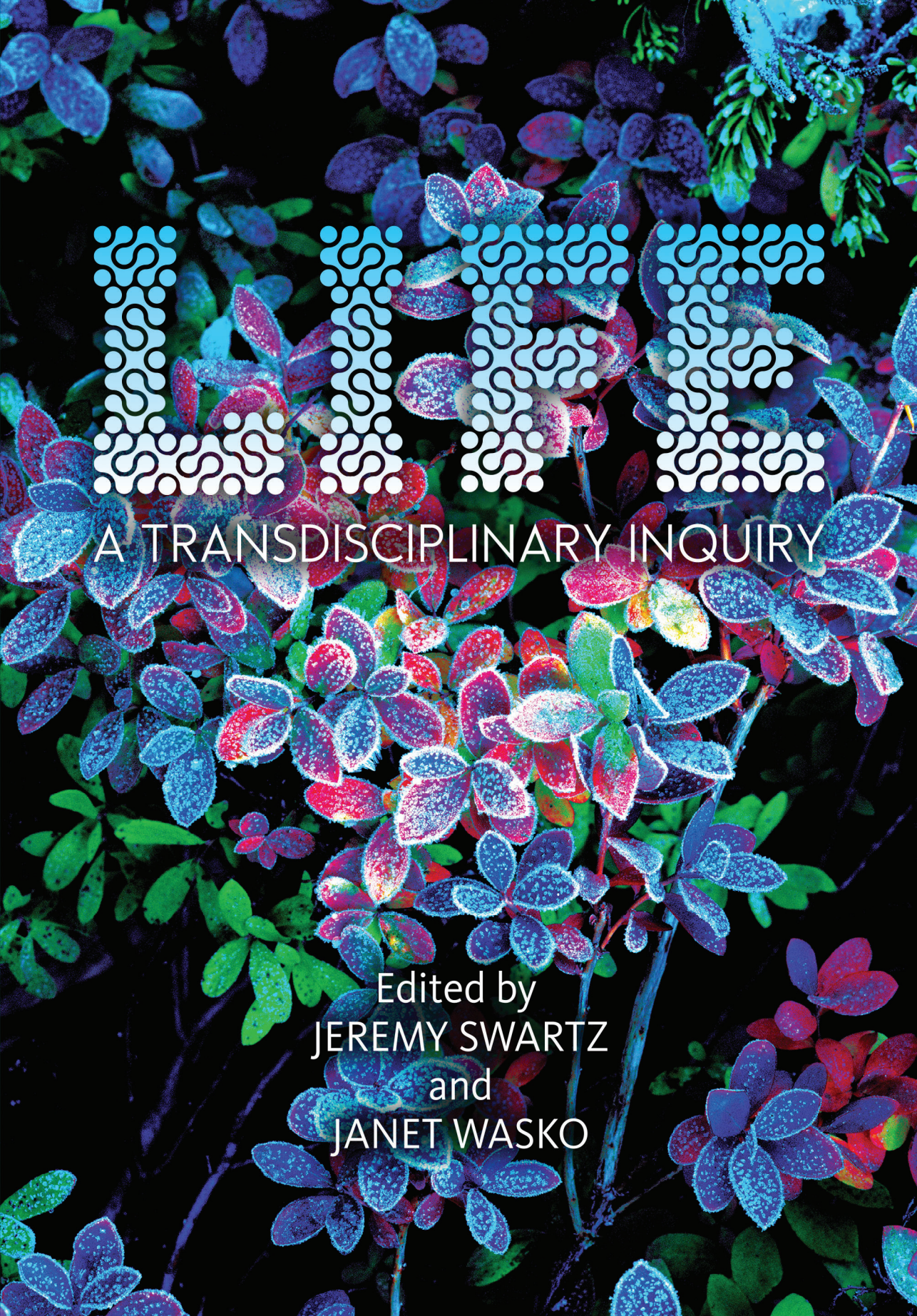




LIBRI

A TRANSDISCIPLINARY INQUIRY

Edited by
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Media • Life • Universe

Preface to a Trilogy

Jeremy Swartz and Janet Wasko

This volume is part of a trilogy that seeks to investigate and understand conceptual frameworks of *Media • Life • Universe*. The series presents transdisciplinary inquiries emphasizing relationships of complex systems and dynamics. Our understandings of media, as well as of information and therefore life, have been limited in various ways. One of the key motivations for this series is to challenge scholars, generally, and communication and media scholars, in particular, to think and act critically, evolving beyond merely narrow conceptualizations, oversimplifications, linearities and reductionisms. By recognizing patterns, processes, networks and their relationships, it becomes increasingly possible to visualize and experience universes of communication that have emerged and are emerging. These volumes are explorations into opening more integrative and accessible *spaces of meaning*.¹

The trilogy emerged from three conference-experience-exhibitions at the University of Oregon in Portland that posed questions challenging established and narrow interpretations of these concepts – specifically, what are media, life and universe? These gatherings cultivated *transdisciplinary* research and its impact at the heart of science, art and their environments, and they offered opportunities to build bridges, remix, regenerate and reimagine disciplinary boundaries. Our aim was to build new conversations and encourage philosophical inquiry that may inspire theory and practice going forward.

The ideas and exchanges that flowed from these discussions pointed more broadly to relationships across technology, information and communication. These connections will be examined in the trilogy, involving threads and driving forces that run throughout the volumes. In other words, we have sought to ‘curate’ (repair) conceptual frameworks to better understand these concepts and to invigorate further exploration. We need a more flexible notion of inquiry, one that is more adequate to the realities of emerging technologies that we are facing, not only

in theory but also practice via intersections between analogue, digital, physical, virtual and hybrid frames.

We also suggest that it is important to consider grounded practical theories that enact immersion and inclusion for transdisciplinary research. The trilogy itself attempts to represent engaged reflection, or the reflexivity between theory and practice and how each informs the other as a systematic focus on problems, dilemmas and sites (Craig and Tracy 2014). To enact theory-practice, or better yet praxis, we also emphasize the value of cultivating networks, as in the *What is...?* series and other such events,² and stress a commitment to perspectives in problem-solving-based dialogue and community building. This trilogy represents a transdisciplinary experience, which brings together scholars from the humanities, natural sciences (physical and life sciences) and the arts. More specifically, it draws not only on media and communication studies, but also on art, biology, computer science, information studies, philosophy, political science, sociology and other disciplines.

