciplinary-based artworks whose purpose was never to eliminate worldly wonder or deny the ontological relatedness of all living beings, but instead, to make present, vivid, and meaningful, the world's imbroglio, perplexity, and messiness. Using art as a medium, this research hopes to warn of our actions while using the strange, unexpected, and beautiful to elicit affect. Here, the collision between art and science forms a space where wonder, science, and malleable bio-matter (which is frequently interlaced with worldly anxieties and dystopic foreshadowing) continually stumble and weave into one another. By seeking the beauty within the messiness and ugliness of the ever-increasing postnatural state that the world is moving towards, I position bio art as a vital art form since it gives artists, including myself, the opportunity to explore new fields and engage with ground-breaking scientific research and equipment. At the same time, bio art allows the viewer to see beyond the every day – to see the biological impacts that often go unnoticed or unheard.

Although my research did not actively contribute to new scientific knowledge, it did participate in its communication through an attempt to induce a sense of responsibility in

my audience to share the implications resulting from the influence of human culture and biotechnology on the environment. By drawing from shared experiences and hopes for a healthy ecology, the artworks were born from numerous conversations with experts in their respective fields. Although I cannot verify the different degrees of affect elicited by the artworks, I can be reminded that art itself is not a grand solution guaranteed to save us from ourselves. Instead, it works in more subtle ways to affect perceptions and knowledge on current and speculative future world events.

As we progress into a future where technology gradually sculpts cultural awareness, this study ultimately suggests that bio art's ventures may be beneficial in aiding the understandings of and discourses surrounding biotechnological development and its impacts on nature and humanity. From a theoretical perspective, the artworks in *After Nature* can shape spaces in which provocative and controversial questions can be raised and debated. From a pedagogic perspective, it can lead to an enhanced comprehension of fundamental political and ethical problems faced in biotechnological development by creating an environment where the greater, non-specialist public can access the world of science. From a political perspective, *After Nature* can aid in cultivating a critical view towards biotechnology. From an institutional perspective, the exhibition can partake in the more generalised coming together of art and science, deconstructing the divides that separate the two 'cultures' of art and science. And lastly, from an affective perspective, this study can allow for a more immersive, emotional connection to biological impacts on nature and society.

Ultimately my art practice and research intended to convey the central idea in which power relationships cause imbalances in the more extensive ecology. I aimed to create a sense of responsibility, sadness, remorse, or even wonder by using art to address the consequences of our actions. In this regard, affective responses to the artworks may be beneficial in driving us towards movement, thought, or even action, which can likewise suspend us across a barely noticeable layer of force-relations, or even leave us overwhelmed by the world's apparent intractability and our position within it.

4.2 Coda and Suggestions for further Research

Although the focus of the dissertation falls on the production of bio art in affecting a change in the *viewer*, I found it necessary to also briefly share personal encounters and responses to my bio artworks and how the process of collaborating with the UP ISMC contributed to change my horizon. I conclude the coda by referring to limitations of the study and suggestions for further research.

Planning and conceptualising working with living matter (such as the mosquitoes) presented its challenges, especially when realising the outcome is not always what was envisioned. Living matter is processual, multiplicitous, and always already uncontainable in both its material and conceptual sense; this is precisely what makes bio art so unique as a medium. While creating specific works, I had to allow for change to occur and be flexible in the outcomes of what was envisioned. This inability to not always fully have control over the 'artwork' greatly affected my understanding of bio art as a constantly evolving and changing practice - one must always leave space for the unexpected, as things do not often go as planned.

While the 'unexpected' can sometimes be marvellous, glorious and ground-breaking, it can also be monstrous, giving way to the darker side of technology's impacts. I was privileged to have scientists from the UP ISMC guide me in the outcomes of my artworks, ensuring that the 'unexpected' translate into something beautiful. Working with the UP ISMC allowed me to push boundaries of traditional art-making practices. I had freedom to move between different spaces and campuses. With this freedom came the added benefit of access to people from different fields of knowledge. This broadened my awareness and allowed me to conduct research and create art that stretches across different fields.

Due to the nature of bio art, the research, even at this point, is still in process, constantly replicating, ceaselessly establishing connections and ever-emergent. Despite the linear order and structure of the dissertation's chapters that reflect the interconnection of bio art with affect, there is still much more to explore in the field. The topic of bio art is made up of multiple directions that are constantly in motion and advancing. Some of these directions that spark further curiosity include research on biophilosophy, the uncontainability of life, the entwinement of living bodies and technologies and the relationship between power, politics, ethics and life.

Limitations for this particular study mostly revolved around the worldwide COVID pandemic that restricted access for most people, including myself. The study was placed on hold for approximately a year wherein I had limited access to the University. With this restricted access came a restricted exhibition. The exhibition was only open for a few hours and allowed a small amount of people entry. These regulations restricted the original intent of the exhibition to affect a broader audience. Due to the nature of the exhibition, the artworks cannot simply be recreated for audiences to experience again once COVID restrictions fall away. This was partially overcame through good documentation of the artworks.

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