Science & Philosophy Volume 14(2), 2026

Between mind and matter: Hypotheses regarding the afterlife and immortality

Edoardo J. Bruno[1]

Abstract

The significance and empirical decidability of questions about life after death and immortality have received relatively little systematic attention. This article offers a conceptual and speculative review of contemporary scientific and philosophical hypotheses on these topics. It introduces a twofold taxonomy distinguishing between natural afterlife and divine or Creator-based afterlife, and between biological and technological immortality. Within this framework, I examine proposals involving quantum theory, cosmology, information, and advanced technology, and assess to what extent they could, in principle, be tested—for example, through artificial intelligence, contact with extraterrestrial civilizations, or the mathematical and empirical study of cosmological models and cosmic information. I argue that, although none of these hypotheses is presently confirmed, many are at least empirically meaningful. I defend the rationality of a temporary pragmatic agnosticism: we currently lack decisive evidence about the afterlife and immortality, but future interdisciplinary research may ultimately resolve some aspects of these questions.

Keywords: Afterlife; Immortality; Universe; Technology; Philosophy of Science.[2]

[1] Catholic University of Milan, Italy; edoardo.bruno@gmail.com.
[2] Received on July 3, 2025. Accepted on May 21, 2026. Published on July 25, 2026.
DOI: 10.23756/sp.v14i2.1699. ISSN 2282-7757; eISSN 2282-7765.

1. Introduction

Questions such as “Does life after death exist?” (Fontana, 2005; Goswami, 2013; Martin and Augustine, 2015) and “Is immortality possible?” (Pickover, 2007; Bolonkin, 2011; Hulsroj, 2015) are actively debated within academic circles. The philosophical–scientific school of atheism rejects the notion of an afterlife. Russell (1925, p. 348) asserts that nothing of one’s ego survives death, a perspective recently endorsed by biologists and physicists. Dawkins (2006, p. 21) contends that the hope of an individual’s brain surviving death is neurologically untenable. Similarly, Hawking (2018, p. 38) emphasizes that belief in an afterlife is representative of an unattainable desire with no reliable evidence to support its existence. The notion of biological and technological immortality is largely absent from the doctrines of revealed religions, such as Judaism, Islam, and Christianity, whose dogmas typically posit the afterlife as a transcendent realm accessible only through physical death. In this article, arguments based solely on religious revelation are not considered, except insofar as they intersect with scientific or philosophical theories—for example, when traditional eschatological ideas are reformulated within multiverse cosmology or creator-based simulation scenarios. Regarding the potential discovery of an afterlife and immortality, Gödel’s incompleteness theorems are sometimes invoked to illustrate general limits on human knowledge. Gödel (1990) showed that any sufficiently rich formal mathematical system contains true statements that cannot be proven within the system itself. These results concern the boundaries of formal axiomatic systems; they do not directly address the existence of an afterlife or immortality. In what follows, they are taken simply as a reminder that even our most rigorous methods have intrinsic limits, not as proof that questions about survival are mathematically undecidable. In contrast to the theories of Russell, Dawkins, and Hawking, and to many traditional religious doctrines, this article explores the possibility of hypotheses regarding life after death and immortality—both biological and technological—within a conceptual and speculative framework informed by contemporary science. The aim is not to demonstrate that an afterlife or immortality exists, but to organize and assess the main scientific and philosophical proposals that have been advanced on these topics, and to clarify under what conditions they might be empirically decidable. Accordingly, the purpose and method of this manuscript are threefold: to provide a taxonomy of current scientific and philosophical hypotheses about the afterlife and immortality; to argue that these questions are, in principle, empirically decidable—at least to the extent that they make testable claims about the physical world; and to defend the rationality of a specific agnostic stance, namely a temporary pragmatic

agnosticism, which holds that we currently lack decisive evidence but that future inquiry may resolve at least some aspects of these issues.

In Section 2, I review physical processes and cosmological scenarios that could allow humans and other living beings to survive physical death or attain immortality. Section 3 presents scientific and philosophical theories that explicitly predict the existence of an afterlife, distinguishing between "natural" and "creator-based" proposals. Section 4 examines biological and technological routes to immortality for humanity and extraterrestrial civilizations, including possible strategies for escaping cosmic death. Section 5 discusses tools and methods—experimental, informational, mathematical, technological, and astrobiological—that might one day bear on the existence of an afterlife and immortality. Section 6 offers conclusions and reflects on the epistemic status of our current knowledge. Throughout, I emphasize the complementary roles of philosophy, which is fundamental to conceptual clarification, and science, which is instrumental in determining whether specific claims about the afterlife and immortality can be confirmed or refuted.

1.1 Methodological and conceptual framework

1.1.1 Main research questions

The discussion is organized around three overarching questions:

1. Conceptual: How can contemporary scientific and philosophical theories about the afterlife and immortality be systematically classified and compared?
2. Epistemic: To what extent are these theories, in principle, empirically decidable, given current and foreseeable methods in physics, cosmology, biology, technology, and the study of consciousness?
3. Attitudinal: What is a rational epistemic stance toward these theories, given present evidence and realistic prospects of future inquiry?

This article proposes that: (a) a useful taxonomy distinguishes between natural and creator-based afterlives, and between biological and technological immortality; (b) many of the scenarios discussed can be framed in empirically meaningful terms, even if they remain far beyond current testing capabilities; and (c) a temporary pragmatic agnosticism is, at present, the most defensible overall attitude.

1.1.2 Classification criteria

Two main classificatory axes are employed.

(a) Natural vs. divine/creator-based afterlife
An afterlife is natural when, in principle, it can be realized solely through impersonal physical laws and processes, without invoking a divine being or intentional creator. Examples include:

- Orchestrated objective reduction (Orch-OR)-style survival of consciousness within spacetime;
- quantum immortality and biocentrism, in which consciousness persists or reincarnates via quantum or multiverse mechanisms.

An afterlife is divine or creator-based when its existence depends essentially on the will, design, or sustaining activity of a God, gods, or advanced creators. Examples include:

- the Omega Point of de Chardin and Tipler;
- simulated universes and brain-in-a-vat scenarios;
- laboratory-created universes or Boltzmann brain–style realities that function as de facto creators of an experiential world.

(b) Biological vs. technological immortality
Biological immortality refers to scenarios in which organisms avoid death or dramatically extend their lifespans through biological interventions, such as:

- eradication of fatal diseases;
- genetic and cellular modifications (for example, involving telomerase) that slow or halt aging.

Technological immortality refers to scenarios in which survival is secured by changing the substrate or environment of conscious life, for instance through:

- mind uploading or whole-brain emulation;
- extensive cyborgization;
- cosmological engineering strategies (e.g., wormholes, time travel, Dyson-style civilizations) that relocate or prolong civilizations beyond the natural death of their original universe.

These distinctions are conceptual tools. Many concrete proposals straddle categories (e.g., an Omega civilization realized through advanced technology), but the taxonomy helps clarify their principal commitments.

1.1.3 Epistemic status of the main families of proposals

The proposals discussed in this manuscript can be grouped into three broad epistemic categories, largely independent of the previous taxonomy:

(a) relatively well-established physical frameworks;
(b) speculative extrapolations of known physics;
(c) primarily philosophical or metaphorical proposals.

(a) Physics
Standard quantum mechanics and quantum information theory (entanglement, decoherence, computation, information bounds) are well established and empirically supported. They do not, by themselves, assert the existence of an afterlife or immortality; when used here to motivate survival scenarios, this involves speculative interpretation. Similarly, multiverse and cyclic models, universe-from-fluctuation scenarios, and holographic approaches are speculative but mathematically and physically motivated extensions of ΛCDM. They provide a backdrop for thinking about multiple universes, cyclic time, and information bounds, but any link to afterlife or immortality is not part of their core physical content.

(b) Natural afterlife theories
Orch-OR, biocentrism, and quantum immortality are speculative attempts to derive survival scenarios from quantum processes and consciousness studies. They are not part of standard quantum mechanics or mainstream neuroscience, and their scientific status is contested. In this manuscript, they are treated as naturalistic hypotheses about post-mortem existence, informed by physics but going beyond established theory.

(c) Divine or creator-based afterlife
Omega Point proposals, laboratory-created universes, simulated universes, brain-in-a-vat thought experiments, and Boltzmann brain scenarios combine elements of cosmology, information theory, and philosophy of mind. Their core is primarily philosophical or theological: they posit creators or simulators whose intentions underwrite post-mortem survival. While they make contact with physical ideas, they are not derivable from

standard cosmology or quantum theory alone and are here classified as creator-based or divine afterlife hypotheses.

(d) Biological immortality
Research on telomeres and telomerase is grounded in experimental cell biology and biogerontology. Telomere dynamics clearly play a role in cellular aging, and telomerase is associated with immortalized cell lines and many cancers. Extending these findings to whole-organism immortality remains highly speculative and raises serious safety and complexity issues. In this manuscript, telomerase-based biological immortality is treated as an extrapolation from robust cellular results to uncertain organism- and species-level possibilities.

(e) Technological immortality
Mind uploading, whole-brain emulation, and cyborgization are speculative proposals conceptually linked to artificial intelligence (AI), neuroscience, and robotics but not implied by current theories of mind or technology; they face major empirical and philosophical challenges, especially concerning personal identity and consciousness. Cosmological engineering strategies (wormholes, time travel, baby universes, Dyson's eternal intelligence) are extrapolations of general relativity and high-energy physics to the far future, requiring conditions far beyond current evidence.

By making these distinctions explicit, the manuscript clarifies which claims rest on relatively secure physical theories, which extend those theories into speculative territory, and which belong primarily to philosophical or theological reflection. This, in turn, supports the overall methodological stance: that questions about the afterlife and immortality can be discussed rigorously, their empirical content assessed, and a rational agnostic position articulated in light of current knowledge and plausible future developments.

2. Consciousness, physical laws, and the universe: The mysteries of the afterlife and immortality

2.1 Philosophical debates on resurrection, personal identity, and immortality

Recent analytic philosophy has developed a rich literature on resurrection, personal identity, and immortality that can illuminate the scenarios sketched below. Discussions

of bodily resurrection examine whether a person could survive death if God (or an advanced civilization) reconstituted a body or created a numerically distinct but qualitatively similar one, and what conditions would have to be met for the resurrected individual to be the same person rather than a replica. Baker (2000), for instance, emphasizes the persistence of a substantial self or first-person perspective, whereas van Inwagen (1978) and Zimmerman (2016) focus more on the continuity of psychological states or on the reassembly of the same matter in a suitably ordered way. Debates on personal identity and survival often contrast psychological continuity views, which ground identity in the persistence of memory, character, and other mental features (Parfit, 1984), with animalist views that identify persons with human organisms and thus tend to be more restrictive about the possible kinds of post-mortem survival (Olson, 1997). These positions have direct implications for how we should assess the coherence of scenarios involving mind uploading, quantum resurrection, or technologically mediated immortality: depending on which criterion of identity is adopted, some of these scenarios may count as genuine survival, whereas others may instead be interpreted as the creation of new, merely similar individuals. Contemporary literature also addresses the question of how desirable or meaningful an immortal existence might be, focusing on aspects of value rather than on metaphysical ones. Scheffler (2013) and Hodge (2011) argue that an unending life could lead to boredom or a loss of practical identity, while Fischer (1994) contends that properly structured immortal lives could remain open to new projects, relationships, and forms of flourishing indefinitely. Parallel debates examine whether there is empirical or experiential evidence for post-mortem survival, and what such evidence would imply for the immortality of consciousness[3] (Kelly et al., 2007; Carter, 2012; Kelly et al., 2015; Kelly and Marshall, 2021). In addition, recent work has explored the idea of "digital immortality," whereby aspects of a person's identity, data, or behavioral patterns persist in virtual environments or networked infrastructures (Graham et al., 2013; Savin-Baden and Burden, 2019). These discussions raise new questions about whether the survival of informational profiles or virtual agents can plausibly count as personal survival, or whether it concerns only the endurance of data and social traces. These debates show that even if certain cosmological, technological, or informational conditions made survival possible, further philosophical work would be needed to determine whether such forms of immortality would amount to genuine survival of the person, and whether they would be a good thing for finite agents like us.

