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The Philosophy of Life in
Erwin Schrödinger's Poetry,
1918-1950

By

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Abstract

The death and destruction wrought by the World Wars and the Interwar era heightened a collective desire among twentieth-century Europeans to find meaning in their fragile lives and to establish the boundaries distinguishing living organisms, especially humans, from their inanimate counterparts. As a theoretical pioneer in the science of life, molecular biology, the Austrian physicist Erwin Schrödinger indelibly shaped the discourse on life and the methodologies of generations of scientists. However, scholars have overwhelmingly emphasized the mechanistic tendencies in Schrödinger's philosophy of life. In my thesis, I propose that Schrödinger's often-overlooked poetry provides a glimpse into the synthesis of mechanism and organicism in his philosophy. This synthesis influenced Schrödinger's ideas about the co-existence of determinism and free will in life, the necessity of love and passion for the sciences, and the usefulness of interdisciplinary collaboration and public engagement for the study of life. With the aid of Schrödinger, the logic and methodologies of both mechanism and organicism have had a long-lasting influence on the discourse on life.

The Problem of Life

What do we mean when we say that something is “alive”? In other words, what distinguishes the living from the non-living? What defines “life”? Many people consider life to be something that we can only experience and never truly explain. Some believe that a less empirical, more mystical life force permeates those organisms that we consider to be living.¹ Meanwhile, present-day scientists often turn to physicochemical laws to explain how living organisms came to be.² Still, others understand life to be a combination of the material and the immaterial. Regardless of how one chooses to define life, the fact that the nature of life remains at the forefront of conversations in classrooms, art galleries, places of worship, and beyond points to the importance of the problem of life for its inquirers who are, what the Austrian physicist Erwin Schrödinger called, “life” itself.³

In his work, Schrödinger joined an extensive group of European intellectuals who reflected on the problem of life in the early twentieth century. For these intellectuals, someone’s answer to this question—“What is life?”—both hinted at this person’s sociopolitical beliefs, as well as the value and rights that this person attributed to their own life and the lives of others. Witnessing the growing banality of death and destruction during the World Wars and the tumultuous Interwar years drove the intellectuals’ desire to find meaning in their fragile lives and heightened a collective interest in understanding the nature of life that continues to linger in our present-day discussions about artificial intelligence and the boundaries of life.⁴ As a theoretical pioneer in the science of life, molecular biology, Schrödinger indelibly shaped the discourse on

¹ Addy Pross, *What is Life?: How Chemistry Becomes Biology* (Oxford University Press, 2012), viii-x.

² Pross, *What is Life?*, 122-125.

³ Erwin Schrödinger, *Einleitung to What is Life?*, ca. 1949, reel 44-10, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

⁴ Jessica Riskin, “The Defecating Duck, or, the Ambiguous Origins of Artificial Life,” *Critical Inquiry* 29, no. 4 (2003): 631-633, <https://doi.org/10.1086/377722>.

life and the thinking of generations of scientists. His philosophy of life, therefore, merits significantly greater attention.

In my thesis, I aim to trace Schrödinger's evolving—and, at times, contradictory—understanding of life and studies of life in, mainly, his creative writings, within the context of early twentieth-century European intellectual debates about life and the vocation of the intellectual. Writing in scientific journals and more formal correspondence with his colleagues pressured Schrödinger to adhere more to the expectations that his society had established for him: namely, a modern scientist ought to employ empirical logic and methodologies. However, writing poetry alongside his formal scientific work encouraged Schrödinger to incorporate more organic logic and methodologies into his philosophy. Through poetry, he acquired greater inspiration and freedom to convey more fully his desire to understand the nature of life through the relationship between determinism and free will, as well as the necessity of love and passion for the scientific work required to study life more closely. Accessing some of these innermost thoughts of Schrödinger through his poetry allows us to understand more fully not only the beliefs and assumptions guiding *his* approach to the science of life, but also the approach of his *successors* in both the (social) sciences and the arts.