The concept of disciplinarity itself can be traced back to at least the mid-twelfth century, while interdisciplinarity emerged in the early twentieth century. The concept of transdisciplinarity came to the fore in the 1970s as a ‘critique of the standard configuration of knowledge in disciplines’. It re-emerged in the 1990s and continues to grow ‘as an urgent issue relating to the solution of new, highly complex global concerns’ (Bernstein 2015: 1).³ Note the following distinctions between these various frameworks:

- *Disciplinary*: acquisition of learning or mental training or a *system* [...] and relating to a branch of learning or knowledge, field study, etc.⁴
- *Interdisciplinary*: pertaining to, contributing to, or benefiting from two or more disciplines or branches of learning.⁵
- *Transdisciplinary*: a synthetic creation that encompasses work from different disciplines (Cat 2017); (*research*) new conceptual, theoretical, methodological and translational innovations that integrate and move beyond discipline-specific approaches (Harvard TREC Center 2022); (*frameworks*) the synthetic paradigms of general *systems* theory and sustainability, as well as the shift from a disease model to a new paradigm of health and wellness (National Research Council 2014: 32, emphasis added); (*emblematic practices*) the concept of gender in feminist theory (Sandford 2015) and action research.⁶

If disciplines can be understood as systems, then transdisciplinary research may also be conceptualized as a systems approach. As Fritjof Capra and Pier Luigi Luisi ([2014] 2020: i) observe, ‘New emphasis has been given to complexity, networks, and patterns of organization, leading to a novel kind of “systemic” thinking’. In

this sense, we suggest that the trilogy may contribute to a kind of systems *repair/curation* that can assist recoveries by reconnecting fragmented environments (Stokstad 2019). Although the trilogy may appear to present a variety of disparate frames, in actuality it is a saga of inextricable, systemic concepts.

Even communication and media scholars such as Marshall McLuhan and Herbert Schiller suggested including systems as a frame for inquiry. McLuhan once explained, ‘My own interest in studying media is a “systems development” approach [...] a structural analysis of pressures and strains [...] It is concerned with the inner dynamics of the form’ ([1967] 2014: 74). Schiller discussed this perspective in his ‘integrated’ analysis of a major media corporation, when he stated that the best way to understand the message it is selling is to adopt a systems analysis approach [...] to take [...] an entity, and to examine its many outputs as *elements in a totality* with some common features’ (Schiller 1973: 99, original emphasis). More critically, McLuhan and Schiller evoke another issue that ‘the “message” of any medium or technology is the change of scale, or pace, or pattern that it introduces into human affairs’ (McLuhan [1964] 2003: 20).

Another initial framework for the trilogy was category analysis that stems from the philosophy of language (Lakoff 1995; Johnson 2018) as well as a range of transdisciplinary modes of inquiry, including but not limited to media genealogy and archaeology; music and dance; science, technology and society studies; and rethinking communication and information theories. If – as John Dewey ([1940] 2008: 101) recounts – a ‘block universe’ can be considered ‘a closed universe in which there is no room for novelty and adventure’, then what we require is a *philosophy of openness* that can offer dynamic impetus to remediate the emergencies we face collectively, and in turn repair and regenerate the world.

Volume I: MEDIA

Within the cacophony of divergent and heterogeneous attempts to define the obscure object [...] scholars today are caught by the impossibility of finding common ground for what they mean by media.

(Horn 2007: 7)

MEDIA: A Transdisciplinary Inquiry is the first volume of the trilogy and explores notions of *media as technologies* and *as systems*, with special attention to material, historical and ecological ramifications. The collection reconceptualizes media from environmental and integrative approaches, utilizing various techniques and platforms, to envision ‘spaces, places and traces’ of what media have been and can become.

Media today increasingly represents a wider and wider range of concepts, products, services and institutions. The very definitions of medium/media and their study continue to encompass more and more of human experience and are in a constant state of flux. What are media today? How is media studies evolving? How have technologies transformed communication and media theory, and informed praxis? What are some of the futures of media? In other words, one might ask what are mediation, emerging media/technology and emerging systems?

The volume's sections focus on Genealogy; Meanings of Media; Organs and Organization; Engagement and Extensions; Biomediations; and Repair and Meta-media.

Volume II: LIFE

[B]acteria communicate with our cells, telling them about a world 'out there', a chatter of which we are very little aware, not to mention the resonances of all matter in the world, constantly humming to every part of our bodies, the boundaries of which thus dissolve, because we are also resonance, a cloud of microbes, energy, smell and light.

(Lindman 2013: 63)

The second volume, *LIFE: A Transdisciplinary Inquiry*, considers how information and communication are instrumental in and for living systems. The contributors examine habitats we live in, how media increasingly constitute and permeate all avenues and forms of life – public, private, organic and synthetic. We review historical and contemporary explorations of the concept of life, and, following from the *MEDIA* volume, continue to address biosemiotics and biomediations.

Similarly, the book probes the juxtapositions between material and representational (symbolic) forms. To understand this distinction, we offer a conceptual metaphor for your consideration: differences between analogue and digital. For example, take a digital representation of an analogue waveform, whereby only a certain number of points of the wave are incorporated and the rest are approximated or ignored. Now imagine the ocean—the analogue wave is energy, manifesting as continuous or smooth, rather than as discrete or striated. So, in this way, could it be argued that digitization is an estimation of nature to fit an anthropocentric, built environment?

Life can also be viewed as an ecosystem of interactions, transactions and contexts, by recognizing patterns in the natural sciences, cognitive science and the social sciences. In contemplating our surroundings and our lifeworlds, the

volume integrates discussions of embodiment together with ecomedia literacies, criticisms and sustainability-related frames.

This volume's clusters include Genealogy; Information and Ecologies; Enactions and Values; Ecomediations and Education; Syntheses and Biodesigning; and Artful Lives and Metaliving. Our hope is to weave and cultivate connections within the trilogy, expanding how we value and honour nature.

Volume III: UNIVERSE

Art is the opening up of the universe to becoming-other, just as science is the opening up of the universe to practical action, to becoming-useful and philosophy is the opening up of the universe to thought-becoming. Art is the most direct intensification of the resonance, and dissonance, between bodies and the cosmos, between one milieu or rhythm and another. It is that which impacts the body most directly, that which intensifies and affects most viscerally. Through the plane of composition it casts, art is the way that the universe most directly intensifies life, enervates organs, mobilizes forces. It is the passage from the house [...] the body of the living being to the universe itself.