[3] Consciousness remains an intensely debated topic among scientists and philosophers, as evidenced by Schneider and Velmans (2017), Seth (2021), Dennett (1992), Penrose (1989, 1994), Hameroff and Penrose (2014), Searle (1997), and Chalmers (1996).

2.2 Afterlife, physicalism, and the continuity of consciousness

Contemporary analytic philosophy of religion and philosophy of mind also examines how beliefs in an afterlife relate to physicalism, personal identity, and the continuity of consciousness. Non-physicalist accounts hold that persons have immaterial souls or mental substances that could, in principle, continue to exist without the body, thereby providing a straightforward route to post-mortem survival (Swinburne, 1997). By contrast, physicalist and non-reductive physicalist views attempt to understand mental properties as realized in, or emergent from, physical processes in the brain, raising the question of how survival could be possible if consciousness depends essentially on specific neural structures (Papineau, 2001; Murphy, 2006). Various models have been proposed in response. Theists such as Hick (1976) suggest that God could recreate or "copy" the relevant physical and functional patterns elsewhere, preserving the continuity of consciousness through a suitable form of psychological or structural continuity, even if the original brain is destroyed. By contrast, Merricks (1998) and Hudson (2001) argue that only a continuous, non-interrupted physical process can underwrite genuine survival, and that any scenario involving duplication, branching, or radical reconstruction would disrupt identity, yielding at best qualitatively similar successors rather than the same person. These debates also intersect with discussions of near-death experiences, brain death, and the nature of conscious awareness at the edge of life, which raise difficult questions about when consciousness ceases and whether it could resume in a different physical or metaphysical context (van Lommel, 2001; Kelly et al., 2007; Parnia, 2014). Overall, the contemporary literature suggests that the coherence of afterlife and immortality scenarios depends crucially on how we understand the metaphysics of persons, the relation between mind and body, and the criteria for the persistence of a single stream of consciousness through time and radical change.

2.3 Consciousness and quantum physics

A challenge that has baffled scientists over the ages is understanding consciousness—why humans possess awareness that enables them to think, feel, and interpret the reality around them. This consciousness might also belong to all living beings who have lived, are living, and will live on Earth. Stapp (2009) suggests that consciousness, owing to the laws of quantum physics[4], could persist beyond physical death. Therefore, science could

[4] For an extensive bibliography concerning quantum physics and its implications for understanding the universe, the most relevant works are Bohm (1989), Binney and Skinner (2008), Eisberg and Resnick

arguably offer the potential for quantum physics to support the idea of an afterlife. This is, however, a philosophical extrapolation from quantum theory rather than a consequence entailed by the standard formalism of quantum mechanics, which remains officially agnostic about survival after bodily death.

2.4 Cosmological models and the structure of reality

Among the various recent scientific theories[5] on the existence of parallel and serial universes, the multiverse hypothesis is explored in the many-worlds interpretation (Everett, 1957), string theory (Kaku, 1999), eternal inflation theory (Guth, 2007), black hole cosmology (Good, 1972), and cosmological natural selection (Smolin, 1997). The cyclic universe is posited in theories such as the ekpyrotic universe (Steinhardt and Turok, 2007), the Big Bounce (Ashtekar et al., 2006), the Baum–Frampton model (Baum and Frampton, 2008), conformal cyclic cosmology (Penrose, 2010), and the quasi-steady state universe (Hoyle et al., 1993). Simultaneously, some theories embrace the possibility of a single universe, proposing that our cosmos originated from a process prior to the Big Bang or from a primordial energetic core. The former hypothesis encompasses several specific models, including a Big Bang triggered by a quantum fluctuation (Tryon, 1973), the Hartle–Hawking no-boundary state (Hartle and Hawking, 1983), the emergent universe scenario (Ellis and Maartens, 2003), and quantum potential cosmology (Farag Ali and Das, 2015). The holographic universe theory (Hertog, 2023) provides primary support for the latter hypothesis.

2.5 Objections to and limitations of contemporary cosmological theories

While these models are part of contemporary theoretical cosmology, each faces important scientific and philosophical objections. Multiverse proposals, for example, are often criticized for their limited empirical testability and the risk of blurring the boundary between physics and metaphysics, as many putative "other universes" may be, in practice, observationally inaccessible (Vilenkin, 2006; Ellis, 2014). Concerns have been raised that such theories may rely heavily on anthropic reasoning and introduce measure problems

(1985), Feynman et al. (1965), Griffiths (2004), Greenberger et al. (2009), Cox and Forshaw (2011), and Chester (1987).

[5] The most comprehensive book for understanding the hypotheses on what came before the Big Bang is Vaas (2011).

when attempting to assign probabilities to events across infinitely many universes (Ellis et al., 2004). Cyclic universe models, despite offering an appealing way to evade an initial singularity, confront difficulties related to entropy accumulation and the second law of thermodynamics: it is not straightforward to explain how each new cycle could begin in a low-entropy state compatible with the observed large-scale structure of our universe (Tolman, 1934; Penrose, 2010). Some variants also depend on speculative high-energy physics or specific forms of dark energy that have not yet been confirmed (Steinhardt, 2011). Theories of a universe "from nothing" are frequently contested on conceptual grounds. Critics point out that the "nothing" invoked in such accounts often involves rich physical structures—such as quantum fields, laws, or boundary conditions—that seem far removed from the absolute nothingness of philosophical discussion (Carroll, 2016). Questions remain about whether such laws or fields can meaningfully be said to exist "before" spacetime, and whether appeals to quantum vacuum fluctuations really explain why there is something rather than nothing (Vilenkin, 2006). Finally, holographic approaches propose that the fundamental description of reality is encoded on a lower-dimensional boundary, with the familiar three-dimensional world emerging from this deeper structure. Although motivated by developments in quantum gravity and black hole thermodynamics, these ideas remain mathematically and conceptually incomplete, and there is ongoing debate about how, and to what extent, holographic models could be directly tested in our universe (Bousso, 2002). These objections do not refute the theories outright but highlight that the cosmological models being referenced here are highly speculative and actively debated. The possible implications for an afterlife or immortality discussed below should therefore be understood as philosophical interpretations built on contested physical frameworks, rather than as consequences endorsed by the standard models of cosmology or quantum theory.

2.6 Afterlife and immortality as philosophical interpretations

All theories concerning the origin and global structure of the universe are, at least in principle, compatible with the hypothesis of an afterlife. Through quantum mechanics, consciousness could continue to exist within our universe, transition to another universe, or return to a cyclical existence (Mensky, 2010). These possibilities are not predictions of the accepted physical theories themselves; rather, they represent philosophical interpretations that attempt to relate cosmological and quantum frameworks to questions about survival after death. Closely related to the afterlife is the hypothesis of immortality, which can be biological or technological. Future advancements in medicine may make the human body immortal (West, 2003), and future technologies may enable human

consciousness to persist through specific mechanisms (Perry, 2000). However, even if this were feasible, the challenge of ensuring their true perpetuity would remain. Here again, the scenarios considered are speculative extrapolations based on imagined developments in biomedicine and technology, rather than outcomes guaranteed by current scientific models.

2.7 Ultimate fate of the universe and limits of eternal life

Theories concerning the ultimate fate of the universe[6] offer little optimism for the possibility of eternal life. According to the Big Freeze (Thomson, 1882), the universe is destined to become a dark, cold place devoid of available energy. Big Crunch proponents (Friedman, 1922) predict that the universe will contract back into the primordial energy core of the Big Bang, whereas the Big Rip (Caldwell et al., 2003), Big Decay (Leslie, 1996), and Big Hit (Starobinsky, 2000) theorize that it will disintegrate. Alternatively, according to the Mars–Senovilla–Vera model (2008), time itself could cease. Nevertheless, it is conceptually possible that humanity may develop an advanced technology that can avert its tragic fate, enabling eternal life. This idea, however, is presented as a philosophical and speculative proposal that goes beyond the standard implications of contemporary cosmology, which generally predicts scenarios under which all known forms of life eventually cease.

2.8 Life beyond Earth and alternative biochemistries

At this point, it is essential to determine whether the hypotheses about life after death and immortality can be applied to other species on Earth, on other planets, or in other universes. If consciousness, through the principles of quantum mechanics, could endure beyond physical death, or if a future advanced technology could help achieve biological and technological immortality, it would potentially be applicable to all living species on Earth in the distant future. This line of reasoning can be extended to any living organism within our universe or across other cosmic realms governed by the same physical laws. Carbon remains the only known element that theoretically enables life to extend beyond Earth. Given the vastness and potentially infinite universe that operates under consistent physical laws, it is only reasonable to speculate that life, including carbon-based intelligent beings, could be widespread. On the question of whether life can emerge solely

[6] Hypotheses concerning the ultimate fate of the universe have been investigated by Davies (1994) and Mack (2020).

through carbon-based processes, Sagan (1973, p. 47) reasoned that life could manifest in unfamiliar forms, beyond traditional carbon-based structures, in ways we cannot yet conceive. His carbon chauvinism hypothesis suggests that extraterrestrial life forms might be composed of alternative chemical elements, such as silicon. The critical issue here is whether the concepts of an afterlife and immortality would apply to living species regardless of whether they emerged from carbon, silicon, or hitherto unknown chemical processes. Quantum laws and advanced technology could also apply to any alien life form[7] in our cosmos or other universes that operate on the same physical laws. Furthermore, any technologically advanced civilization might develop the means to attain biological and technological immortality, apply their discoveries to living beings on their planets, and enable them to exist indefinitely. Such possibilities, however, remain speculative projections that extend well beyond the current empirical reach of astrobiology and exoplanetary science.

2.9 Multiverse, cyclic universes, and the scope of survival

When considering the possibility of life forms evolving within a multiverse or cyclic universe, various theories propose that living beings could emerge under physical laws entirely different from our own. However, even if their bodies and consciousness were formed through mechanisms utterly distinct from ours, the possibility of an afterlife and immortality cannot be ruled out. Physical laws that give rise to conscious beings in parallel and cyclic universes, if such universes exist, might also allow these species to persist after death in forms unknown to us and different from those envisaged by standard quantum mechanics. Additionally, intelligent extraterrestrial civilizations, evolved via unknown mechanisms, may achieve immortality that transcends human imagination. They might harness their advanced technologies to prevent cosmic extinction, or even extend these technologies to other species on their respective planets, potentially granting them immortality. These scenarios should be read as philosophical thought experiments about how different physical laws might still permit survival and immortality, not as claims entailed by current multiverse or cyclic models.

[7] Webb (2015) summarizes the arguments for and against the existence of extraterrestrial life.

2.10 God, the afterlife, and immortality

Another aspect worth exploring is the possible relationship between the concept of God[8], the afterlife, and immortality. The existence of God remains a much-debated subject in the 21st century. Scientifically, the presence of a God or multiple gods responsible for the emergence of the cosmos, or its evolutionary process, is possible. These gods could have created the cosmos or infinite cosmoses to develop life. Moreover, they could have structured the universe according to certain physical principles that enable the afterlife and immortality; established quantum laws to ensure that consciousness could persist beyond the death of the physical body; and created physical laws enabling intelligent beings to develop the necessary technology to attain immortality. These reflections belong to the author's philosophical and theological interpretation of how divinity, physical law, and survival might be related. They are not claims that follow from the standard models of cosmology or quantum theory, which, as scientific frameworks, remain neutral on the existence of God and on the reality of an afterlife.

2.11 Afterlife, eternal continuity, and structure of time

Regarding the potential link between the afterlife and immortality, the fundamental question is whether it allows for eternal continuity in time. This question is embedded in every theory concerning the afterlife. It can be argued that any model positing the existence of a singular universe or infinite parallel or sequential universes[9] does not preclude the possibility of an immortal consciousness. If only a single universe exists, then future advancements in human technology may address the ultimate fate of the universe, preventing scenarios such as the Big Freeze and Big Crunch. Consequently, the consciousness of every deceased being in the universe could continue to exist indefinitely. This is a speculative philosophical scenario that presupposes both radical technological capacities and a particular view of how consciousness could be preserved or re-instantiated. Conversely, if parallel or sequential universes exist, consciousness might persist eternally by transitioning between different universes or recurring cyclically. However, such transitions may reach a limit: at some stage, we might discover a universe

[8] For academic discussions on how the question of God's existence continues to provoke divergent opinions among scientists, philosophers, and theologians, see Spitzer (2010), Stenger (2007), and Diller and Kasher (2013).