Approaches to the Entanglement of the Arts and Sciences in Twentieth-Century Europe

Prior to the 1980s, historians of science have traditionally traced the formation of scientific ideas and theories by analyzing the scientists' more formal texts such as manuscripts and official communications.⁵ While these formal texts are certainly valuable for understanding

⁵ Thomas Kuhn, *The Structure of Scientific Revolutions* (University of Chicago Press, 2012); Paul Forman, "Weimar Culture, Causality, and Quantum Theory, 1918-1927: Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environment," *Historical Studies in the Physical Sciences* 3 (1971), <https://doi.org/10.2307/27757315>; Mathias Grote, Lisa Onaga, Angela N. H. Creager, Soraya de Chadarevian, Daniel Liu, Gina Surita, and Sarah E. Tracy, "The Molecular Vista: Current Perspectives on Molecules and Life in the Twentieth Century," *History and Philosophy of the Life Sciences* 43, no. 16 (2021): 1-18, <https://doi.org/10.1007/s40656-020-00364-5>.

the development of ideas and theories, historians have begun studying more closely the sources that this historiography traditionally does not emphasize, such as scientists' informal poetry or private correspondence. Because informal writings allowed scientists to reveal more freely the emotions and beliefs that shaped their work, these writings also helped historians to understand the emotional and ideological context of the *people* forming these scientific ideas.⁶ By analyzing Schrödinger's informal writings, I aim to examine the philosophical elements in "the paradigm change [that he] initiated" in the sciences, humanities, and broader popular culture.⁷

The physicists, historians, and philosophers who have studied Schrödinger's paradigm overwhelmingly prioritized his ideas as they related mostly, or even solely, to quantum mechanics.⁸ These scholars have drawn significant parallels between Schrödinger's ideas about quantum mechanics and the currents of determinism and reductionism in his philosophy.⁹ Schrödinger's philosophical belief in the potential unity of science informed his attitudes towards various interpretations of quantum physics, and his scientific belief in the potential of statistical

⁶ Walter Moore, *Schrödinger: Life and Thought* (Cambridge University Press, 1989), 3; Robert Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (University of Chicago Press, 2002), 5; Tzvetia Sofronieva, "Erwin Schrödinger's Poetry," *Science and Education* 23 (2014): 656, <https://doi.org/10.1007/s11191-013-9579-4>; Sarah M. Schönbauer, "A Passion for Science: Addressing the Role of Emotions in Identities of Biologists," in *Community and Identity in Contemporary Technosciences*, ed. Karen Kastenhofer and Susan Molyneux-Hodgson, 283, https://doi.org/10.1007/978-3-030-61728-8_14.

⁷ Sofronieva, "Erwin Schrödinger's Poetry," 656; Johann Götschl and Werner Leinfellner, "Introduction," in *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 1.

⁸ Abner Shimony, "Reflections on the Philosophy of Bohr, Heisenberg and Schrödinger," in *Physics, Philosophy and Psychoanalysis: Essays in Honor of Adolf Grünbaum*, ed. Robert S. Cohen and Larry Laudan (D. Reidel Publishing Company, 1983), 215; Erhard Scheibe, "Erwin Schrödinger and the Philosophy of the Physicists," in *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 25-27.

⁹ Erwin Schrödinger, *Science and Humanism: Physics in Our Time* (Cambridge University Press, 1961), 51; Scheibe, "Erwin Schrödinger and the Philosophy of the Physicists," 29-32; Herbert Pietschmann, "Holistic Aspects of the Schrödinger Equation," in *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 35. To support their claims about Schrödinger's determinism and reductionism, scholars have often cited Schrödinger's adherence to Ludwig Boltzmann's statistical physics, his critique of the Copenhagen interpretation of quantum mechanics—namely, its affinity for indeterminism and incomprehensibility of the universe—and his development of a wave quantum mechanics rooted in classical, deterministic laws of physics.

physics to explain natural phenomena informed his philosophy of science, one frequently labeled as deterministic, reductionist, and therefore mechanistic.¹⁰ However, this overt emphasis on Schrödinger's work in physics and his mechanistic philosophy provides an incomplete treatment of his scientific and philosophical work. If Schrödinger's influence extended primarily to quantum mechanics, as the scholarly discourse on Schrödinger suggests by its dominant focus, he could not have individually launched as significant of a "paradigm change" for both the sciences and the humanities as scholars claimed that he did.