(Grosz 2008: 23–24)

The third volume of the trilogy, *UNIVERSE: A Transdisciplinary Inquiry*, examines a range of conceptualizations of universe in relationship to communication. It explores universe through the lens of networks of relationships, highlighting links to complexity and category analysis, as well as how they may contribute to a 'pluralistic conception of an open universe' (Dewey [1948] 2008: 26). Contributors to the collection discuss issues related to cosmologies and meaning-making as well as applications across a transdisciplinary multiverse.

The book explores various scales, paces and patterns of universes. It addresses pressing questions of our time, including how do societies move forward, turning with shared agreement about the associative nature of our world, problems confronting it and/or solutions necessary to improve it? Can this be done by changing the scalar lens of our analyses? For example, consider the difference between the nanoscopic worlds of the electron microscope that have come into view, the periscopic landscapes and topologies looking across a viewing deck or holodeck, and the telescopic long lens of cosmological horizons, recognizing the earth as a system constantly (re)entwining.

The volume also examines a multiplicity of ontologies, identities, social worlds, spiritualities and universal rights, as well as the concepts of pluriverse and ecoverse respectively.

Concluding Thoughts

This has been merely a prelude to a trilogy that endeavors to reimagine inquiries of media, life and universe – a panorama where technology, information and communication catalyze, facilitate and transform. Thus, the trilogy moves toward metadisciplinarity networking a cornucopia of sources, motifs and melioristic praxes. These three volumes unfold through each other, and they can be encountered collectively, in clusters or through individual chapters. *Media • Life • Universe* are offered for contemplation and further curational co-inquiry.

NOTES

1. For neurobiologist and philosopher Owen Flanagan, these consist of a ‘sextet {art, science, technology, ethics, politics, spirituality}’ (2009: 11–12). Philosopher Christian Coseru ‘find[s] that these logical connections open up new possibilities for enhancing, refining, and expanding the range of philosophical arguments and possibilities’ (2014: 218).
2. Other examples of international transdisciplinary conference-experience-exhibitions and organizations include *documenta* (Germany, 1955–present), Ars Electronica (Austria, 1979–present), Leonardo, the International Society for Arts, Sciences, and Technology (Leonardo/ISAST) (United States, 1982–present), *ISEA Symposia* (international, 1988–present), *Transmediale* (Germany, 2001–present), Humanities, Arts, Science and Technology Alliance and Collaboratory (HASTAC) (international, 2002–present), in addition to the Philosophy of Communication section of the European Communication Research & Education Association’s workshop on ‘Communication, Art, Media: Probing Impacts and Intersections’ (2017), the International Association for Media and Communication Research conference’s Ecomedia Arts Festival (2018), and the International Communication Association conference’s *Making & Doing* exhibition (2017), ‘Blue Sky Workshop: Multi-Modal Research in Communication’ (2019) and ‘Preconference: Communicating Multi-Modally: Research and Expressive Culture’ (2022).
3. Also see Ngram of disciplinary, interdisciplinary and transdisciplinary from 1550 to 2019 (<https://bit.ly/3heps6t>. Accessed 4 February 2020). It was created utilizing software by Michel et al. (2011). See also Osborne (2015), Jantsch (1970) and Judge (1991, 2006).
4. ‘Disciplinary, adj. and n.’ (*OED Online* 2023).
5. ‘Interdisciplinary, adj.’ (*OED Online* 2023).
6. A few examples of work on transdisciplinarity as sustainability, action research, conservation and art-science include: Stokols (2006); Christens and Perkins (2008); Brandt et al. (2013); Toomey et al. (2015); Leavy (2016); and Clark et al. (2020). For the Science.gov Alliance’s search of ‘sample records for transdisciplinary’, see <https://www.science.gov/topicpages/t/transdisciplinary.html>. Accessed 4 February 2020.

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Introduction

Jeremy Swartz and Janet Wasko

Life is life, whether we can put a finger on the line that marks the boundary between it and the non-living, or whether a distinction here is far beyond our immediate powers.

— John Dewey and Arthur Bentley

Introduction

As actuality and metaphor, life can be understood as a connective tapestry that weaves together complex systems, dynamics and networks across various scales. This volume considers how information and communication are instrumental—that is, *intermediate*¹—in and for living systems. An aim of this collection is a fuller and richer account of life through a spectrum of insights from the natural, cognitive, social sciences and the arts.

Consistent with one of the driving forces of the *Media • Life • Universe* trilogy, authors expand on the notion of medium as *environment*, with special attention given to material, historical and ecological ramifications.² This book continues to explore *biomediations*—if life is a medium, how is it mediated?—as well as *biosemiotics*—recognizing information simultaneously *as* something (physical), *for* something (instructional) and *about* something (semantic) (Floridi 2010: 74-5). How is the study of life evolving and what are emerging possibilities for living futures?

This project was incubated within a working group on ‘Communication, Complexity, and Sustainability’ in the Institute of Cognitive and Decision Sciences³ at the University of Oregon (UO) in 2016 and then was realized as a conference-experience-exhibition held a year later in Portland.⁴ Subsequently, the theme of the International Association for Media and Communication Research conference held at UO in 2018 addressed *reimagining sustainability*, echoing calls for equitable and artful resilient futures (see Appendix).⁵ The intention of these gatherings was to bring people together to discuss how complex systems frameworks can reinform and transform how we study and understand life, ecosystems, natureculture, the role of information flows and their implications for worldmaking.

This collection of works engages a transdisciplinary notion of life, integrating a wide range of disciplinary-focused lenses and terminologies, too numerous to list here.⁶ Although environmental and ecological accounts have been traditionally brought to our attention, a biological account has been neglected in the history and study of communication and media, for instance, by Robert T. Craig and his ‘constitutive metamodel’ of traditions in communication theory. However, at least since the early 90s biological approaches and a burgeoning tradition has been enacted and is evolving (Craig and Muller 2007: 497–99; Craig 2020: xvii–xviii; Floyd and Weber 2020: 5–8; Cappella 2020: 11, 15–16).

Communication and Life

Scholarship and research presented at conferences and meetings are exploring these patterns, relationships and contexts in emerging areas of inquiry.⁷ There is a rich history of the use of biological and ecological *metaphors*, including fermentation, a metabolic process, most notably used in the title of the ‘Ferment[s] in the Field’ issues of the *Journal of Communication*.⁸ Similarly, the utilization of the metaphor of ‘natural life cycle’ for new media evolution is also common.⁹ Metaphors including the word ‘ecosystem’ are also employed rhetorically to elaborate connections amongst media platforms, relationships among entities and networks, etc. Another instance is ‘going viral’ in augmented social networks, which can be seen as a positive metaphor in contrast to a negative disease vector.