[9] For a deeper exploration of the concept of infinity from a philosophical and scientific perspective, refer to Heller and Woodin (2011), Barrow (2005), and Rucker (1984).

where a form of immortality already exists, preventing any further transfer of our consciousness. If this hypothesis were valid, consciousness would last forever in that universe. Once again, this is intended as a philosophical thought experiment that explores the logical space opened by different cosmological models rather than as an implication formally deduced from the standard theories of cosmology or quantum physics.

3. Hypotheses on life after death: A multidisciplinary analysis

3.1 Natural afterlife hypotheses

Are there scientific theories that affirm the plausibility of life after death? Contrary to common assumptions, some interpretations of current science seemingly allow for this possibility. It is important to stress at the outset that the following hypotheses—although inspired by contemporary physics and cosmology—are speculative philosophical interpretations rather than consequences entailed by the standard models of quantum theory or neuroscience. One such theory is the Orch-OR hypothesis, which contends that human consciousness arises from quantum processes occurring within the brain (Hameroff and Penrose, 2014). Hameroff and Chopra (2012) suggest that these same quantum processes might also enable consciousness to persist beyond physical death, continue to exist within the spacetime fabric of the cosmos, and allow a deceased individual to experience a new form of existence. In this sense, the idea of a natural afterlife is read into the Orch-OR framework: if consciousness is grounded in fundamental quantum processes, these processes might conceivably continue independently of a particular biological substrate. Another theory supporting the possibility of life after death is quantum immortality, first theorized by Squires (1986). Linked to the quantum states predicted by Everett's (1957) many-worlds interpretation, it posits that every quantum event results in the branching of multiple worlds. The fundamental premise of quantum immortality is that, upon death, an individual's consciousness transfers to the body of an individual in another universe, allowing the deceased person to continue existing beyond physical death. Quantum immortality is similar to biocentrism, developed by Lanza et al. (2009, 2016, 2020). This theory asserts that reality is merely a construct of the human consciousness and that consciousness, owing to quantum processes, does not perish with the physical body but is transferred to another entity in an alternate universe. The implicit suggestion is that this phenomenon could occur under any theory positing the existence of a multiverse, such as cosmological natural selection, eternal inflation, string theory, or even Everett's (1957) hypothesis.

Once again, the move from these physical frameworks to claims about post-mortem survival reflects a philosophical extrapolation rather than the official content of the theories themselves.

3.2 Objections to and limitations of natural afterlife theories

Regarding Orch-OR, several physicists and neuroscientists argue that the brain is far too warm and noisy an environment to sustain the kind of delicate quantum coherence required by the model over relevant time-scales, and that there is currently no robust empirical evidence that microtubules play the proposed role in generating consciousness (Grush and Churchland, 1995; Tegmark, 2000). More recent discussions of experimental tests and underground radiation measurements likewise suggest that, so far, no decisive empirical support for the Orch-OR mechanism has emerged (McQueen, 2023). From this perspective, the use of Orch-OR to support a natural afterlife is doubly speculative: both the underlying account of consciousness and the further claim that the relevant quantum processes could persist independently of the brain remain contentious. Quantum immortality has been challenged on conceptual and ethical grounds. Critics maintain that the theory misinterprets probability in the many-worlds framework and neglects issues of personal identity: the existence of branches in which a counterpart survives does not straightforwardly entail that the original person continues to exist (Wallace, 2012). Moreover, the view has counterintuitive practical implications—such as an apparent indifference to life-threatening risks—that have been taken as a reductio of the underlying interpretation (Lewis, 2016). Biocentrism, finally, is often criticized for treating consciousness as primary in a way that appears to conflict with well-established findings in physics and biology. Detractors point out that the dependence of experience on neural processes is strongly supported by contemporary science, and that re-describing physical theories in consciousness-centered terms does not by itself provide a mechanism for post-mortem survival. From this perspective, biocentrism has been faulted for its lack of a clear anchoring in standard physical theory and for relying on speculative metaphysical claims that go beyond available empirical support (Smith, 2010). Even in more popular discussions, Lanza is frequently portrayed as a provocative figure operating at the margins of mainstream science rather than as articulating a widely accepted research program (Herper, 2010). On this reading, biocentrism employs scientific language but, in its stronger forms, operates more as a metaphysical or quasi-religious doctrine than as an empirically constrained theory. These objections do not demonstrate that natural afterlife hypotheses are impossible but indicate that they are not supported by standard quantum

mechanics or mainstream neuroscience and remain highly controversial both empirically and conceptually.

3.3 Creator-based afterlife scenarios

Other theories focused on the existence of God and incorporating the potential for an afterlife are the Omega Point, laboratory-created universe, simulated universe, brain-in-a-vat, and Boltzmann brain theories. Here again it is useful to distinguish carefully between (a) what is suggested by current cosmology and information theory and (b) the author's philosophical interpretation connecting these ideas to life after death. Proposed by the Jesuit priest de Chardin (1955) and physicist Tipler (1994, 2007), the Omega Point posits that, in the distant future, an omnipotent and omniscient God with the capacity to overcome the end of the universe will come into existence, formed by the fusion of human consciousness. The distinction between de Chardin's and Tipler's hypotheses lies in how this Omega Point is realized: natural processes per de Chardin and simulation-related mechanisms according to Tipler. Moreover, de Chardin's theory is supported by the Big Freeze scenario, wherein the potential God becomes transcendent and escapes the ultimate fate of the universe. Conversely, Tipler's Omega Point can be realized only within the Big Crunch model, wherein God remains immanent within the cosmos and evades cosmic extinction through the physical processes associated with the final gravitational singularity. The theories of the laboratory-created universe (Harrison, 1995), simulated universe (Bostrom, 2003), brain-in-a-vat (Putnam, 1981), and Boltzmann brain (Dyson et al., 2002) share a common premise: one or multiple Creators are responsible for our existence and the universe we inhabit. According to the laboratory-created universe, simulated universe, or brain-in-a-vat hypotheses, the necessary conditions for existence could be created through experimental means by an extraterrestrial civilization, council of deities, or scientist. Specifically, a universe suitable for life or a reality where human beings can exist could be constructed within a computer simulation or generated by submerging a human brain in a vat of nutrient-rich liquid. The Boltzmann brain hypothesis differs significantly, positing that a brain arising from a quantum fluctuation within a chaotic state could fabricate a reality akin to that observed in our universe, ensuring its existence through a human being. According to some interpretations, all these theories built on the notion of a Creator could also allow for the possibility of an afterlife, whose specific nature would depend on the scientific framework underlying the theorized Creator's existence. If, for instance, our universe was engineered in a laboratory, the extraterrestrial civilization responsible for initiating the Big Bang may have deliberately established certain physical laws, such as quantum laws, to enable the consciousness of

intelligent beings to persist beyond the death of their physical bodies. In these scenarios, the continuation of existence after death depends fundamentally on the choices, intentions, or design constraints of the relevant Creator(s).

3.4 Objections to and limitations of Creator-based theories

Creator-based scenarios face their own set of objections. The Omega Point has been criticized for relying on highly specific cosmological conditions—such as a closed universe that re-collapses in a Big Crunch—that appear to be at odds with current observations favoring an accelerated expansion driven by dark energy. Earman (1995) therefore regards Tipler's framework as physically implausible at present and treats both versions of the Omega Point as speculative theological or philosophical constructions rather than as serious contenders within standard cosmology. Similarly, Jaki (1988) criticizes de Chardin's Omega Point for conflating scientific cosmology with theological eschatology and for relying on outdated physical models; on his reading, de Chardin's proposal functions more as a theologically motivated vision of cosmic salvation than as an empirically grounded cosmological hypothesis. The simulated universe hypothesis, while stimulating fruitful discussion in analytic philosophy of religion and philosophy of mind, is frequently challenged for its limited empirical testability and for the difficulty of distinguishing, from within a putative simulation, between genuine evidence and simulated evidence. Philosophers such as Weatherson (2003) and Chalmers (2005) argue that simulation scenarios raise serious skeptical and explanatory problems: particularly, they can appear to collapse into forms of radical skepticism with little practical import, or to presuppose background physical facts (about the simulators and their world) that are at least as puzzling as the reality they are meant to explain. Brain-in-a-vat thought experiments are typically understood as devices for probing the limits of knowledge and reference, rather than as realistic physical models of our condition, and their physical feasibility is rarely defended in detail (Brueckner, 1992). The Boltzmann brain hypothesis, meanwhile, is often treated as a reductio: if a cosmological model predicts that isolated, fluctuation-generated brains are vastly more probable than ordinary observers embedded in an orderly universe, this is taken to count against the model rather than in favor of the reality of Boltzmann brains (Albrecht and Sorbo, 2004; Page, 2006). As with naturalistic hypotheses, these criticisms suggest that creator-based accounts of the afterlife belong primarily to the realm of speculative metaphysics. They employ concepts drawn from cosmology, thermodynamics, and information theory, but they do not follow from standard physical theories and remain deeply controversial. This applies not only to Omega Point and simulation scenarios but also to proposals involving

laboratory-created universes, which typically presuppose speculative control over high-energy physics and initial conditions far beyond anything currently envisioned in empirical cosmology (Ellis and Silk, 2014).

3.5 Multiverse and plural afterlives

In exploring the possibility of other scientific forms of post-mortem existence, alongside those theorized by philosophy and religions, examining the multiverse concept may prove valuable. Currently, numerous theories predict the existence of infinite universes taking various forms, each operating under similar or distinct natural laws. Tegmark (2014) categorized the multiverse into four levels, whereas Greene (2011) identified nine types. Of particular relevance to our discussion on the afterlife are Tegmark's fourth-level multiverse and Greene's ninth-level (extreme) multiverse. The latter suggests that all possible types of universe are as real within the multiverse as our own. This implies that, provided their probability of existence differs from zero, there must be universes in which the afterlives envisioned by Judaism, Islam, Christianity, Greek, Roman, and Celtic traditions exist alongside those posited by Hinduism, Buddhism, and Taoism. Similarly, philosophical notions of the afterlife, such as the entry of consciousness into Plato's World of Forms (Brumbaugh and Wells, 1968), would also be feasible within Greene's extreme multiverse. Conversely, should these traditional forms of the afterlife be deemed incompatible with our physical laws and, thus, scientifically impossible, they may find a place within Tegmark's fourth-level multiverse. This model postulates the existence of universes governed by entirely different sets of physical laws, allowing for the potential realization of any kind of religious or philosophical afterlife conceptualized throughout human history, including the nirvana of Eastern religions and the Hades of polytheism. Within Greene's extreme multiverse and Tegmark's fourth-level multiverse, any scientifically conceivable form of afterlife existence could arguably also be realized, including entry into a hidden dimension. The rationale for this contention is the existence in their predicted multiverse of any scenario with a non-zero probability of existing in universes with our laws of nature or in cosmoses with different laws. As before, this is an interpretive extension: the multiverse frameworks themselves do not assert the actuality of specific religious or philosophical afterlives, but they provide a conceptual space within which such possibilities can be situated.