What helped to secure the status of Schrödinger's ideas as a new "paradigm" in the early twentieth century was his endeavor to synthesize the ideas of the increasingly specialized sciences and craft an interdisciplinary, interideological understanding of life and the science of life.¹¹ By expanding their analyses of Schrödinger's influence beyond quantum mechanics, scholars who studied Schrödinger's understanding of biology highlighted his interdisciplinarity but still prioritized the mechanistic in Schrödinger's thought, undermining the interideological nature of his work.¹² These scholars argued that Schrödinger's understanding of life hinged deterministically on the notion that laws governed the genomes of living things and drove them

¹⁰ Shimony, "Reflections on the Philosophy," 215; Bernulf Kanitscheider, "Schrödinger's Cat and the Interpretation of Quantum Mechanics," in *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 42; Timothy Lenoir, *The Strategy of Life: Teleology and Mechanics in Nineteenth-Century German Biology* (University of Chicago Press, 1989), 5.

¹¹ Franz M. Wuketits, "Erwin Schrödinger and His Contribution to a New Understanding of Living Systems," in *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 103.

¹² Andrew Domondon, "Bringing Physics to Bear on the Phenomenon of Life: The Divergent Positions of Bohr, Delbrück, and Schrödinger," *Studies in History and Philosophy of Biological and Biomedical Sciences* 37, no. 3 (2006): 448-450, <https://doi.org/10.1016/j.shpsc.2006.06.014>; Nils Roll-Hansen, "Niels Bohr and Max Delbrück: Balancing Autonomy and Reductionism in Biology," in *Creating a Physical Biology: The Three-Man Paper and Early Molecular Biology*, ed. Phillip R. Sloan and Brandon Fogel (University of Chicago Press, 2011), 168-169; Phillip R. Sloan and Brandon Fogel, "Introduction," in *Creating a Physical Biology: The Three-Man Paper and Early Molecular Biology*, ed. Phillip R. Sloan and Brandon Fogel (University of Chicago Press, 2011), 23-24.

towards greater order.¹³ Indeed, Schrödinger strongly believed that a statistical physics—one adopted for living beings—would be crucial for understanding the phenomenon of life.¹⁴ Yet having lived in an Austrian scientific milieu that embraced uncertainty, Schrödinger refuted a dogmatically deterministic and mechanistic understanding of biology; he even called “the assertion of [absolute] determinism ... when more closely examined not at all very probable.”¹⁵

Some scholars, however, have conversely analyzed Schrödinger’s worldview as a synthesis of distinct philosophical tendencies and approaches.¹⁶ Without denying the importance of the “statistical mechanism” in Schrödinger’s approach, scholars have traced his emphasis on “the role of chance in a theoretical understanding of reality” to a distinctly Kantian conception of free will and agency.¹⁷ The idea that a living organism could choose from a variety of actions—which all had *chances* of being chosen—presupposed the existence of free will and agency. Free will and agency therefore existed even in a natural world that was governed by a physicochemical, “mechanical determinism” and a cultural world that weaponized scientific determinism to justify its “[treatment of] living systems as mechanical systems.”¹⁸ By calling for free will and agency, Schrödinger also drew upon the tradition of *Naturphilosophie*, echoes of which had resonated during the Interwar years. Like the studies that treated Schrödinger’s work

¹³ Erwin Schrödinger, *What Is Life?: The Physical Aspect of the Living Cell & Mind and Matter* (Cambridge University Press, 1988), 4-5; Domondon, “Bringing Physics to Bear on the Phenomenon of Life,” 450; Werner Leinfellner, “Schrödinger, The Self and the Genes,” in *Erwin Schrödinger’s World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 88-89.

¹⁴ Schrödinger, *What Is Life?*, 4-5.

¹⁵ Erwin Schrödinger, “What Is a Law of Nature?” in *Science, Theory, and Man* (1935; Dover, 1957), 142, 147, quoted in Deborah R. Coen, *Vienna in the Age of Uncertainty: Science, Liberalism, and Private Life* (University of Chicago Press, 2007), 280-281.

¹⁶ Werner Leinfellner, “Schrödinger, The Self and the Genes,” 94; Wuketits, “Erwin Schrödinger and His Contribution to a New Understanding of Living Systems,” 101, 103.