Additionally, linguistics and the philosophy of language have elaborated the bodily basis of metaphors by recognizing an organism’s ongoing engagement with its environment (Johnson 2017). The conceptual blending of metaphors *along with* the biological and ecological holds together relationships across embodied, embedded and enacted views, with increasing attention to the impacts of extended apparati. In this way, awareness of critical infrastructures is fostered, explicating spaces, places and traces where physical server farms for social mediation materialize, rendering and ecologizing their reliance on cooling river waters. By acknowledging human and nonhuman embodiments in, of, for and by the natural world, these frameworks recognize biocultural diversity.

Correspondingly, science and technology studies interrogate metaphors such as technological and biological determinisms in hopes of moving ‘beyond “determinisms” to capture the multifaceted complexity of technology as *communication* made durable’ (Lievrouw 2014: 50, original emphasis). This focus can be seen in alignment with a perspective ‘centered’ on humans, similar to conceptually siloed determinations, especially regarding our technologies, our communications and our social-cultural frameworks.

Therefore, when the biological and/or the environmental is addressed, it is done so in the natural sciences, e.g. in the journals and research of *Nature Communications*,¹⁰ and in the social sciences, e.g. via various lenses of ‘environmental communication’.¹¹ Not until fairly recently has a material medium itself been given agency, as opposed to simply being a ‘thing’ that is re-sourced out of nature. In bringing a spectrum of conceptualizations of ‘life’ further into the fold of the field of communication and media studies, we continue to widen the scope towards transdisciplinary explorations, where natural, cognitive and social systems are entwined.¹²

Understanding Life

When asked ‘What does life mean to you?’, answers typically involve two general responses. The first pertains to ‘everyday life’, implying ‘public or social life’, ‘private life’ or ‘ways of life’, in other words, work, leisure and everything in between (e.g. relationships, politics, culture, education). The second conceptualization involves associations with the environment and the natural world or ‘life space’ (e.g. a cell, a bobcat, a forest, a river, or going for a walk).

These common understandings can be compared and contrasted with the *Oxford English Dictionary* (OED) etymology and definitions of life:

Cognate with Old Frisian *lif*, life, body, person [...]

I. The condition or attribute of living or being alive; animate existence. Opposed to death or inanimate existence.

II. With reference to duration [e.g.] the period from birth to death.

III. A course, condition, or manner of living. [...] The series of actions and occurrences constituting the history of an individual.

(OED Online 2023)

The condition that distinguishes animals and plants from inorganic matter.

(Oxford Dictionaries 2022)

In Greek, βίος (*bíos*) integrates many of the interpretations noted above, as well as ‘mode of life’. A second definition in Greek is ‘livelihood, means of living’; while the third specifies life as ‘the world we live in’; and the fourth brings forward enactments of ‘settled life, almost, = abode’¹³ (Liddell and Scott 1940a).

Other definitions highlight ζωή (*zōē*), which ‘separate[s] out natural life [...] from the reflective life that enables human experience’ (Cassin 2014: 576). A comparable example can be found in *The Cambridge Dictionary of Philosophy*: ‘mental activities such as perception and thought (*mental life*) or physical activities

such as absorption, excretion, metabolism, synthesis, and reproduction (*physical life*)’ (Hoffman and Rosenkrantz 1999: 504, original emphasis). These states can also be situated with ‘the French *vie* (life), deriving from the Latin *vita*, [which] serves to designate’ narratives, models, and histories (Cassin 2014: 576). Yet another explication comes from ecology¹⁴: ‘A state of physical entities that utilize substances derived from outside themselves’ (Allaby 2015: n.pag.).

Beyond these dictionary definitions, there has been a multitude of attempts to define life by philosophers, scientists and others.¹⁵ Historically, encyclopedia entries, articles and books on life have included the *physiological*, *metabolic*, *biochemical*, *thermodynamic*, *evolutionary* and *autopoietic*, which are further discussed in this volume.¹⁶ Others have suggested ways to discuss life beyond definitions, for instance, Tibor Gánti’s (2003) real and potential *criteria*. And, in this volume, Mark A. Bedau offers the possibility of *hallmarks*, while Carol E. Cleland argues against definitions and suggests using *tentative criteria*.

Interestingly, *strong definitions* and *operational definitions* also have been contrasted. The former attempts ‘to provide a complete set of necessary and sufficient conditions’, while the latter proposes ‘open-ended [...] necessary (and satisficing) provisional conditions’ that ‘can be applied to specific case studies’ theoretically and experimentally (Bich and Green 2018: 3941, 3936).

Moreover, Carlos Mariscal (2021) has identified ‘attempts at meta-categories for life definitions’. These include Bedau and Cleland (2010), Radu Popa (2004) and Edward N. Trifonov (2011), as well as Christophe Malaterre and Jean-François Chartier (2019: 4545), whose data-driven ‘analyses across over 30,000 full-text biology articles’ pointed to various dimensions of *liveness* inferred from topic modelling, category analysis and sorting by subject matter. Their meta-analysis provided initial findings for these compelling dimensions: *matter-energy* (metabolism, catalysis and synthesis), *structure* (structural/cellular features), *environment* (micro/macro and related to plant/animal/human), *evolution* (variation, adaptation and speciation) and *information-program* (transcription, translation and modification) (Malaterre and Chartier 2019: 4562; see also Mariscal 2021).

But even with increasing amounts of dedicated research, there still seems to be no consensus among scholars and a definition of life is still an open question.

Systems Approaches to Life

As suggested by this discussion of categorizing and defining life, there is also a multiplicity of theoretical views about life and its origins. Many of the authors in this collection have engaged with a systems approach that embraces the natural, cognitive and social.

An etymology of the word ‘system’ is offered in the first chapter of this volume. Although there is a plethora of definitions for the term, a complex systems approach identifies examples of relationships between and across molecules and atoms, the brain and neurons, weather patterns and airflows. It ‘studies how relationships between parts give rise to the collective [dynamic] behaviors of a system and how the system interacts and forms relationships with its environment’ (Bar-Yam 2011: n.pag.).

Furthermore, complex systems are everywhere ‘be they living entities, social systems, cities, or insect colonies’. These assemblages are made of functional parts and structures, and their properties stem from their interdependence and interaction (Luisi 2016: n.pag.; also see von Bertalanffy [1968] 2015; Krippendorff 2008). Thus, communication as a field can be understood to comprise ‘a network of related hierarchical subsystems (disciplines) with their functional parts (topi)’ (Gunaratne 2021: 131).