3.6 Natural vs creator-designed afterlife

The scientific, philosophical, and religious conceptions of the afterlife described here warrant further contemplation. We have focused so far on how life after death is possible through natural mechanisms, such as biocentrism, or through a Creator-driven paradigm, as exemplified by the simulated universe hypothesis. It is also possible that the afterlife could extend to any form of alien civilization and living beings within this or any other universe governed by similar physical laws. Quantum immortality, biocentrism, and the Orch-OR theory, which postulate that quantum laws enable the survival of consciousness, could apply to any life species, as each possesses some form of consciousness. Similarly, afterlife scenarios based on body simulation, the brain-in-a-vat, the Boltzmann brain, or religious and philosophical traditions could be valid for all living beings, as the physical processes employed by the Creators to facilitate an afterlife might apply to all species. However, in universes with physical laws distinct from our own, a different argument must be made about a potential afterlife. Even in universes without quantum laws or simulation-related processes enabling an afterlife, there could be scientific, religious, or philosophical forms of afterlife existence, which the physical constraints of our cosmos place entirely beyond human comprehension. Regarding the exact nature of life after death, pertaining to humans or other living beings, it is necessary to establish whether the afterlife that awaits us is a natural phenomenon or designed by a Creator. A natural afterlife would involve the continuation of conscious existence within spacetime (Orch-OR theory) or reincarnation into a specific body (biocentrism and quantum immortality). In the first scenario, the consciousness of all living beings (humans, animals, plants, or extraterrestrials) who have lived, are living, or will live in the universe would continue to travel through cosmic spacetime, observing the progression of life on planets they once inhabited. In the second scenario, consciousness would reincarnate into bodies of the same species in other universes. As the consciousness of each being is unique, it would be impossible through purely natural processes for the consciousness of a human being to coincide with that of a cat in another cosmos. The concept of an afterlife determined by a Creator is distinct: life after death would unfold according to the specific will of a God capable of deciding how different living beings should continue their existence. Within the framework of the Omega Point and revealed religions, the afterlife would manifest as heaven, purgatory, or hell for any species that has ever existed throughout the history of the universe. As per the theories of the simulated universe, brain-in-a-vat, and Boltzmann brain, the types of life after death would be infinite, with the Creator able to decide to reincarnate every living being that has ever lived. This reincarnation could take the form of a human, alien, animal, or plant, perhaps following the rules of karma

established by Eastern religions. Alternatively, beings might be transferred to hidden dimensions, such as those theorized in string theory, or transcendent worlds, such as those hypothesized by Plato, according to the Creator's unquestionable will.

3.7 Eternity and the temporal structure of the afterlife

On the nature of eternity, we must consider the specific type of afterlife that awaits us. According to Hameroff's Orch-OR theory, it could be eternal, with the indefinite persistence of consciousness within cosmic spacetime owing to future technological advancements. An eternal afterlife also aligns with de Chardin's and Tipler's Omega Point, along with the eschatological beliefs of revealed religions: once an entity has reached heaven, purgatory, or hell, that afterlife existence could never be altered. Conversely, as posited by quantum immortality and biocentrism, one might continue reincarnating into human bodies indefinitely or transition into a universe where the human species is immortal, thus halting the continuous transfer of consciousness. In the simulated universe, brain-in-a-vat, and Boltzmann brain hypotheses, eternity would be contingent on the will of the Creator, who might choose to perpetuate the reincarnation of consciousness into human forms or various other life forms indefinitely; eventually terminate the ongoing cycle of rebirth and transfer consciousness to a universe devoid of death, where all species exist in a state of immortality; or directly transmigrate consciousness into a transcendent world, allowing beings to live there eternally. In all these cases, the appeal to eternity reflects the author's philosophical interpretation of how different physical or theological frameworks might shape the temporal profile of post-mortem existence; it is not a prediction yielded by standard cosmological or quantum models.

3.8 A schematic taxonomy of afterlife hypotheses

For clarity, the main families of hypotheses discussed in this section can be schematically summarized along three dimensions:
(1) whether the afterlife is natural or depends on a Creator;
(2) whether it unfolds within a single universe or a multiverse;
(3) whether it involves finite or eternal survival.

(A) Natural afterlife (no Creator required)

1. **Single-universe, finite survival**
   Hypothetical scenarios in which consciousness persists for a long but ultimately limited period within a single cosmos (for example, via advanced technologies extending life or preserving consciousness until the heat death of the universe).
2. **Single-universe, eternal survival**
   More speculative proposals in which quantum or informational processes sustain consciousness indefinitely within our universe, perhaps aided by future technology (e.g., Orch-OR-style survival in cosmic spacetime, if combined with technological stabilization).
3. **Multiverse-based, finite survival**
   Models in which consciousness can transition between a limited range of universes or cycles, but where the overall sequence of existences is still temporally bounded.
4. **Multiverse-based, eternal survival**
   Quantum immortality and strong versions of biocentrism, which envisage an unending sequence of reincarnations or transfers of consciousness across branches or universes, with no final termination point.

(B) Creator-based afterlife (dependent on a divine or quasi-divine agent)

1. **Single-universe, finite survival**
   Scenarios in which a Creator grants post-mortem existence for a limited period or up to a final cosmic event (for example, certain interpretations of eschatological timelines with a definitive end).
2. **Single-universe, eternal survival**
   Traditional religious afterlives (heaven, purgatory, hell) and Omega Point-style views in which God or a God-like reality guarantees an unending existence for resurrected or transformed beings.
3. **Multiverse-based, finite survival**
   Simulation-style scenarios where Creators or simulators can instantiate multiple universes or levels of reality, but choose to provide only a temporally limited sequence of post-mortem lives or environments.
4. **Multiverse-based, eternal survival**
   More expansive creator-based hypotheses—such as open-ended simulations, laboratory-created universes, or deity-governed multiverses—where a God or simulator can perpetually re-instantiate, transfer, or transform conscious beings across different universes or dimensions without temporal limit.

(C) Multiverse-based pluralism about afterlives

Greene's extreme multiverse and Tegmark's level-four multiverse provide an overarching framework within which both natural and creator-based afterlives—religious, philosophical, or scientific—might each be realized in different universes. This matrix makes it explicit that, in principle, every combination of natural vs creator-based, single-universe vs multiverse, and finite vs eternal survival could be instantiated somewhere in the multiverse, even if only a subset of these possibilities has been discussed in detail in this manuscript. Highlighting the full space of combinations also helps identify potential gaps in coverage and to avoid repeating similar scenarios in different sections, as many proposals can be located at specific points within this three-dimensional taxonomy.

4. Future immortality: Scenarios for humanity and extraterrestrial civilizations

4.1 Biological immortality

This study proposes that humanity could one day achieve immortality through biological or technological means. The first step toward biological immortality would be to eradicate all infectious, cardiovascular, neurological, and oncological diseases that currently lead to human death. Advancements in future medicine could permanently eliminate many fatal diseases. However, aging would persist, eventually resulting in physical death. Preventing this would require modifications to human DNA that halt or radically slow cellular aging, for instance by stabilizing telomeres and modulating telomerase activity in ways that protect cells from senescence[10]. On optimistic readings of current biogerontology (de Grey and Rae, 2007), sustained progress in these areas could enable humans to reach biological immortality by ceasing to experience aging-related decline and, consequently, most forms of natural death. From the standpoint of mainstream aging research, however, several limitations arise. First, aging is widely understood as a complex, multifactorial process involving genomic instability, telomere attrition, epigenetic alterations, mitochondrial dysfunction, cellular senescence, stem-cell exhaustion, and altered intercellular communication (López-Otín et al., 2013). This "hallmarks" framework suggests that no single intervention—such as telomerase activation—can by itself abolish organismal aging. Second, evolutionary theories of

[10] On the importance of telomerase in achieving biological immortality, see Kim et al. (1994), Cohen et al. (2007), Bryan et al. (1995), Murnane et al. (1994), and Barsov (2011).

senescence emphasize that organisms are not "designed" for indefinite survival: trade-offs between early-life fitness and late-life maintenance may place fundamental constraints on how far the lifespan can be extended (Olshansky et al., 1990; Kirkwood, 1999). Third, telomere extension and telomerase activation are strongly implicated in tumorigenesis, raising the prospect that attempts to engineer cellular immortality could substantially increase cancer risk (Blasco, 2005). Taken together, these considerations lead authors such as Olshansky et al. (1990), Kirkwood (1999), López-Otín et al. (2013), and Blasco (2005) to regard radical biological immortality as a speculative extrapolation from current data rather than a realistic near-term prospect. While significant life extension may be achievable, the idea of completely overcoming aging via telomerase-focused interventions remains highly conjectural within standard biomedicine.

4.2 Technological immortality

Technological immortality could be accomplished through mind-uploading[11] or transforming humans into cyborgs. Future technological advancements could enable the transfer of human consciousness into a computer or robot before death, ensuring indefinite existence, or allow individuals to integrate self-repairing technological components into their bodies in ways that greatly extend their lives. Proponents of mind uploading such as Moravec (1988) argue that, given a sufficiently detailed capture of neural structure and functional organization, a person's consciousness and identity could be instantiated on a different substrate, thereby securing a form of technological survival. Defenders of cyborg futures, however, such as Clark (2004), maintain that humans are already "natural-born cyborgs," whose cognitive capacities can be durably and beneficially extended through intimate technological integration. These scenarios draw on ongoing developments in AI, neuroscience, and human–machine integration, but they face substantive empirical and philosophical objections. From a neuroscientific and cognitive perspective, some authors argue that consciousness depends on the specific dynamical, embodied, and biologically embedded organization of the brain, casting doubt on whether a purely digital simulation could reproduce the relevant properties (Metzinger, 2009; Nicolelis, 2011). If conscious experience is tightly linked to continuous, organism-level processes, then a discrete, substrate-independent "upload" may fail to preserve the original subject's consciousness, even if it replicates functional behavior. Philosophically, critics of mind uploading question whether a perfect informational copy would count as the same person or merely as a numerically distinct successor. Concerns about duplication, branching, and fission suggest that uploading may at best create new

[11] For more on theories of achieving technological immortality through mind-uploading, see Bamford (2012), Sotala and Valpola (2012), Sandberg and Bostrom (2008), Kurzweil (2000), and Choe et al. (2012).

individuals with similar mental states, without securing genuine survival for the original agent (Hauskeller, 2013; Diéguez, 2017). On such views, promises of technological immortality via uploading rest on a controversial and under-argued notion of personal identity. Cyborg-oriented approaches confront further difficulties. Long-term integration of complex technological components into the human body raises persistent issues of biocompatibility, system reliability, and vulnerability to catastrophic failure or cybernetic attack. Moreover, critics highlight ethical and social risks: the emergence of radically enhanced elites, new forms of dependence on proprietary technologies, and potential erosion of traditional forms of human embodiment, agency, and responsibility (Hauskeller, 2013; Diéguez, 2017). These concerns suggest that even if extreme enhancement were technically feasible, it might not deliver the stable, egalitarian, and meaningful form of immortality often envisaged in transhumanist discourse.

4.3 Escape from cosmic death

The fundamental issue with biological or technological immortality is that, even if attained, it would still have to cope with processes inherent to the end of the universe. All cosmological theories about the fate of the universe suggest that life, in its conventional sense, cannot persist indefinitely. Nonetheless, some theories suggest that this existential catastrophe could be averted. Kaku (2004, pp. 321–342) suggests multiple ways of ensuring perpetual existence: "developing and proving a theory of everything, discovering natural wormholes and white holes, sending probes through black holes, building a black hole in slow-motion, creating a 'baby universe,' building huge particle accelerators, developing implosion mechanisms, building a warp-drive propulsion machine, harnessing negative energy from compressed states, waiting for a quantum transition, or injecting sufficient information into a new universe to reconstruct our civilization on the other side of a wormhole." Kaku's hypotheses build on the utilization of wormholes as hypothetical spacetime tunnels through which humanity could potentially escape the death of the universe. By navigating through wormholes that arise in connection with black holes, white holes, quantum transitions, or compressed states of negative energy, human civilization or its constituent information could enter a spacetime conduit and emerge elsewhere, either within the same (infinite) universe or in another universe in the multiverse. This reasoning also applies to the creation of a baby universe, the construction of huge particle accelerators, and the development of implosion mechanisms, as theorized by Kaku. In these cases, the wormholes necessary to abandon our cosmos and transfer to another are created by humanity, rather than being intrinsic to the nature of the universe. Kaku's only non-wormhole hypothesis is the construction of a

warp-drive machine, which would essentially function as a form of time machine[12] and enable humanity to return to an era when the universe was warmer, thus allowing civilization to persist. Kaku's hypotheses also involve immortality of the human species, as these processes circumvent the death of the universe and could be repeated endlessly, enabling humans to exist indefinitely. Other scientific theories proposing boundless existence include Dyson's (1979a, 1979b) eternal intelligence theory, whereby future human civilization could escape the effects of the Big Freeze by performing an infinite number of computations while consuming only a finite amount of energy. With the cooling of the universe, these computations would slow down but their infinite nature would ensure the continued existence of human civilization. More cosmologically ambitious variants of technological immortality—such as using wormholes, warp drives, or time travel to escape cosmic death, or realizing Dyson-style "eternal civilizations"—also face stringent physical constraints. Proposals for traversable wormholes typically require exotic matter and negative energy densities that may be forbidden by quantum inequalities or rendered unstable by semiclassical effects (Morris et al., 1988; Visser, 1995). Similar issues arise for warp-drive spacetimes, which likewise rely on distributions of negative energy that clash with known energy conditions and quantum constraints (Visser, 1995; Everett and Roman, 1997). Time-travel scenarios based on wormholes encounter additional difficulties related to the formation of closed time-like curves and possible mechanisms for chronology protection (Visser, 1995; Everett and Roman, 1997). Finally, analyses of the far future of the universe indicate that, in many plausible cosmological models, there is only a finite amount of free energy available for computation, undermining the long-term viability of indefinitely sustained "eternal civilizations" or Dyson-style cosmic computers (Adams and Laughlin, 1997; Krauss and Starkman, 2000). In light of these limitations, cosmological escape routes from cosmic death—whether via wormholes, warp drives, time travel, or Dyson-style eternal civilizations—should be regarded as highly speculative projections rather than as consequences of established physical theory.