¹⁷ Wuketits, “Erwin Schrödinger and His Contribution to a New Understanding of Living Systems,” 102-103; Immanuel Kant, *Groundwork of the Metaphysics of Morals*, ed. and trans. Mary Gregor (Cambridge University Press, 2001), 4:440.

¹⁸ Herbert Hörz, “Determination and Self-Organization: Erwin Schrödinger’s Views on Chance,” in *Erwin Schrödinger’s World View: The Dynamics of Knowledge and Reality*, ed. Johann Götschl (Kluwer Academic Publishers, 1992), 72.

as a discourse of philosophies, my thesis highlights the entanglement of mechanistic science and *Naturphilosophie* in Schrödinger's philosophy of life.

By examining this entanglement of philosophies, I also enter a debate about whether more organic, emotion-driven philosophies (such as *Naturphilosophie*) and artistic forms (such as drawings and poetry) are appropriate lenses through which scholars can view a science as logic-driven as physics or biology.¹⁹ During the twentieth century, historical narratives of science overwhelmingly claimed that mechanistic philosophy outpaced *Naturphilosophie* in nineteenth- and twentieth-century German scientific culture because mechanism relied upon—and by implication, *Naturphilosophie* did not rely upon—the objectivity and reason that we now associate with scientific inquiry. The true men of science resisted *Naturphilosophie* and embraced mechanistic science both in their work and in the form of their personal writings.²⁰ These narratives, however, disregarded how the proponents of *Naturphilosophie* also sought to conduct science objectively and rationally, as well as how emotion was and remains vital to the formation of scientific knowledge.²¹ More recently, scholars have sought to challenge the preeminent role of mechanism in German scientific culture and complicate our understanding of

¹⁹ Lenoir, *The Strategy of Life*, 5-6; Richards, *The Romantic Conception of Life*, 3-4; Suzanne Elizabeth Shimek, "In Uncertain Terms: Poetry, Physics, and Representation in the Quantum Era" (PhD diss., University of California, Los Angeles, 2001), 17-19, <https://www.proquest.com/dissertations-theses/uncertain-terms-poetry-physics-representation/docview/304686768/se-2>; Sofronieva, "Erwin Schrödinger's Philosophy," 658; Joan Steigerwald, *Experimenting at the Boundaries of Life: Organic Vitality in Germany around 1800* (University of Pittsburgh Press, 2019), 39.

²⁰ Lenoir, *The Strategy of Life*, 7; Harry A. M. Snelders, "Romanticism and Naturphilosophie and the Inorganic Natural Sciences 1797-1840: An Introductory Survey," *Studies in Romanticism* 9, no. 3 (1970): 195, <https://doi.org/10.2307/25599763>.

²¹ For discussions of objectivity and reason in *Naturphilosophie*, see Richards, *The Romantic Conception of Life*, 12; Steigerwald, *Experimenting at the Boundaries of Life*, 36; For discussions of emotions in scientific knowledge production, see Max Weber, "Science as a Vocation," in *The Vocation Lectures*, ed. David Owen and Tracy B. Strong, trans. Rodney Livingstone (Hackett Publishing, 2004), 8-10; Jack Barbalet, "Science and Emotions," *The Sociological Review* 50, no. S2 (2002): 134; <https://doi.org/10.1111/j.1467-954X.2002.tb03595.x>; Sarah M. Schönbauer, "A Passion for Science: Addressing the Role of Emotions in Identities of Biologists," in *Community and Identity in Contemporary Technosciences*, ed. Karen Kastenhofer and Susan Molyneux-Hodgson, 283-284, https://doi.org/10.1007/978-3-030-61728-8_14.

Naturphilosophie and Romantic science at large.²² Drawing upon works that formed the core of the German *Bildung*, these scholars argued that the organicist tendencies in these works shaped the research and philosophy of German scientists more than the scholarship has acknowledged.²³ To trace these organicist tendencies in scientific thought, some scholars have closely analyzed the poetry and other forms of creative writing that scientists produced alongside their research.²⁴

Applying this method of close reading to Schrödinger's writings, this thesis examines the cultural and literary context of the words that Schrödinger chose and the images that he evoked in his anomalous collection of poetry that was published in 1949 and his private correspondence. To supplement this analysis, I also examine his and his colleagues' formal scientific writings and lectures. Studying these writings together allows us to trace Schrödinger's ambiguous portrayals of life, love, science, and art and to draw inferences about the conflicts in his philosophy of life that have often been obscured in analyses that focused solely on his scientific writings. This thesis aims to show the fruitfulness of analyzing scientists' personal writings through the lenses of several philosophies in our studies of the philosophies that guide scientific research.