Emerging from a systems approach are areas that overlap biological systems and mediation, as well as information (Schiller 1988; Cook 2016; Godfrey-Smith and Sterelny 2016) and communication (Raymond 1950; Cappella 1991). There are many examples of communication and biology approaches, including different concepts, methods and variables (Knapp 2009), as well as integrations of media, information and communication.

The study of biology and communication may focus on neurobiological systems and physiological responses, as well as systems of the body and genetics (Boren and Veksler 2016: 184). This brings back into the fold a recognition of material biology and is in alignment with a systems approach (Beatty et al. 2009; Yeghiyan 2017; Floyd and Weber 2020). This is most easily identifiable in the use of physiological categories delineating, for example, ‘neurological, genetic, endocrine, immunological, muscular, hematological and cardiovascular’ systems and ‘dimensions of social behavior’ (Floyd and Weber 2020: 5).¹⁷

Meanwhile, Kathleen Mullan Harris and Thomas W. McDade (2018: 3) note a biosocial approach which ‘conceptualizes the biological and the social as mutually constituting forces’. It ‘draws on models and methods from the biological, medical, behavioral and social sciences’, blurring boundaries between the outside and inside of the body. They recognize that this is also ‘a transdisciplinary approach to understanding human development, behavior and health’ (see also Hickson and Stacks 2010; Veksler et al. 2020; Stumpf 2022).

In addition, biomedica are defined as ‘informatic recontextualization of biological components and processes’. They can have ends with effects that may be medical or nonmedical (economic, technical), ‘cultural, social, and political as they are scientific’. Therefore, biomedica are ‘both a medium and a process

of mediation’ (Thacker 2010: 123, 2004). In parallel (as noted in the *MEDIA* volume), Luciano Floridi (2010) states, ‘Genes do not contain information like envelopes or emails do, nor do they describe it, like a blueprint; they are more like performatives’ (79), strengthening Sandra Braman’s (2004) account of recombinant deoxyribonucleic acid (rDNA) as meta-technology. These biomediations can also be identified as bioinformatics, which has been defined as ‘a branch of biology that is concerned with the acquisition, storage, display and analysis of biological information’ as a codescript (NIH 2021: n.pag.; see also Floridi 2010: 74). Similarly, in biotechnology, Wilhelm Peekhaus (2016: 196) observes that ‘the information metaphor and specifically “life as information” is given material reality that lends it to commodification’ (Rajan 2006).

Philosopher of science Guenther Witzany problematizes biocommunication utilizing a biosemiotic account noted previously, but more specifically regarding plant signaling to explain ‘life as a social event of cellular and sub-cellular agents that communicate, that is, based on interactions that are sign-mediated according to three levels of semiotic rules’ (2019: 100). These include ‘combinatorial (syntactic), context-sensitive (pragmatic) and content-specific (semantic)’ (Witzany 2020: 3). Other biocommunicative approaches could include communication science and biology, human biology and culture (Condit 2000), as well as developmental biology related to models, metaphors and machines (Keller 2003).¹⁸

In summary, Mark Hickson III and Don W. Stacks (2010: 272) point out that the various research groups in communication ‘all make separate and independent conclusions that biology is much more important than we have historically considered it to be’.

This volume presents a tapestry of relationships and contexts at different scales of emergence across *ecologies* (Bateson [1972] 2000), *enterprises* (Mattelart 1996), *metabolisms* (Nail 2023) and *registers* (Guattari [1989] 2000). The components of each of these conceptual frameworks include some sense of the natural, matter-energy as living-organism-environments; the cognitive or mental, human and nonhuman, subjectivities; and the social, relational, collectives and institutions. Félix Guattari argues for a relationship between these scales acting as driving forces for ‘ethico-political articulation’ ([1989] 2000: 28), similar to the metaphors of *islands* identified in urban metabolism research.¹⁹

Thus, conceptual frameworks interwoven together in this volume present steps towards transdisciplinarity. More implicitly, this collection constitutes an open-ended inquiry in the middle of the trilogy – exploring myriad ways in which humans understand, design and value life through the natural, cognitive, social sciences and arts.

Volume Overview

Drawing from chronicles of living systems, this volume is composed around a spectrum of perspectives from the natural, cognitive and social sciences, as well as art, architecture, design and philosophy.

Similar to the *MEDIA* volume, contributors to this collection offer an array of research, theories and practices related to life. This book is a network of nodes or chapters, organized and presented in six clusters, from genealogy to information and ecologies, from enactive values to ecomediations and education, and from syntheses and biodesigning onward to artful lives and metaliving.

By holding together histories, definitions, propagations of information, and communication, life is constantly unfolding and refolding across a range of biocultures. As this century enfolds embodied hybrid relations and meanings into ecological mediations and literacies, there are increasing demands for accountability that attenuate imaginative design practices with artful living trajectories.

Brief summaries of the clusters and chapters are offered below.

Genealogy

The first cluster of chapters highlights conceptualizations of life across multiple time periods. The first chapter explores how a systems approach from the Renaissance returned in the early 20th century through the study of communication and information. The following contribution charts a course from the ancient Greeks to contemporary research in the early 21st century. The section concludes by confronting us with the existential question: should we even be trying to define life?

Fritjof Capra presents a brief overview of systems science, design and their ecological dimensions. His historical approach begins with Leonardo da Vinci and his studies of nature, leading to present day philosophical, social and policy developments and implications. Capra's systems view of life offers a framework for integrating various patterns, including metabolism, networks, flow, emergence and cognition. He concludes with how ecological literacies and sustainable design can foster opportunities for systemic problem-solving.

Mark A. Bedau highlights phenomena of life including potential criteria such as evolvability, while recognizing some hallmarks, borderline cases and puzzles. He then explicates various accounts of life, from the genomic to the protocellular, from information processing to an open-ended evolutionary process of adaptation. Early in the chapter, Bedau notes early twenty-first century examples of these characteristics in hardware, software and wetware based artificial life.

Carol E. Cleland's chapter offers a variety of popular definitions of life, including a review of the thermodynamic, metabolic, evolutionary and self-organizing. She explains why the scientific project of defining life is mistaken and argues that life is not the sort of thing that can be successfully defined. A definition of life is more likely to hinder than facilitate the discovery of novel forms of life. Cleland's problematization of the complexities of meaning leads her to acknowledge tentative criteria as provisional space. She also provides insights into astrobiology, as well as programs and missions searching for life on various planets, including Mars.