4.4 Immortality, advanced civilizations, and philosophical interpretation

The ultimate immortality of the human species can be linked to the theories explored in Section 3 concerning the potential existence of an afterlife. For example, a civilization

[12] The possibility of time travel into the past and future is supported by Davies (2002).

that reaches the Omega Point, whether transcendent or immanent, would attain immortality by overcoming the processes that would otherwise determine its extinction, thereby securing its eternal existence. According to theories of a simulated or laboratory-created universe, a future human society might construct such a universe and transfer into it through a wormhole to exist perpetually. Scientific theories on humanity's potential for immortality could also apply to future non-intelligent life forms inhabiting Earth. No known physical law precludes the possibility that biological immortality, technological immortality, or immortality achieved by escaping the death of the universe could be available to any species. This would be facilitated by the benevolence of future humans, who might apply the same processes used for themselves to grant immortality to all living beings on Earth. Each of the aforementioned possibilities could be realized at some point in the history of the universe, owing to the technological singularity and the Barrow scale. As predicted by Kurzweil (2005), the technological singularity posits that, at some stage, technological progress will accelerate beyond human predictive capacity, leading to an advanced future technology that may help humanity attain biological and technological immortality, potentially even overcoming the end of the universe. These sophisticated technologies may eradicate fatal diseases, modify DNA, proceed with mind-uploading, and construct laboratory-based or simulated universes. From the perspective of current science, however, the singularity and associated forms of immortality are prospective scenarios rather than outcomes mandated by existing physical or computational theories. Another way of achieving immortality is determined by how human civilization develops. Kardašëv (1964) classified civilizations into three types based on their technological development: Type I can harness all the energy of their planet, Type II of the star in their planetary system, and Type III of the galaxy. Subsequently, Barrow (1998, p. 133) reformulated the Kardašëv scale, proposing seven types of civilizations. The seventh type, known as Omega Minus, is most pertinent to our discourse. Barrow posited that, one day, human civilization may be able to manipulate the fundamental structures of spacetime, making it possible to develop Dyson's eternal civilization and the Omega Point of de Chardin and Tipler. Considering the broader consequences of immortality, no law of nature prevents intelligent extraterrestrial civilizations from attaining immortality, whether or not they are governed by the same physical laws as ours. Intelligent extraterrestrial species on other planets within our cosmos, or in other universes governed by the same physical laws, could achieve biological and technological immortality through several mechanisms: telomerase, eradication of fatal diseases, mind-uploading, or cyborgization. By applying these techniques to life forms on their planets, they could extend immortality to other species. In universes governed by different physical laws, analogous mechanisms compatible with those laws might play a similar role. Intelligent

alien species inhabiting a universe doomed to die could escape its death by harnessing advanced technologies of extraterrestrial civilizations residing in this or other universes governed by the same physical laws to become Dyson's eternal civilization, reach an Omega Point, construct laboratory-based or simulated universes, or traverse wormholes. Doing so would give all life forms on their planets the opportunity to achieve immortality. Although methods and theories such as telomerase, mind-uploading, and cyborg transformation may be unfeasible in universes with different physical laws, alien civilizations may achieve immortality through other unknown means. These reflections represent the author's philosophical extension of current physical and cosmological ideas to a wider cosmic context; they are not statements derivable from standard cosmology or quantum theory, which remain non-committal about extraterrestrial strategies for survival. Finally, the nature of eternity associated with immortality is related to the ultimate fate of the universe, a prospect that may await civilizations within the cosmos, the multiverse, or a cyclic universe. In the case of Dyson's eternal civilization or Tipler's and de Chardin's Omega Point, eternal immortality would manifest within our cosmos or in another dimension. Further, the environment in which we reside would determine the possibility of escaping the death of the universe by constructing a time machine, creating a laboratory-based universe, simulating a cosmos, or traveling via wormholes, black holes, and white holes to other regions of the cosmos or alternative universes conducive to life. If we went back in time in our universe or moved to another cosmos with the same physical laws, the same processes driving the ultimate death of the universe would re-occur, leading to an endless repetition of attempts to escape a new cosmic doom. This could be avoided by constructing simulated or laboratory-based universes and designing specific natural laws to sustain life; in this case, the act of preserving humanity or an alien species would happen only once, as this civilization would inhabit an eternal cosmos of its creation in which the universe does not perish. Certain universes accessible through wormholes may also possess physical laws that prevent cosmic death. As nature itself would prevent the death of the universe, the composition of the cosmos would make humans' escape attempt superfluous. Again, such scenarios belong to the realm of philosophical speculation about possible cosmologies, rather than to the established predictions of the standard cosmological model.

4.5 Schematic taxonomy of immortality scenarios

This subsection does not introduce new scenarios, but locates those of Section 4 within the same three-dimensional framework used for afterlife hypotheses in Section 3: (1) natural vs creator-based;

(2) single-universe vs multiverse;
(3) finite vs eternal survival.

(A) Biological immortality (organism-level, primarily natural)

1. **Natural, single-universe, finite survival**
   Moderate life extension through improved medicine and partial control of aging processes, within a universe that eventually becomes uninhabitable.
2. **Natural, single-universe, eternal survival**
   Strong biological immortality claims in which aging is eliminated and individuals remain biologically viable indefinitely within one cosmos—treated here as a speculative limit case in light of current biogerontology.
3. **Natural, multiverse, finite or eternal survival**
   Extensions of the above in which similar biological strategies are imagined to recur in multiple universes or cycles, though this manuscript has not explored such combinations in detail and leaves them as open possibilities.
4. **Creator-based variants**
   Scenarios in which a deity or advanced simulator designs organisms with indefinitely self-maintaining biology; these are structurally possible but largely discussed in Section 3 under creator-based afterlife models rather than in the present section.

(B) Technological immortality (substrate or embodiment change)

1. **Natural, single-universe, finite survival**
   Mind uploading and cyborgization that prolong life substantially but remain bounded by the lifetime and physical constraints of our universe.
2. **Natural, single-universe, eternal survival**
   Hypothetical cases in which digital or cyborg agents persist as long as the universe exists, or exploit speculative spacetime engineering to extend survival arbitrarily—subject to the physical objections noted above.
3. **Natural, multiverse, finite or eternal survival**
   Scenarios where uploaded or technologically enhanced beings migrate between universes or cosmic cycles via wormholes, baby universes, or similar mechanisms. Eternal survival would require that such transitions can continue without limit, a possibility left open but not fully developed in this manuscript.

4. **Creator-based, single-universe or multiverse, finite or eternal survival**
   Cases in which simulators, laboratory universe-builders, or deities sustain technologically mediated beings (uploads, cyborgs, or AI) across one or many universes for a finite period or eternally. These combinations connect Section 4 to the creator-based afterlife scenarios of Section 3 and illustrate how similar technological motifs (e.g., simulation, spacetime engineering) can be embedded in both naturalistic and theistic frameworks.

(C) Integrated grid and remaining gaps

When combined with the afterlife taxonomy in Section 3, this schema shows that, in principle, every combination of natural vs creator-based, single-universe vs multiverse, and finite vs eternal survival can be applied not only to post-mortem afterlife hypotheses but also to future immortality scenarios for biological and technological beings.

The present manuscript primarily discusses:

- natural, single-universe and multiverse scenarios for biological and technological immortality (Sections 4.1–4.4);
- creator-based, single-universe and multiverse scenarios in the context of afterlife (Section 3).

Other logically possible combinations—such as systematically developed models of creator-based biological immortality in a multiverse, or detailed accounts of natural, multiverse-based biological immortality—are acknowledged but not explored in depth, and thus represent potential gaps for future work.

Making this three-dimensional structure explicit helps locate each scenario precisely within the broader conceptual space and reduce repetition when similar configurations (e.g., natural–multiverse–eternal) reappear in different guises across Sections 3 and 4. This three-dimensional structure is summarized in Table 1, which systematically locates the main hypotheses discussed in Sections 3 and 4.

Main dimensions	**Natural (no creator required)**	**Creator-based (divine or designer)**
Single universe -- Finite time	Afterlife (Sec. 3): Scenarios of limited natural survival (e.g., forms of quasi-survival, quantum or informational) that last only until the heat death of our universe. Immortality (Sec. 4): Significant life extension via biology (anti-aging interventions) or technology (cyborgs, enhancements) but still constrained by the duration and physical conditions of our universe.	Afterlife (Sec. 3): Eschatological readings with resurrection or post-mortem life up to a final judgment or a definitive transformation of the cosmos. Immortality (Sec. 4): Civilizations created or sustained by a Creator (e.g., in a simulated or laboratory universe) that enjoy very long but not necessarily infinite lifespans, ending when the created container is closed or altered.
Single universe -- Eternal time	Afterlife (Sec. 3): Strong interpretations of Orch-OR, biocentrism, or quantum eternalism in which consciousness persists indefinitely within the spacetime of our universe (treated as highly speculative). Immortality (Sec. 4): Hypotheses of genuine biological or digital immortality within a single cosmos that never collapses or remains forever habitable, assuming suitable cosmological conditions.	Afterlife (Sec. 3): Heavens, hells, nirvana, and Omega Point (de Chardin, Tipler) understood as eternal states guaranteed by God or a divine reality immanent/transcendent to the cosmos. Immortality (Sec. 4): Endless existence of biological or technological beings in a single universe sustained forever by a Creator (e.g., a cosmos maintained statically or continuously renewed by God or a simulator).
Multiverse -- Finite time	Afterlife (Sec. 3): Transitions of consciousness across a limited number of universes or cosmic cycles, with an overall finite sequence of lives. Immortality (Sec. 4): Civilizations or individuals that migrate through universes or cycles via wormholes, baby universes, or similar mechanisms, but whose global history ends after some finite number of transitions.	Afterlife (Sec. 3): Forms of afterlife in several created universes, each with finite duration (e.g., multiple simulations or intermediate worlds designed by a Creator but not eternal). Immortality (Sec. 4): Civilizations or individuals sustained by Creators who move them across multiple universes or simulations, yet only for an overall finite time (e.g., designed

		cycles of reincarnation that eventually terminate).
Multiverse -- Eternal time	Afterlife (Sec. 3): Quantum immortality and strong versions of biocentrism, in which consciousness bounces endlessly among branches or universes—multiverse realizations of every conceivable form of natural afterlife (Greene, Tegmark). Immortality (Sec. 4): Civilizations that survive eternally by moving from one universe to another, exploiting wormholes, baby universes, or other cosmological mechanisms in an unending sequence.	Afterlife (Sec. 3): Infinite realizations of heavens, hells, nirvanas, and philosophical worlds distributed across a multiverse created or sustained by one or more Gods or simulators, with eternal survival of individuals in at least one such world. Immortality (Sec. 4): Unlimited existence of biological, digital, or hybrid beings maintained by Creators who can continually recreate, transfer, or transform consciousness into new universes or simulations, with no final temporal limit.

Table 1. Summary of the main options for the afterlife and immortality in cosmological scenarios.