Mechanistic and Organicist Understandings of Life

Two of the philosophies that guided Schrödinger's research were mechanistic science and *Naturphilosophie*. During the eighteenth-century Age of Reason, the spirit of "cautious and complete induction" dominated European society and culture, and scientists sought to determine

²² Richards, *The Romantic Conception of Life*, 4; Amanda Goldstein, *Sweet Science: Romantic Materialism and the New Logics of Life* (University of Chicago Press, 2017), 22-26; Steigerwald, *Experimenting at the Boundaries of Life*, 15.

²³ Goldstein, *Sweet Science*, 115-124; Moore, *Schrödinger: Life and Thought*, 46-49; Mary Midgley, *Science and Poetry* (Routledge, 2001), 22, 39; Richards, *The Romantic Conception of Life*, 128-137, 407-409; Sofronieva, "Erwin Schrödinger's Poetry," 658-659; Steigerwald, *Experimenting at the Boundaries of Life*, 36.

²⁴ Sofronieva, "Erwin Schrödinger's Poetry," 656; Midgley, *Science and Poetry*, 21-22; Daniel Albright, *Quantum Poetics: Yeats, Pound, Eliot, and the Science of Modernism* (Cambridge University Press, 1997), 1-7; Peter Middleton, *Physics Envy: American Poetry and Science in the Cold War and After* (University of Chicago Press, 2015), 17-18.

the “mechanical cause[s]” of all natural phenomena.²⁵ Drawing from Kantian and British empiricist philosophies, this “mechanistic” science reduced our understanding of living organisms to an understanding of solely physical or chemical processes.²⁶ Yet for the German Romantic intellectuals who were living amid the eighteenth-century ruins of war, industrialization, and political and scientific instability, the “mechanistic” approach led to insufficient explanations of natural phenomena such as the existence of life.

Seeking to preserve the beauty in their nation’s landscapes and culture—the latter of which included science—German Romantic intellectuals led by the writer-scientists Johann von Goethe and Friedrich Schelling drew from Immanuel Kant as the mechanistic scientists did. But unlike their peers, Goethe and Schelling developed *Naturphilosophie*, an organicist approach to science that emphasized the exceptional life force and agency present in all organisms and harmonized art and science.²⁷ While *Naturphilosophie* grew popular during the nineteenth century, some scientists such as Hermann von Helmholtz and Rudolf Virchow believed that the mechanistic approach—not the metaphysical *Naturphilosophie*—should undergird rational scientific inquiry.²⁸ This philosophical conflict intensified among German-speaking scientists following the First World War. The repercussions of this war plunged Germany and Austria into a state of chaos, and the alienation and uncertainty that its people experienced fueled a pervasive disenchantment.²⁹ For many scientists, this disenchantment drove a distinctly mechanistic

²⁵ Robert E. Schofeld, *Mechanism and Materialism: British Natural Philosophy in an Age of Reason* (Princeton University Press, 1969), 3; John Zammito, “Reill’s Vitalizing Nature in the Enlightenment and German Naturphilosophie,” in *Life Forms in the Thinking of the Long Eighteenth Century*, ed. Keith Michael Baker and Jenna M. Gibbs (University of Toronto Press, 2016), 70-71.

²⁶ Lenoir, *The Strategy of Life*, 5.

²⁷ Richards, *The Romantic Conception of Life*, xvii, 12, 114.

²⁸ Lenoir, *The Strategy of Life*, 195, 198.