Information and Ecologies

The next three chapters present systems in the context of information, communication and ecologies. These nodes provide insights into propagating organizations of life, plant-to-plant communication and biodiversity. The cluster begins with a multidimensional notion of information, proceeds to elucidate plant signalling and kin recognition, and consummates with a study of the human microbiome at different scales including assumptions, limitations and therapeutic applications. Each of these chapters exemplify different ecological scales of inquiry.

Stuart Kauffman, Robert K. Logan, Robert Este, Randy Goebel, David Hobill, and Ilya Shmulevich discuss propagating organization or the union of matter, energy, work, constraints and information in living physical systems. They argue that information should be understood simultaneously as 'Shannon information' which deals with, for example, the signal-to-noise ratio in telecommunications, as well as instructional or biotic information. In other words, information can be understood as both a thing or noun, as well as a process or verb.²⁰ This chapter provides context for information as physical manifestations, such as DNA, RNA and protein transcription and translation processes — giving rise to information *with* meaning. The authors draw on biology, physics and computer science to suggest that information provides the construction of constraints, which partially underlie the processes of evolution to dynamically determine the fitness of organisms within the context of a biotic universe.

Exploring the multiple pathways of information transfer and communication in plants, **Roza D. Bilas, Amanda Bretman and Tom Bennett** point to the key role of signalling in plant-plant communication. This emphasis on biocommunication, belowground and aboveground, is echoed by Rouhallah Sharifi and Choong-Min Ryu (2021: 1095), who describe *wired communications* involving 'direct signal transfers between plants mediated by mycorrhizal hyphae and parasitic plant stems'. They also identify *wireless communications* that include

‘plant volatile emissions and root exudates elicited by microbes/insects’, enabling signalling between plants with no physical contact. In other words, their research emphasizes the roles of light signals, chemical markers and how microbial organisms can alter underlying mechanisms. Furthermore, according to Niels P. R. Anten and Bin J. W. Chen (2021: 1059), plants react and respond to their neighbors; they are not passive. Kin recognition bridges mechanistic and ecological elements of plant-plant interactions, which are also discussed in terms of a spectrum of ‘live and let live’ between cooperation and competition.

Nicolae Morar and Brendan J. M. Bohannon move beyond information and plants to address the conceptual ecology of the human microbiome, a vast array of microorganisms on and in the human body. They present competing metaphors used to refer to our microbiomes, including as an organ containing our second genome; as a component of a host’s immune system consisting of two distinctive parts, the self and nonself; as a superorganism or a collection of organisms that interact closely and from which functions emerge; as a metaphorical symbiont in the human holobiont, coevolving to increase their inclusive host and microbe fitness and shaping their hologenome; and as an ecosystem consisting of a community of organisms interacting with an environment, such as a forest. Each of these views include their own assumptions about the fundamental biology of the human-microbe system, with important implications and limitations, as well as potential therapeutic applications. The synthesis of these various scales of microbiome systems offers a rich tapestry for investigating a scientifically pluralistic approach to guide the exploration of our complexity as chimeric beings.

Enactions and Values

The contributors in this cluster explore embodiment via natural, cognitive (neurosciences) and societal lenses in the study of drifting metabolisms across scales and the emergence of mind from life. Overall, the section offers an enactivist approach that culminates with how extensions/media/technologies/environments have found their way into our lives and livelihoods, and most importantly into our waste streams. In other words, the authors consider a variety of eco-nomic ways in which we are intermeshed within networks in the world.

In his chapter, **Mark L. Johnson** presents embodied cognition and its relationship to the emergence of language and mind. He recognizes allostasis as a proactive recalibration of expectations in anticipation of changing conditions and argues for the primacy of a more expansive and richer notion of aesthetics and ways that it underlies all the processes that give rise to meaning. He concludes by reflecting

on the blending of science, art and the humanities as ways to develop the intelligence and values we need for a critical, reflective life.

Building on an inquiry into ‘new materialism’²¹ and a philosophy of movement, **Thomas Nail** has elaborated an ontology of motion. His ‘kinetic’ theory links to a long-forgotten threefold theory of metabolism, which includes the metabolism of nature, the human metabolism with nature and the interdependent process of social metabolism. Nail postulates that instead of metabolic rift (being torn from rootless grounds), we should embrace metabolic drift, where intra-active value is material and interwoven across systems.

Jussi Parikka’s chapter connects to Johnson’s conceptual scaffolding of embodiment and Nail’s discussion of metabolic movements by acknowledging cognitive extensions (such as computers or metamediums) through their geological materiality. He notes how contemporary forms of waste and violence are intrinsically tied to issues related to the largely unseen international extraction of raw materials and the production of dead media (e-waste) revealed through tracing their lifecycles. Parikka also offers critical reflections on issues related to race, colonialism and news reporting on environmental disasters.

Ecomediations and Education

This cluster continues to develop an embodied, embedded, enacted and extended cognitive approach in society, acknowledging ways to address mounting problems in the education and translation of ecological literacies to future generations. This set of chapters views life through traditional media and information literacies, a journalistic approach to STEM (science, technology, engineering and mathematics), along with the language arts, as well as case studies of ecological mediations. Each chapter offers different approaches to teaching and learning, as well as how traditional media including environmental and ecological content are created by diverse producers for diverse audiences.

Divina Frau-Meigs offers a cyberist paradigm, redefining information opportunities and the international and transborder nature of network cultures. She continues by noting the relevance of a shift from information contracts (publicity) to sharing contracts (participation) and on to engagement. Frau-Meigs also addresses the contemporary information society’s cyberist crisis and how health, work and education have been transformed by the pandemic. She concludes with a discussion of transliteracy and ecomedia literacies, especially for building core curricula in schools, contributing information resiliency to sustainability and democracy.

Ed Madison and others have developed an initiative for learning through journalism, presenting a tailored approach for rural communities. His work expands

on an intentional approach by emphasizing student publications and diversifying STEAM (science, technology, engineering, art and mathematics) through digital storytelling and science communication. Madison explicates and explores near-peer mentorship, engaging identity-based motivation theory to postulate about futures of educational media/technologies.

In their chapter, **Salma Monani** and **Stephen Rust** reflect on more than a decade of ecological cinema, a subset of ecomedia. They bring attention to ecocritical lenses, which interrogate and decenter previous universalizing and Eurocentric trajectories. Bridging decolonial studies and affect studies, their work highlights the need for diverse voices that have been marginalized, offering emerging possibilities for directors, producers and production companies. Monani and Rust's research reinforces an account of the materiality of media, through deep contemplations of aesthetics, questioning habits and desires along with ways to contribute to sustainability and ecojustice for humans and nonhumans alike.