5. Tools and methods for exploring the afterlife and immortality

5.1 Experimental approaches to consciousness and survival

On comprehending the nature of consciousness, the next step is to determine whether it can persist beyond physical death. To address this crucial question, experiments on consciousness are essential. Van Lommel (2011), for example, combines subjective

experiences with scientific methods to argue that consciousness might survive physical death, prompting deep reflection on this existential theme. Experiments in this field will thus be vital in determining whether consciousness can indeed persist beyond physical death. Tests could also help verify whether consciousness might be transferred to another medium, such as a computer, ensuring a form of technological immortality for the deceased. These possibilities, however, represent philosophical interpretations of what future empirical research might reveal; they are not presently supported by standard neuroscientific or physical models, which remain officially neutral on post-mortem survival. As consciousness might originate from quantum processes, the above possibilities could confirm the existence of life after death and the possibility of immortality for all intelligent or non-intelligent species in the cosmos. This connection between quantum processes and survival should again be regarded as a speculative extrapolation from current physics rather than a consequence entailed by the standard formalism of quantum theory.

5.2 Information in the universe

Another potential route to ascertaining the reality of an afterlife and immortality lies in the information within the universe and on Earth. Aczel (2014), Wheeler (1990), Seife (2007), and Lloyd (2006) emphasize that every constituent element of our planet and the cosmos is composed of highly specific information, suggesting that the structure and flow of information may be fundamental to physical reality. From the perspective of standard information theory and quantum information science, several results are relatively well consolidated. Classical information theory, originating with Shannon's (1948) mathematical definition of information and entropy, provides rigorous measures of information content and limits on communication. Quantum information theory extends these ideas, introducing quantum bits, entanglement, and quantum channels, and demonstrating phenomena such as superdense coding and quantum data compression (Bennett and Wiesner, 1992; Schumacher, 1995). Foundational textbooks and lecture notes systematize these results, clarifying how information can be processed, transmitted, and protected against noise using quantum error-correcting codes and entanglement-based protocols (Preskill, 1998; Nielsen and Chuang, 2000). Work on the physics of information connects these concepts to thermodynamics and gravitation, as in discussions of the Bekenstein bound and black hole entropy, where limits are placed on the maximum amount of information that can be stored in a finite region of space with given energy, and where horizon areas appear to encode informational content (Bekenstein, 1973, 1981; 't Hooft, 1993). In this sense, the idea that information is deeply embedded in the fabric

of the universe reflects mainstream developments in contemporary physics. By contrast, the step from these established results to questions of an afterlife and immortality is more speculative and philosophical. The suggestions that our consciousness could transfer to another universe through information in the human genome or the laws of nature, a universal cure might exist to defeat any deadly disease, telomerase could help all living beings achieve biological immortality, or consciousness might become immortal through mind uploading all presuppose that information can be reconfigured or preserved in ways that secure personal survival. Such ideas echo broader discussions about uploading, digital minds, and an "informational" view of persons, where identity is tied to patterns of information rather than to specific biological substrates (Moravec, 1988; Floridi, 2014). However, these proposals go well beyond the current scope of quantum information theory and statistical physics: while the latter clarify how physical systems encode and manipulate information, they do not by themselves resolve questions about personal identity, consciousness, or survival. The links between fundamental information, afterlife, and immortality should therefore be read as interpretive extrapolations proposed by the author, rather than as implications of standard models of cosmology or quantum theory.

5.3 Mathematical and theoretical tools

Additionally, mathematical analysis of the equations governing spacetime could prove instrumental in verifying or refuting scientific theories. Mathematics could be pivotal in determining whether a civilization will eventually reach the Omega Point or become a Dyson-style eternal civilization. Here, a clear distinction is needed. The derivation and analysis of solutions to the field equations of general relativity, or of models in quantum field theory and quantum gravity, belong to standard theoretical physics. They can tell us, for example, which cosmological evolutions are compatible with a given energy content and spacetime geometry. The further claim that such analyses might demonstrate the inevitability of an Omega Point or the feasibility of an eternal civilization is a philosophical interpretation of what certain solutions might allow, contingent on highly idealized assumptions about technology, energy use, and the goals of future agents. In this context, mathematics provides a rigorous framework for exploring possible spacetime structures, while the connection to immortality reflects the author's speculative extrapolation from those structures to the long-term fate of intelligent life.

5.4 Technological pathways

Alternative approaches for definitively assessing the scientific reality of an afterlife and immortality may involve diverse methodologies, with technology being the key instrument. For instance, AI (Luger and Stubblefield, 2004; Rich et al., 2010; Russell and Norvig, 2021) could potentially demonstrate whether our consciousness will survive to join the universe, move to another cosmos, or cyclically return to existence. Another possibility is the implantation of microchips within the human brain or the transformation of individuals into hyper-intelligent cyborgs (Gray, 1995; Mann and Niedzviecki, 2001; Clark, 2004) equipped with capabilities that could confirm or refute the existence of an afterlife and immortality. From the standpoint of current science and technology studies, AI systems can already assist in data analysis, theory exploration, and simulation, and neurotechnology can interface with the brain in increasingly sophisticated ways. Yet the suggestion that such tools will eventually "demonstrate" the survival of consciousness or provide decisive evidence for or against an afterlife is, at present, a philosophical conjecture about the eventual reach of technological inquiry. Standard models of computation and current AI research programs do not themselves imply that questions about immortality will be empirically settled; they simply expand the range of methods available for investigating consciousness and cosmology.

5.5 Extraterrestrial civilizations

A final opportunity to unravel these mysteries could emerge from contact with extraterrestrial civilizations within the universe. The ongoing search for extraterrestrial intelligence continues to play a fundamental role in seeking intelligent life in the universe. Future technological advancements may enable the search for extraterrestrial intelligence to develop more powerful satellites and space probes capable of detecting the number of galaxies in the observable universe, whether alien life exists, and how we might establish contact with it (Montebugnoli et al., 2022). Vinge (1993) suggests that extraterrestrial civilizations could reach a technological singularity, while Smart (2012) emphasizes that aliens may transcend the spacetime of the cosmos. Their reasoning leads to the conclusion that, if such civilizations exist, they likely possess advanced intellectual and technological capabilities, enabling them to understand the structure of the universe and our place within it. Thus, contact with aliens could enable humanity to ask whether life after death and immortality really exist. If this article's theories regarding the afterlife and immortality are scientific, super-intelligent alien civilizations have likely already confirmed or refuted them. Further, aliens may have already learnt whether the death of

the universe can be circumvented by constructing laboratory-based universes and time machines or using wormholes to relocate to other regions of the cosmos or alternative universes. These arguments suggest that agnosticism should be maintained regarding the afterlife and immortality.

5.6 Epistemic status of afterlife and immortality hypotheses

Dawkins (2006, pp. 46-54) delineates two forms of agnosticism: temporary pragmatic agnosticism, whereby valid answers to the great cosmic mysteries exist and may one day be discovered by humanity, and permanent theoretical agnosticism, according to which humans will never solve these mysteries owing to the lack of available evidence to confirm or refute them. Given the possibility of determining the existence of life after death and immortality through consciousness experiments, information analysis, mathematical inquiry, technological advancements, and extraterrestrial contact, this article suggests that temporary pragmatic agnosticism should be applied to these two great mysteries. While life after death and immortality remain an enigma, humanity might ultimately confirm or refute them. This stance reflects the author's philosophical position on our current epistemic situation, rather than a result mandated by existing physical or cosmological theories, which themselves remain silent on the ultimate fate of persons and civilizations beyond the observable consequences of known laws.

6. Conclusions

The debate surrounding the possibility of life after death, as well as biological and technological immortality, raises several philosophical and scientific questions, many still unresolved. While the theses of Russell (1925), Hawking (2018), and Dawkins (2006) deny the existence of an afterlife, the formalism of quantum mechanics, as currently understood, remains officially neutral on this issue. Certain interpretations and speculative extensions of quantum theory have been used to argue that human consciousness may survive physical death, but these go beyond the claims of standard quantum mechanics and represent philosophical proposals rather than established physical results. Furthermore, contrary to the doctrines of revealed religions, which often reject the idea of a human becoming immortal, future technological developments could plausibly enable the long-term or even permanent transfer of a person's awareness to devices such as computers, although this too is a conjectural extrapolation from present trends in neuroscience and information technology. Notions about the afterlife and

immortality need not be limited to the human species: they could extend to all other forms of life on Earth, on other planets, and in universes with similar physical laws. Quantum laws, as far as they are known, apply universally to physical systems, and the technologies developed by alien civilizations to achieve very long lifespans or effective forms of eternal life could be adaptable to any species. This possibility, however, is an interpretive extension of current physical theory into the domain of astrobiological and philosophical speculation. Finally, these matters could also concern other living entities—whether intelligent or not—that have formed according to physical laws different from ours. They might attain immortality or some form of life after death in ways we cannot conceive based on our current understanding. Such scenarios occupy a conceptual space opened by multiverse and alternative-cosmos models, but they are not predictions entailed by the standard cosmological framework. The afterlife can be broadly divided into two main categories. In terms of natural afterlife, the consciousness of every living being could continue to exist in time and space, as proposed by the Orch-OR theory, or transfer into another universe, as suggested by quantum immortality and biocentrism. These models are speculative interpretations that attempt to derive survival scenarios from quantum processes and multiverse hypotheses. By contrast, the divine afterlife presupposes the intervention of a Creator who, through natural laws or specific technologies such as simulation, allows species to survive after death. Theories like the simulated universe, brain-in-a-vat, Boltzmann brain, or Omega Point fall into this latter category and depend on theological or Creator-based assumptions in addition to physical considerations. Additionally, the multiverse does not exclude the possibility that philosophical and religious conceptions of the afterlife could also exist—either within one of the infinite universes with laws similar to ours or in universes with different physical laws. In this way, multiverse frameworks offer a cosmological backdrop within which many traditional and contemporary ideas about post-mortem existence can be situated, even though the frameworks themselves do not single out any particular form of afterlife as real. Finally, immortality can be divided into biological and technological. Biological immortality is based on treatments to eliminate deadly diseases and genetic or cellular modifications (e.g., involving telomerase and other aging mechanisms) to make the body extremely long-lived or effectively immortal. Conversely, technological immortality focuses on transferring or sustaining consciousness in computers, robots, or cyborg bodies, allowing an individual to continue living in a digital or artificial form. Both forms rely on speculative extrapolations from existing biology and technology and are not guaranteed outcomes of current scientific models. Immortality can also be related to the philosophical concept of eternity, even though many scientific theories predict that our universe is destined for destruction. Theories such as Dyson’s eternal civilization, the

Omega Point, the creation of universes in laboratories and simulations, the transfer of civilizations through wormholes or into other universes, and the construction of time machines capable of traveling back in time reveal the possibility for any intelligent species, having achieved biological or technological immortality, to exist eternally. This possibility could be realized by a civilization through technological singularity or by reaching the seventh level of Barrow's scale during specific stages in the universe's evolution. My study is limited by the current lack of technological means to test or implement these speculative scenarios and by our incomplete understanding of many aspects of the cosmos; therefore, the hypotheses about life after death and immortality remain unresolved. Gödel's incompleteness theorems concern the inherent limits of formal mathematical systems: they show that, in any sufficiently rich formal system, there are true statements that cannot be proven within that system. These results do not directly address the existence of an afterlife or immortality. Rather than implying that such questions are mathematically undecidable, they illustrate that even mathematics has intrinsic boundaries. In this context, I highlight the possibility of tools and methods—mathematical, empirical, and technological—that may still lead human civilization to a deeper understanding of these fundamental topics. The study of mathematics, development of technology, and contact with extraterrestrial civilizations could prove essential to understanding the existence or non-existence of life after death and immortality. Additionally, future research might explore how interdisciplinary approaches—combining advances in physics, cosmology, technology, and philosophy—could offer new insights into all questions concerning the afterlife and immortality. Given the possibility that these enigmas will ultimately be solved, a temporary pragmatic agnosticism may be appropriate: we currently lack decisive evidence, but it is reasonable to remain open to future discoveries. In conclusion, this study opens the door to a future where life after death and immortality could be clarified owing to AI, contact with alien civilizations, and thorough exploration of mathematical and cosmic information. Moreover, it encourages researchers to pursue the unknown with boldness and creativity. As Einstein (1938, p. 83) reasoned, "To pose new questions, new possibilities, and to view old problems from a new angle requires creative imagination and marks real progress in science."

References

A. Aczel. Why Science Does Not Disprove God. New York: William Morrow. 2014.
F. C. Adams, G. Laughlin. A dying universe: The long-term fate and evolution of astrophysical objects. Reviews of Modern Physics, 69(2), 337-372. 1997.