²⁹ Roswitha Reinbothe, *Deutsch als internationale Wissenschaftssprache und der Boykott nach dem Ersten Weltkrieg* (De Gruyter, 2019), 22.

approach to doing science, which in turn further fueled their disenchantment.³⁰ Yet other scientists sought a corrective to the disenchantment in their societies and their disciplines, leading these scientists to seek solace in the arts and philosophy and to embrace a form of organistic *Naturphilosophie*.³¹

Some German-speaking scientists, including Schrödinger, drew their inspiration from both *Naturphilosophie* and mechanistic science. Born on August 12, 1887, in an imperial Vienna, Erwin Schrödinger grew up in a family of intellectuals and lovers of art, and he developed his inherited loves for the arts and sciences at the Akademisches Gymnasium in Vienna.³² An alumnus of the Gymnasium, Ludwig Boltzmann, had proposed that “inanimate atoms had evolved into mechanical structures called human brains,” and Boltzmann’s “range of ideas played the role of a scientific young love” for the impressionable Schrödinger who brought those mechanistic ideas into his future work.³³ The Gymnasium also provided Schrödinger with a distinctly “humanistic” curriculum filled by German and ancient Greek and Roman literature that he applied to his philosophical and poetical work.³⁴ Schrödinger’s interests in mechanistic science and *Naturphilosophie* heightened during his time at the University of Vienna, where he met his mentors (and Boltzmann’s students), Franz S. Exner and Friedrich Hasenöhr, as well as

³⁰ Weber, “Science as a Vocation,” 30.

³¹ Anne Harrington, *Reenchanted Science: Holism in German Culture from Wilhelm II to Hitler* (Princeton University Press, 1996), 212.

³² Nobel Foundation, *Physics: 1922-1941* (Elsevier Publishing Company, 1965), <https://doi.org/10.1016/B978-1-4831-9745-6.50016-7>; Moore, *Schrödinger: Life and Thought*, 10-12. Schrödinger’s father, Rudolf, studied chemistry and published papers on plant phylogeny even while managing his family’s factory. Meanwhile, Schrödinger’s mother, Georgine, sought to name him after the poet whom Schrödinger would often reference in his work, Goethe. In his mother’s family, an aunt penned many poems—the subjects of which often appeared in Schrödinger’s own poetry—and his grandfather, a chemistry professor, curated Vienna’s Museum of Art and Industry and served on the Theater Commission for Lower Austria.

³³ Moore, *Schrödinger: Life and Thought*, 39.

³⁴ Moore, *Schrödinger: Life and Thought*, 20-23.

a close friend, Franz Frimmel, who introduced him to a philosophy of life shaped by *Naturphilosophie*.³⁵

As Schrödinger grappled with these philosophies, their ideas permeated his work in physics and his thoughts on early molecular biology, the latter of which culminated in a popular book titled *What Is Life?*.³⁶ Since the book's publication in 1944, generations of molecular biologists have cited Schrödinger's work—and thus implicitly the philosophies that affected his work—as a significant influence on their research, guiding them to critical discoveries such as the structure of DNA, as well as distinct positions on science policies and biological research initiatives.³⁷ This tremendous influence that Schrödinger's philosophy of life had in twentieth-century biology further established his role as a vital interlocutor in the debates about life.



My thesis aims to trace Schrödinger's influential philosophy of life by analyzing his personal writings—particularly his ambiguous poetry—through the conflicting lenses of mechanistic science and *Naturphilosophie*. Acknowledging the influences of these two philosophies on Schrödinger's work and focusing on his personal and creative writings, rather than his formal scientific ones, help us to create a more nuanced portrayal of Schrödinger's philosophy of life. Reflecting his interdisciplinary and interideological understanding of life, Schrödinger used his poetry and works of popular science to call upon his fellow intellectuals

³⁵ Moore, *Schrödinger: Life and Thought*, 46-47. Schrödinger and Frimmel discussed Richard Semon's *Die Mneme als erhaltendes Prinzip (The Mneme as Conservative Principle)* that drew heavily from the *Naturphilosophie* and materialism of Ernst Haeckel.

³⁶ Moore, *Schrödinger: Life and Thought*, 49; Image: *Portraitfoto von Erwin Schrödinger*, 1927, photograph, 17 x 23 cm, Sammlung Irmgard Bertel, Österreichische Zentralbibliothek für Physik, University of Vienna, <https://phaidra.univie.ac.at/o:1543179>.