Syntheses and Biodesigning

This cluster challenges us with a variety of design approaches to life, bringing twenty-first century bioinspiration face-to-face with global innovation ecologies. Discussions include the history of system dynamics modelling as a field and how it has evolved along with developments in artificial neural networks; autopoiesis applied in laboratory settings and practices in the development of synthetic biology; and, implementations and problematics of bioengineers offloading digital data and storing it in life itself.²²

Following on the historical chapters at the outset of this volume, **William Schoenberg** and **Jeremy Swartz** present an overview of system dynamics. From modelling to critiques, they address how to make use of machine learning and deep learning to improve the quality of models via structural validation. Schoenberg and Swartz address criticisms of modelling by integrating feedback loop dominance analysis to find 'loops that matter'. Their goal is to turn black box models into white box models by utilizing a variety of non-linear techniques, including feedforward artificial neural networks to address real-world problems, as well as offering resources for systems education.

Pier Luigi Luisi expands on a transdisciplinary frame across life and media, or cells and environments, further explicating systems, autopoiesis and cognition noted in earlier chapters, and taking us to the edge of synthetic biology. He reviews his experiments to realize a minimal cell, one with the smallest number of components to still act biologically, as well as procedures that utilize 'spontaneous overcrowding'. Luisi engages both top-down and bottom-up approaches,

in addition to various speculations on why the origin of life is still a mystery for science. In doing so, he reinforces a systemic view of nature and evolution in multiplicity.

In their collaboration, **Mél Hogan** and **Tessa J. Brown** examine multivalent implications of biodesigning synthetic DNA to be utilized as hard drives. They present a revised history of the discovery of DNA by highlighting neglected contributors, as well as a brief exposition of genomics research — from its eugenic beginnings to the Human Genome Project and the subsequent development of clustered regularly interspaced short palindromic repeats (CRISPR) gene editing. Hogan and Brown bring to light dataists' archives, where codescript is more than merely bioinformatic content, but also requires significantly more context, revealing anxieties and priorities, discourses and infrastructures, or in other words, meanings.

Artful Lives and Metaliving

This last cluster serves as a transition into the next volume of the trilogy. The authors consider modes of communication and social organization, including harmonizing human, nonhuman and more-than-human habitats, places and spaces for symbioses across natural and built environments. Integrative approaches are brought forth through the water ways of architecture; in artful collective living, together with mountains, forests, rivers and seas; and by embodied aesthetics and ethics applied to transformations occurring every day. The contributors acknowledge the significance of stewardship, custodianship, kinship and myriad ways of valuing and honouring lifeways of past, present and future generations.

Brook Muller offers insights on the guidance of water, a medium for transporting beings, energy and thoughts. He directs our attention to reimagining city-nature relationships or urbanized watersheds, and reworking interactions between hydrological and urban landscape formations. Muller transports us from oceans to rivers, and from cities to buildings in different parts of the world, ultimately urging that our assemblies become mediums benefitting a diversity of species, that is to say, building-environment pairings that protect us from the elements, while at the same time supporting life forms nearby.

In the following chapter, **Diane Durston** immerses us in a world of satoyama and satoumi, where nature-culture exists, highlighting traditional Japanese styles of living in harmony with the land and the sea. She explores the history of these lifestyles and contemporary efforts to resuscitate them through rural regeneration. Durston concludes by stressing that initiatives dedicated to the revitalization of cooperation – from rural arts experiences and replanting forests to increasing

transgenerational dialogue and well-being — are key to the flourishing of life on the planet.

Additionally, Durston is highlighted in the Appendix with Sadafumi Uchiyama, third generation Japanese gardener and curator, for their gracious facilitation of *Experience: Life • Lifeworlds • Lifeworks*, a collaboration with the Portland Japanese Garden. The *LIFE WORLDS* (2017) group exhibition expanded on an ecology of inquiry across nature and art.

In the last chapter, Jeremy Swartz offers a brief overview of the volume, followed by discussions of integrative systems, pattern recognition and the study of futures at various scales from the local and regional to the national and global. He then engages pluralistic approaches highlighting programs in critical futures studies and ways of worldmaking. Finally, Swartz reflects on metaliving, *metá* meaning in the *midst of* and *with* – not above or beyond – and how scholars, researchers, communities and societies are embodying – bringing forth or keeping close – their heritages, stories and worlds. It is in this way that artful co-curation honours kinships, responsibilities and accountabilities among all living systems.

NOTES

1. In *Knowing and the Known* ([1949] 2008: 244), John Dewey and Arthur Bentley explicated: ‘What is called *environment* is that in which the conditions called physical are enmeshed in cultural conditions and thereby are more than “physical” in its technical sense. [...] it is their *medium*, or *milieu*, in the sense in which a medium is intermediate in the execution or carrying out of human activities, as well as being the channel through which they move and the vehicle by which they go on’ (original emphasis). Around the same time, and in his purportedly lost last manuscript, Dewey explained that *instrumental* should be understood ‘to designate the intermediate position and function of the subject matter of knowledge in the inclusive complex of the transactions constituting human living as an ongoing concern’. He cautioned against ‘linguistic uses that give instruments a mechanical sense’ and instead encouraged ‘treating knowing as a mode of technology [...] exhibited and made evident in scientific inquiry’. This intermediate position is thus a mode between *means* and *ends-in-view*, distinct from a mere static *end* (Dewey 2012: 242; also see Hickman 2013).
2. This volume, *LIFE*, is reinforced by *MEDIA: A Transdisciplinary Inquiry*’s recognition of the synonymous relationships across media/technologies/environments (Swartz and Wasko 2021).
3. The group facilitated dialogues between members from architecture and allied arts (now design), biology, chemistry, environmental studies, interdisciplinary studies, journalism and communication, media studies, philosophy, psychology and sustainable materials chemistry.
4. This was the seventh in the *What is...?* Series and featured a unique coalescing of scholars, librarians, government and community officials, industry professionals, grassroots organizations, artists, designers, students and the public.