A. Albrecht, L. Sorbo. Can the universe afford inflation? Physical Review D, 70(6), 063528. 2004.
A. Ashtekar, T. Pawlowski, P. Singh. Quantum nature of the Big Bang. Physical Review Letters, 96(14), 141301. 2006.
L. R. Baker. Persons and Bodies: A Constitution View. Cambridge: Cambridge University Press. 2000.
S. Bamford. A framework for approaches to transfer of a mind's substrate. International Journal of Machine Consciousness, 4(1), 23-34. 2012.
J. D. Barrow. Impossibility: The Limits of Science and the Science of Limits. Oxford: Oxford University Press. 1998.
J. D. Barrow. The Infinite Book: A Short Guide to the Boundless, Timeless and Endless. New York: Pantheon Books. 2005.
E. V. Barsov. Telomerase and primary T cells: Biology and immortalization for adoptive immunotherapy. Immunotherapy, 3(3), 407-421. 2011.
L. Baum, P. H. Frampton. Entropy of contracting universe in cyclic cosmology. Modern Physics Letters A, 23(1), 33-36. 2008.
J. D. Bekenstein. Black holes and entropy. Physical Review D, 7(8), 2333-2346. 1973.
J. D. Bekenstein. Universal upper bound on the entropy-to-energy ratio for bounded systems. Physical Review D, 23(2), 287-298. 1981.
C. H. Bennett, S. J. Wiesner. Communication via one- and two-particle operators on Einstein–Podolsky–Rosen states. Physical Review Letters, 69(20), 2881-2884. 1992.
J. Binney, D. Skinner. The Physics of Quantum Mechanics. Oxford: Oxford University Press. 2008.
M. A. Blasco. Telomeres and human disease: Ageing, cancer and beyond. Nature Reviews Genetics, 6(8), 611–622. 2005.
D. Bohm. Quantum Theory. New York: Dover Publications. 1989.
A. Bolonkin. Universe, Human Immortality and Future Human Evaluation. Amsterdam: Elsevier. 2011.
N. Bostrom. Are we living in a computer simulation? The Philosophical Quarterly, 53(211), 243-255. 2003.
R. Bousso. The holographic principle. Reviews of Modern Physics, 74(3), 825-874. 2002.
A. Brueckner. Brains in a vat. Journal of Philosophy, 89(1), 3-23. 1992.
R. S. Brumbaugh, R. Wells. The Plato Manuscripts. New Haven: Yale University Press. 1968.
T. M. Bryan, A. Englezou, J. Gupta, S. Bacchetti, R. R. Reddel. Telomere elongation in immortal human cells without detectable telomerase activity. The EMBO Journal,

14(17), 4240-4248. 1995.
R. R. Caldwell, M. Kamionkowski, N. N. Weinberg. Phantom energy: Dark energy with $w < -1$ causes a cosmic doomsday. Physical Review Letters, 91(7), 071301. 2003.
S. Carroll. The Big Picture: On the Origins of Life, Meaning, and the Universe Itself. New York: Dutton. 2016.
C. Carter. Science and the Afterlife Experience: Evidence for the Immortality of Consciousness. Rochester, VT: Inner Traditions. 2012.
D. J. Chalmers. The Conscious Mind: In Search of a Fundamental Theory. Oxford: Oxford University Press. 1996.
D. J. Chalmers. The Matrix as Metaphysics. In C. Grau (ed.), Philosophers Explore the Matrix. Oxford: Oxford University Press, pp. 132-176. 2005.
M. Chester. Primer of Quantum Mechanics. Hoboken: John Wiley. 1987.
Y. Choe, J. Kwon, J. R. Chung. Time, consciousness, and mind uploading. International Journal of Machine Consciousness, 4(1), 257-274. 2012.
A. Clark. Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence. Oxford: Oxford University Press. 2004.
S. B. Cohen, M. E. Graham, G. O. Lovrecz, N. Bache, P. J. Robinson, R. R. Reddel. Protein composition of catalytically active human telomerase from immortal cells. Science, 315(5820), 1850-1853. 2007.

B. Cox, J. Forshaw. The Quantum Universe: Everything That Can Happen Does Happen. London: Allen Lane. 2011.
P. Davies. The Last Three Minutes: Conjecture about the Ultimate Fate of the Universe. New York: Basic Books. 1994.
P. Davies. How to Build a Time Machine. Westminster: Penguin Books. 2002.
R. Dawkins. The God Delusion. London: Bantam Press. 2006.
T. de Chardin. The Phenomenon of Man. Translated by B. Wall. New York: HarperCollins. 1955/2002.
A. de Grey, M. Rae. Ending Aging: The Rejuvenation Breakthroughs that Could Reverse Human Aging in Our Lifetime. New York: St. Martin's Press. 2007.
D. Dennett. Consciousness Explained. New York: Back Bay Books. 1992.
A. Diéguez. Transhumanismo. La Búsqueda Tecnológica del Mejoramiento Humano. Madrid: Tecnos. 2017.
J. Diller, A. Kasher. Models of God and Alternative Ultimate Realities. New York: Springer. 2013.
F. J. Dyson. Disturbing the Universe. New York: Harper & Row. 1979a.
F. J. Dyson. Time without end: Physics and biology in an open universe. Reviews of Modern Physics, 51(3), 447-460. 1979b.

L. Dyson, M. Kleban, L. Susskind. Disturbing implications of a cosmological constant. Journal of High Energy Physics, 2002(10), 239-258. 2002.
J. Earman. Bangs, Crunches, Whimpers, and Shrieks: Singularities and Acausalities in Relativistic Spacetimes. Oxford: Oxford University Press. 1995.
A. Einstein, L. Infeld. The Evolution of Physics. New York: Simon and Schuster. 1938.
R. Eisberg, R. Resnick. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles. Hoboken: Wiley. 1985.
G. F. R. Ellis, R. Maartens. The emergent universe: Inflationary cosmology with no singularity. Classical and Quantum Gravity, 21(1), 223-232. 2003.
G. F. R. Ellis, U. Kirchner, W. R. Stoeger. Multiverses and physical cosmology. Monthly Notices of the Royal Astronomical Society, 347(3), 921-936. 2004.
G. F. R. Ellis, J. Silk. Scientific method: Defend the integrity of physics. Nature, 516(7531), 321-323. 2014.

A. Everett, T. A. Roman. Superluminal subway: The Krasnikov tube. Physical Review D, 56(4), 2100-2108. 1997.

H. Everett. "Relative state" formulation of quantum mechanics. Reviews of Modern Physics, 29(3), 454-462. 1957.
A. Farag Ali, S. Das. Cosmology from quantum potential. Physics Letters B, 741(4), 276-279. 2015.
R. P. Feynman, R. B. Leighton, M. Sands. The Feynman Lectures on Physics, Vol. 1–3. Reading: Addison-Wesley Publishing Company. 1965.
J. M. Fischer. The Metaphysics of Death. Stanford: Stanford University Press. 1994.
L. Floridi. The Fourth Revolution: How the Infosphere is Reshaping Human Reality. Oxford: Oxford University Press. 2014.
D. Fontana. Is There an Afterlife? A Comprehensive Overview of the Evidence. Ropley: O Books. 2005.
A. Friedman. Über die Krümmung des Raumes. Zeitschrift für Physik, 10(1), 377-386. 1922.

K. Gödel. Collected Works, Vol. 2, Publications 1938–1974. New York: Oxford University Press. 1990.
I. J. Good. Chinese universes. Physics Today, 25(7), 15. 1972.

A. Goswami. Physics of the Soul: The Quantum Book of Living, Dying, Reincarnation, and Immortality. Massachusetts: Hampton Roads Publishing Company. 2013.
C. Graham, M. Gibbs, L. Aceti. Introduction to the special issue on the death, afterlife, and immortality of bodies and data. The Information Society, 29(3), 133-141. 2013.

C. H. Gray. The Cyborg Handbook. New York: Routledge. 1995.
D. K. Greenberger, K. F. Hentschel, F. Weinert. Compendium of Quantum Physics: Concepts, Experiments, History and Philosophy. Berlin: Springer-Verlag. 2009.
B. Greene. The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos. New York: Vintage Books. 2011.
D. J. Griffiths. Introduction to Quantum Mechanics. Upper Saddle River: Prentice Hall. 2004.
R. Grush, P. S. Churchland. Gaps in Penrose's toilings. Journal of Consciousness Studies, 2(1), 10-29. 1995.
A. H. Guth. Eternal inflation and its implications. Journal of Physics A: Mathematical and Theoretical, 40(25), 6811-6826. 2007.
S. Hameroff, D. Chopra. The "quantum soul": A scientific hypothesis. In A. Moreira-Almeida, F. Santana Santos (eds.), Exploring Frontiers of the Mind-Brain Relationship. New York: Springer-Verlag, pp. 79-93. 2012.

S. Hameroff, R. Penrose. Consciousness in the universe: A review of the 'Orch OR' theory. Physics of Life Reviews, 11(1), 39-78. 2014.

E. R. Harrison. The natural selection of universes containing intelligent life. Quarterly Journal of the Royal Astronomical Society, 36(3), 193-203. 1995.

J. B. Hartle, S. W. Hawking. Wave function of the universe. Physical Review D, 28(12), 2960-2975. 1983.
M. Hauskeller. Better Humans? Understanding the Enhancement Project. Durham: Acumen. 2013.

S. Hawking. Brief Answers to the Big Questions. New York: Bantam Books. 2018.
M. Heller, W. Hugh Woodin. Infinity: New Research Frontiers. Cambridge: Cambridge University Press. 2011.
M. Herper. A biotech provocateur takes on physics. Forbes. 2010. Accessible at https://www.forbes.com/2007/03/09/lanza-theories-physics-biotech-oped-cx_mh_0309lanza.html.
T. Hertog. On the Origin of Time: Stephen Hawking's Final Theory. London: Bantam Press. 2023.
J. Hick. Death and Eternal Life. London: Macmillan. 1976.

K. M. Hodge. Why immortality alone will not get me to the afterlife. Philosophical Psychology, 24(3), 395–410. 2011.

F. Hoyle, G. R. Burbidge, J. V. Narlikar. A quasi-steady state cosmological model with creation of matter. The Astrophysical Journal, 410(2), 437-457. 1993.

H. Hudson. A Materialist Metaphysics of the Human Person. Ithaca: Cornell University Press. 2001.
P. Hulsroj. What If We Don't Die? The Morality of Immortality. New York: Springer. 2015.
S. L. Jaki. Science and Creation: From Eternal Cycles to an Oscillating Universe. Edinburgh: Scottish Academic Press. 1988.
M. Kaku. Strings, Conformal Fields, and M-Theory. New York: Springer. 1999.
M. Kaku. Parallel Worlds: The Science of Alternative Universes and Our Future in the Cosmos. London: Allen Lane. 2004.
N. S. Kardašëv. Transmission of information by extraterrestrial civilizations. Soviet Astronomy, 8(2), 217-221. 1964.
E. F. Kelly, E. W. Kelly, A. Crabtree, A. Gauld, B. Grosso, B. Greyson (eds.). Irreducible Mind: Toward a Psychology for the 21st Century. Lanham: Rowman & Littlefield. 2007.
E. F. Kelly, A. Crabtree, P. Marshall (eds.). Beyond Physicalism: Toward Reconciliation of Science and Spirituality. Lanham: Rowman & Littlefield. 2015.

E. F. Kelly, P. Marshall (eds.). Consciousness Unbound: Liberating Mind from the Tyranny of Materialism. Lanham: Rowman & Littlefield. 2021.

N. W. Kim, M. A. Piatyszek, K. R. Prowse, C. B. Harley, M. D. West, P. L. Ho, G. M. Coviello, W.

T. B. L. Kirkwood. Time of Our Lives: The Science of Human Aging. London: Weidenfeld & Nicolson. 1999.

L. M. Krauss, G. D. Starkman. Life, the universe, and nothing: Life and death in an ever-expanding universe. The Astrophysical Journal, 531(1), 22-30. 2000.
R. Kurzweil. Live forever—uploading the human brain ... closer than you think. Psychology Today. 2000. Accessible at https://www.thekurzweillibrary.com/live-forever-uploading-the-human-braincloser-than-you-think.