³⁷ James Watson, *The Double Helix: A Personal Account of the Discovery of the Structure of DNA* (Atheneum, 1968), 13.

along with members of the public to engage in the discourse on life more fully through the synthesis of mechanistic and organicist logics and the pursuit of truth through both scientific inquiry and artistic expression.

Doing Science and Writing Poetry

At first glance, Schrödinger seemed to have drawn a dichotomy between poetry and art versus science. Writing on “The Lime-Light of Consciousness,” for instance, Schrödinger compared “poetic picture[s]” to “phantastic musing[s]” and “charming old myths” that ought not to be “revived in the mind of a man who, if anything, certainly was a very ingenious, clear-thinking and successful modern scientist.”³⁸ In this essay, Schrödinger ventured so far as to admonish such scientists—explicitly calling out “the great physiologist” Gustav Fechner—for indulging in such fantasies of the arts, in order to reinforce the necessity of scientists thinking clearly and rationally. Making a further distinction between the modern sciences and the arts, Schrödinger described the modern sciences as being grounded by “sober mathematics, not a wilful day-dream” that, as his contemporary Sigmund Freud argued, grounded the work of children and creative writers.³⁹ Writing to a colleague in—ironically—poetic verse, Schrödinger drew a similar distinction between the activities of children and the “game” of science; he argued that pursuing the work of science meant that “we [scientists] could not remain children.”⁴⁰ These

³⁸ Erwin Schrödinger, “The Lime-Light of Consciousness,” ca. 1940s, reel 44-10, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

³⁹ Erwin Schrödinger, “Teil 1: ‘The Statistical Law in Nature’; 1944 zum 100. Geburtstag von Boltzmann,” 1944, W33-799/1, Nachlass von Erwin Schrödinger (1887-1961), Österreichische Zentralbibliothek für Physik, University of Vienna, <https://phaidra.univie.ac.at/o:167788>; Sigmund Freud, “Creative Writers and Day-Dreaming,” in *Collected Papers*, vol. 4, trans. Alix and James Strachey (Basic Books, 1959), 421.

⁴⁰ Paul Peter Ewald to Erwin Schrödinger, *Brief von Ewald, Paul Peter an Schrödinger, Erwin*, April 19, 1932, B94-49, Undulationsmechanik, Briefe zur Wellenmechanik, Erwin-Schrödinger-Archiv, Österreichische Zentralbibliothek für Physik, University of Vienna, <https://phaidra.univie.ac.at/o:1542850>: “Wir können nicht Kinder bleiben / Und bleiben dem Spiel doch ergeben / Freund, das ist nichts fürs Leben, / Was tun: Wissenschaft treiben !” (We could not remain children / and yet still remain in the game / friend, that is nothing for our life, / what we should do: do science !”).

writings suggested that Schrödinger (along with Freud and many of their colleagues) believed that day-dreaming, playfulness, and the creative writing that day-dreaming and playfulness fostered had no legitimate place in the mature sciences.⁴¹

But if Schrödinger had excluded playfulness and day-dreaming entirely from the work of science, he would not have compared science to a “game” (*Spiel*) at all, and his friend would not have called out his contradictory stance on playfulness in the personality of scientists.⁴² If he had considered creative writing to be truly antithetical to the work of science, he would not have called the vocation of poetry his “early desire,” one that still influenced his thinking as he entered the realm of science.⁴³ He would not have penned—and published—an entire collection of poetry in 1949, as a Nobel laureate in physics of almost ten years, as someone whose major work of popular science *What Is Life?* (1944) was gaining widespread recognition among both scientists and the public. Schrödinger’s lifelong embracing of poems—whether through composition, reading, or translation thereof—suggests that poetry might have influenced (and was influenced by) his thinking as a scientist more than we may have originally believed.⁴⁴

⁴¹ Middleton, *Physics Envy*, 53.

⁴² Ewald to Schrödinger, April 19, 1932: “Gestattet mir Euch zu zitieren, / Wenn vor den Augen der Welt / Die lastende Rektorswürde / Mir auf die Schultern fällt. / Doch kann ich zu Hause die Bürde, / Die bei ernsterem Handeln mich hält, / Auf kurze Stunden verlieren / So sei’s als ob Treffpunkt uns würde / Das Spiel vor gemeinsamem Zelt !” (“Allow me to quote you, / When before the eyes of the world, / the burdensome rector’s dignity / falls on my shoulders. / But at home I can lose the burden, / which holds me in more serious action, / for short hours, / so it’s as if we were at a meeting place, / the game in front of a common tent!”).