5. For examples of concepts and practices integrated into this theme, see *ecocriticism* (Starosielski and Walker 2016; Brevini and Murdock 2017; Slovic, Rangarajan and Sarveswaran 2019; Lupinacci et al. 2022), *ecomedia* (Maxwell and Miller 2012, 2017; Rust, Monani and Cubitt 2016; Iheka 2021; López et al. 2024) and *environmental movements* (Murdock 2020; Parks and Walker 2020; Atapattu et al. 2021; Carvalho et al. 2021; Caniglia et al. 2021; Grasso and Giugni 2022).
6. Disciplines and fields include architecture, art, astrobiology, bioengineering, biology, chemistry, cinema studies, cybernetics, communication, computer and information sciences, design, ecology, ecomedia, electrical engineering, environmental studies, forest and conservation sciences, garden curation, geography, journalism, materials science, media archaeology and ecology, media studies, metamedia, philosophy, physics, political economy, sociology, systems biology, system dynamics and machine learning, as well as synthetic biology.
7. There are several associations with committees, divisions and groups actively creating spaces for participation in these areas. These include the International Environmental Communication Association (IECA), whose mission is fostering inspirational communication which mitigates environmental issues, conflicts and problems with potential solutions. International communication and media associations' thematic areas include: Asociación Latinoamericana de Investigadores de la Comunicación's (ALAIC) Comunicación Y Ciudad Grupo; European Communication Research and Education Association's (ECREA) Science and Environment Communication Section; IAMCR's Environment, Science and Risk Communication Working Group; and ICA's Environmental Communication Division and Communication Science and Biology Interest Group. In addition, the Association for Education in Journalism and Mass Communication (AEJMC) features the Communicating Science, Health, Environment and Risk Division.
8. There have been many major overviews of the field in the *Journal of Communication* beginning with 'Ferment in the Field' (1983), which interestingly featured alchemic imagery, and even a glass slide dipped in a gelatinous gel in a beaker. The fourth issue of 'Ferments in the Field' (2018), includes discussions of 'a new critical and materialist turn [which] is underway that lays bare the political-economic, labor, and environmental underpinnings of communication' (230–31). It includes Miyase Christensen and Annika Nilsson (2018) rethinking media 'as infrastructural and natural, as well as representational' (274). 'They criticize the dominant systems of environmental knowledge production and dissemination from conventional scientific communication' while pointing to materialist analysis of e-waste and its 'ecological, social, and labor costs' (Fuchs and Qiu 2018: 228, see also Parks 2020).
9. For example, several works touch upon these themes (Lehman-Wilzig and Cohen-Avigdor 2004; see also Scolari 2012, 2022; Deuze 2012, 2023; Starosielski 2021).
10. Other subjournals include communications in biology, chemistry, engineering, environment, physics, materials and medicine.

11. See *environmental communication* (Turner 2006; Cox 2015; Hansen and Cox 2015; Pezzullo and Cox 2021; Phillips and Milner 2021; Takahashi et al. 2022) and *communicology* (Catt 2017; Lanigan 2021).
12. See *environmental humanities* (Heise 2019; Horn and Bergthaller 2020), *global interventions* (Gunaratne and Gunaratne 2017; Miike and Yin 2022; Craig and Xiong 2022), *media archaeology* (Huhtamo and Galili 2020; Weibel 2023), *media ecologies* (Fuller 2005; Parikka 2014), *media ecology* (Granata 2017; Sharma and Singh 2022), *media theory* (Kittler 2007; Mitchell and Hansen 2010; Wickberg and Gärdebo 2022; Bauer 2022; Mitchell 2023) and *posthumanities* (Braidotti and Bignall 2018; Vint 2020; Jones 2023).
13. Interestingly, this last definition is reminiscent of ἵκος (*oikos*), or ‘house, not only of built houses, but of any dwelling-place’ (Liddell and Scott 1940b: n.pag.). Also see a history of ecology, community and American social thought from the first half of the 20th century (Mitman 1992).
14. ‘Ecology represented the borderland between the biological and social sciences through the study of interrelationships between and among individual organisms and their environment. This meaning has largely disappeared from today’s disciplinary canon [...]’ (Mitman 1992: 1).
15. A list of those defining life includes, but is not limited to, Aristotle, René Descartes, Immanuel Kant, Charles Darwin, Ernst Haeckel, Friedrich Engels, Thomas Henry Huxley, Alexander Oparin, Jakob von Uexküll, Erwin Schrödinger, Ernst Mayr, Rosalind Franklin, James Grier Miller, Edward O. Wilson and Leslie Orgel.
16. See Sagan 1970; Sagan, Sagan and Margulis, n.d.; see also an earlier version of the encyclopedia entry for ‘life’ (Weber 2018).
17. A biological approach could include, for example, analysing genetic markers and measuring chemical compounds (e.g. hormones, etc.) through blood, saliva and urine. Similarly, mediums also include the measuring and recording of underlying bioinformatic processes or specific system structures, e.g. blood pressure and heart rate of the nervous system, and/or electrical impulses in brain system scanning/mapping with functional magnetic resonance imaging (fMRI) (Boren and Veksler 2011: 6–23, 2016: 185–88, 192).
18. See also work by evolutionary biologist Andreas Wagner (2014, 2019).
19. These islands act as a metaphor for ‘a global circulatory process of socio-natural relations that transforms and (re)creates urban ecosystems through the exchange of resources, capital, humans, and non-humans into and out of the spaces of global urbanization’ (Newell and Cousins 2015: 22). This research includes: *industrial ecology*, where ‘nature is the source of the urban metabolism’s fuel and the destination for its wastes’ (Wachsmuth 2012: 519); and ‘focuses on quantifying material and energy flowing into, within, and out of cities, using accounting methodologies’ (Newell and Cousins 2015: 21; see also Côté 2009). *Urban political ecology* or UPE presents urbanization as ‘a constitutively socio-natural process’ (Wachsmuth 2012: 519); ‘emphasizes power relations that constitute uneven socio-ecological production’ (Newell and Cousins 2015: 21). *Urban ecology* ‘models the

- complex patterns and processes of urban human–ecological systems’ (Newell and Cousins 2015: 21). David Wachsmuth (2012) noted an important point stating that, ‘urban metabolism is analogous to nature, but only analogous – the natural environment itself is simply a backdrop to a purely social process of urbanization’ (519). For recent criticisms, see Hervé Corvellec et al. (2022).
20. As noted by Logan (2014: 41), these positions are held respectively by North American mathematicians, Claude Elwood Shannon and Norbert Wiener, in contrast to British physicist, Donald MacCrimmon MacKay. Separately, see Kauffman (2019) for further elaboration on why living systems should be defined by the concept of organization.
 21. This was previously mentioned in Graham Murdock (2021: 45).
 22. There are many sources for histories and discussions of the biotechnology industry (e.g. Braman 2004; Vettel 2013; Mitchell 2015; Krcmar, Ewoldsen and Koerner 2016; Magin 2017; Hogan 2018; Green 2022).

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