R. Kurzweil. The Singularity Is Near: When Humans Transcend Biology. New York: Viking Press. 2005.

R. Lanza, B. Berman. Biocentrism: How Life and Consciousness Are the Keys to Understanding the True Nature of the Universe. Dallas: BenBella Books. 2009.
R. Lanza, B. Berman. Beyond Biocentrism: Rethinking Time, Space, Consciousness, and the Illusion of Death. Dallas: BenBella Books. 2016.
R. Lanza, B. Berman, M. Pavšič. The Grand Biocentric Design: How Life Creates Reality. Dallas: BenBella Books. 2020.

J. Leslie. The End of the World: The Science and the Ethics of Human Extinction. London: Routledge. 1996.
P. J. Lewis. Quantum Ontology: A Guide to the Everett Interpretation. Oxford: Oxford University Press. 2016.
S. Lloyd. Programming the Universe: A Quantum Computer Scientist Takes on the Cosmos. New York: Knopf. 2006.
C. López-Otín, M. A. Blasco, L. Partridge, M. Serrano, G. Kroemer. The hallmarks of aging. Cell, 153(6), 1194-1211. 2013.

G. Luger, W. Stubblefield. Artificial Intelligence: Structures and Strategies for Complex Problem Solving. San Francisco: Benjamin/Cummings. 2004.
K. Mack. The End of Everything: (Astrophysically Speaking). New York: Scribner. 2020.

S. Mann, H. Niedzviecki. Cyborg: Digital Destiny and Human Possibility in the Age of the Wearable Computer. Toronto: Doubleday Canada. 2001.

M. Mars, J. M. M. Senovilla, R. Vera. Accelerating expansion and change of signature. EAS Publications Series, 30, 307-310. 2008.

M. Martin, K. Augustine. The Myth of an Afterlife: The Case Against Life After Death. Lanham: Rowman & Littlefield. 2015.

K. J. McQueen. Have underground radiation measurements refuted the Orch OR theory? Comment on "At the crossroad of the search for spontaneous radiation and the Orch OR consciousness theory". Physics of Life Reviews, 44, 201-203. 2023.
M. B. Mensky. Consciousness and Quantum Mechanics: Life in Parallel Worlds: Miracles of Consciousness from Quantum Reality. Singapore: World Scientific Publishing Company. 2010.

T. Merricks. There are no criteria of identity over time. Noûs, 32(1), 106-124. 1998.

T. Metzinger. The Ego Tunnel: The Science of the Mind and the Myth of the Self. New York: Basic Books. 2009.

M. Montebugnoli, A. Melis, N. Antonietti. The Search for Extraterrestrial Intelligence. In Proceedings of the 2nd SETI-INAF Meeting 2019 (Springer Proceedings in Physics). New York: Springer. 2022.
H. Moravec. Mind Children: The Future of Robot and Human Intelligence. Cambridge: Harvard University Press. 1988.

M. S. Morris, K. S. Thorne, U. Yurtsever. Wormholes, time machines, and the weak energy condition. Physical Review Letters, 61(13), 1446-1449. 1988.

J. P. Murnane, L. Sabatier, B. A. Marder, W. F. Morgan. Telomere dynamics in an immortal human cell line. The EMBO Journal, 13(20), 4953-4962. 1994.
N. Murphy. Bodies and Souls, or Spirited Bodies? Cambridge: Cambridge University Press. 2006.
M. A. L. Nicolelis. Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines—and How It Will Change Our Lives. New York: Times Books. 2011.
M. A. Nielsen, I. L. Chuang. Quantum Computation and Quantum Information. Cambridge: Cambridge University Press. 2000.
S. J. Olshansky, B. A. Carnes, C. Cassel. In search of Methuselah: Estimating the upper limits to human longevity. Science, 250(4981), 634-640. 1990.

E. T. Olson. The Human Animal: Personal Identity Without Psychology. Oxford: Oxford University Press. 1997.
D. N. Page. Is our universe likely to decay within 20 billion years? Journal of Cosmology and Astroparticle Physics, 2006(01), 004. 2006.
D. Papineau. The rise of physicalism. In C. Gillett, B. Loewer (eds.), Physicalism and its Discontents. Cambridge: Cambridge University Press, pp. 3-36. 2001.
D. Parfit. Reasons and Persons. Oxford: Oxford University Press. 1984.

S. Parnia, K. Spearpoint, G. de Vos, P. Fenwick, D. Goldberg, J. Yang, J. Zhu, K. Baker, H. Killingback, P. McLean, M. Wood, A.M. Zafari, N. Dickert, R. Beisteiner, F. Sterz, M. Berger, C. Warlow, S. Bullock, S. Lovett, R.M.S. McPara, S. Marti-Navarette, P. Cushing, P. Wills, K. Harris, J. Sutton, A. Walmsley, C.D. Deakin, P. Little, M. Farber, B. Greyson, E.R. Schoenfeld. AWARE-AWAreness during REsuscitation-a prospective study. Resuscitation, 85(12), 1799-1805. 2014.
R. Penrose. The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics. Oxford: Oxford University Press. 1989.

R. Penrose. Shadows of the Mind: A Search for the Missing Science of Consciousness. Oxford: Oxford University Press. 1994.
R. Penrose. Cycles of Time: An Extraordinary New View of the Universe. London: The Bodley Head. 2010.
R. M. Perry. Forever for All: Moral Philosophy, Cryonics, and the Scientific Prospects for Immortality. New York: Universal Publishers. 2000.
C. Pickover. A Beginner's Guide to Immortality: Extraordinary People, Alien Brains, and Quantum Resurrection. New York: Thunder's Mouth Press. 2007.

J. Preskill. Lecture Notes for Physics 229: Quantum Information and Computation. Pasadena: California Institute of Technology. 1998.

H. Putnam. Reason, Truth and History. Cambridge: Cambridge University Press. 1981.
E. Rich, K. Knight, B. N. Shivashankar. Artificial Intelligence. New Delhi: McGraw Hill India. 2010.
R. Rucker. Infinity and the Mind: The Science and Philosophy of the Infinite. London: Paladin. 1984.
B. Russell. What I Believe. London: Kegan Paul, Trench, Trübner. 1925.
S. J. Russell, P. Norvig. Artificial Intelligence: A Modern Approach. Hoboken: Pearson. 2021.
C. Sagan. The Cosmic Connection. New York: Anchor Books. 1973.
A. Sandberg, N. Bostrom. Whole Brain Emulation: A Roadmap. Technical Report #2008-3. Future of Humanity Institute, Oxford University. 2008. Accessible at https://www.fhi.ox.ac.uk/brain-emulation-roadmap-report.pdf.

M. Savin-Baden, D. Burden. Digital immortality and virtual humans. Postdigital Science and Education, 1, 87-103. 2019.
S. Scheffler. Death and the Afterlife. Oxford: Oxford University Press. 2013.

S. Schneider, M. Velmans. The Blackwell Companion to Consciousness. Hoboken: Wiley-Blackwell. 2017.

B. Schumacher. Quantum coding. Physical Review A, 51(4), 2738-2747. 1995.
J. R. Searle. The Mystery of Consciousness. London: Granta Books. 1997.
C. Seife. Decoding the Universe: How the New Science of Information Is Explaining Everything in the Cosmos, from Our Brains to Black Holes. New York: Penguin Random House. 2007.
A. Seth. Being You: A New Science of Consciousness. New York: Penguin Random House. 2021.
C. E. Shannon. A mathematical theory of communication. Bell System Technical Journal, 27(3-4), 379-423, 623-656. 1948.
J. M. Smart. The transcension hypothesis: Sufficiently advanced civilizations invariably leave our universe, and implications for METI and SETI. Acta Astronautica, 78, 55-68. 2012.

S. Smith. Review of Robert Lanza & Bob Berman's biocentrism: How life and consciousness are the keys to understanding the true nature of the universe. Journal of Consciousness Exploration & Research, 1(4), 468-470. 2010.
L. Smolin. The Life of the Cosmos. Oxford: Oxford University Press. 1997.

R. J. Spitzer. New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophy. Grand Rapids: William B. Eerdmans Publishing. 2010.

E. Squires. The Mystery of the Quantum World. Bristol: Hilger. 1986.
H. P. Stapp. Compatibility of contemporary physical theory with personality survival. 2009. Accessible at https://www-physics.lbl.gov/~stapp/Compatibility.pdf.
A. Starobinsky. Future and origin of our universe: Modern view. In V. Burdyuzha, G. Khozin (eds.), The Future of the Universe and the Future of Our Civilization. Singapore: World Scientific, pp. 71-84. 2000.
P. J. Steinhardt. The inflation debate: Is the theory at the heart of modern cosmology deeply flawed? Scientific American, 304(4), 36-43. 2011.
P. J. Steinhardt, N. Turok. Endless Universe: Beyond the Big Bang. New York: Doubleday. 2007.
V. J. Stenger. God: The Failed Hypothesis: How Science Shows That God Does Not Exist. Amherst: Prometheus Books. 2007.
R. Swinburne. The Evolution of the Soul. 2nd ed. Oxford: Oxford University Press. 1997.

G. 't Hooft. Dimensional reduction in quantum gravity. In A. Ali, J. Ellis, S. Randjbar-Daemi (eds.), Salamfestschrift: A Collection of Talks from the Conference on Highlights of Particle and Condensed Matter Physics. Singapore: World Scientific, pp. 284-296. 1993.

M. Tegmark. Importance of quantum decoherence in brain processes. Physical Review E, 61(4), 4194-4206. 2000.
M. Tegmark. Our Mathematical Universe: My Quest for the Ultimate Nature of Reality. New York: Vintage Books. 2014.

W. Thomson. On a universal tendency in nature to the dissipation of mechanical energy. In W. Thomson, Mathematical and Physical Papers (Vol. 1, pp. 511-514). Cambridge: Cambridge University Press. 1882.

F. J. Tipler. The Physics of Immortality: Modern Cosmology, God, and the Resurrection of the Dead. New York: Anchor. 1994.
F. J. Tipler. The Physics of Christianity. New York: Doubleday. 2007.
R. C. Tolman. Relativity, Thermodynamics and Cosmology. Oxford: Clarendon Press. 1934.
E. P. Tryon. Is the universe a vacuum fluctuation? Nature, 246(5433), 396-397. 1973.
R. Vaas. Beyond the Big Bang: Competing Scenarios for an Eternal Universe. Berlin: Springer. 2011.

P. van Inwagen. The possibility of resurrection. International Journal for Philosophy of Religion, 9(2), 114-121. 1978.

P. van Lommel. Consciousness Beyond Life: The Science of the Near-Death Experience. San Francisco: HarperOne. 2011.

P. van Lommel, R. van Wees, V. Meyers, I. Elfferich. Near-death experience in survivors of cardiac arrest: A prospective study in the Netherlands. The Lancet, 358(9298), 2039-2045. 2001.

A. Vilenkin. Many Worlds in One: The Search for Other Universes. New York: Hill and Wang. 2006.

V. Vinge. The coming technological singularity: How to survive in the post-human era. Whole Earth Review (Winter), 11. 1993.

M. Visser. Lorentzian Wormholes: From Einstein to Hawking. Woodbury: American Institute of Physics Press. 1995.

D. Wallace. The Emergent Multiverse: Quantum Theory According to the Everett Interpretation. Oxford: Oxford University Press. 2012.

B. Weatherson. Are you a sim? Philosophical Quarterly, 53(211), 425-431. 2003.

S. Webb. If the Universe Is Teeming with Aliens … Where Is Everybody? Seventy-Five Solutions to the Fermi Paradox and the Problem of Extraterrestrial Life. New York: Springer. 2015.

M. D. West. The Immortal Cell: One Scientist's Quest to Solve the Mystery of Human Aging. New York: Doubleday. 2003.

J. A. Wheeler. Information, physics, quantum: The search for links. In W. H. Zurek (ed.), Complexity, Entropy, and the Physics of Information. Redwood City: Addison-Wesley, pp. 354-368. 1990.

E. Wright, S. L. Weinrich, J. W. Shay. Specific association of human telomerase activity with immortal cells and cancer. Science, 266(5193), 2011-2015. 1994.

D. W. Zimmerman. Bodily resurrection: The falling elevator model revisited. In G. Gasser (ed.), Personal Identity and Resurrection: How Do We Survive Our Death? London: Routledge, pp. 33-50. 2016.