⁴³ Sofronieva, “Erwin Schrödinger’s Poetry,” 659.

⁴⁴ Midgley, *Science and Poetry*, 39.



Determinism and Free Will

A crucial theme that permeated both Schrödinger’s poetry and his scientific work was the relationship between the determinism that physicochemical laws seemingly established and the free will that humans experienced. In the voice of his narrator in the poem “Zeit und Glück” (“Time and Happiness”), Schrödinger spoke of a predetermined “fate” (*Schicksal*) with which he would “come to terms” and claimed that he “would accept this life” of hardships and suffering, if only his beloved would give him a happy “summer night.”⁴⁵ Through these verses, Schrödinger revealed his belief in an unchangeable “fate” that one had no choice but to accept and to ignore as blissfully as possible through maintaining an illusion of happiness and pleasures. Continuing this theme of illusions and acceptance (or willful forgetfulness), Schrödinger in a distinctly Romantic vein called for a return to nature “where white birds stand in the blue / and white clouds bask in the wind / and distant mountains vanish in the mist / ... where you forget sunspots

⁴⁵ Auguste Dick, “Ein Physiker in der Literatur: Die andere Seite von Erwin Schrödinger” (“A Physicist in Literature: The Other Side of Erwin Schrödinger”), *Die Zeit*, feature article, December 28, 1985, <https://phaidra.univie.ac.at/o:1424264>.

⁴⁶ Erwin Schrödinger, “Zeit und Glück,” in *Gedichte* (Verlag Helmut Küpper, 1949), 20: “Und wärrt es eine sommernacht / Und nähm das leben mit, / dem schicksal wär ich quitt” (“And were it to last a summer’s night / I’d accept life / fate, I’d come to terms with”).

/ clouds and mountains”—where one can find an illusion of comfort and safety in an uncertain world.⁴⁷

But what, exactly, did these illusions obscure from our view? What determined fates in Schrödinger’s paradigm? Schrödinger asserted in the poem “Parabel” (“Parable” or “Parabola”) that “not, your [the reader’s] jubilation and trembling / are the meaning of this life. / Only the world-spirit [*Weltgeist*], when it sets to work, / can from thousands of attempts / a result finally achieve.”⁴⁸ From this deterministic viewpoint, individual humans could not use their emotions and (often emotionally-charged) decisions to alter the course of their lives and, more broadly, the course of history—which only the invisible force of the world-spirit has sufficient power to influence. While the world-spirit may have shaped the desires and actions of individual humans, the world-spirit was also shaped by the values and knowledge of civilizations. Could individual humans therefore collaborate, making “thousands of attempts” altogether, to shape the (Hegelian) world-spirit?⁴⁹ If Schrödinger interpreted the world-spirit accordingly, then humans had some—albeit limited—agency within his philosophy of life. But in the last verse of “Parabel,” he seemingly dismissed these matters of determinism and agency by asking “whether this is at all our concern?”⁵⁰ By giving a dismissive view the concluding voice in “Parabel,” Schrödinger ultimately returned to his solution in the poems “Zeit and Glück” and “Geborgen”

⁴⁷ Erwin Schrödinger, “Geborgen,” in *Gedichte* (Verlag Helmut Küpper, 1949), 7: “Wo weiße vögel im blauen stehn / und weiße wolken im winde sonnen / und ferne berge in dunst vergehn, / ... wo vergäsest du sonnenflecken / wolken und berge” (“Where white birds stand in the blue / and white clouds bask in the winds / and distant mountains vanish in the mist, / ... where you’d forget sunspots / clouds and mountains”).

⁴⁸ Erwin Schrödinger, “Parabel,” in *Gedichte* (Verlag Helmut Küpper, 1949), 11: “Nicht dein jubeln und erbeben / ist der sinn von diesem leben. / Erst der weltgeist, wenn er drangeht, / mag aus tausenden versuchen / schließlich ein ergebnis buchen” (“Not, your jubilation and trembling / are the meaning of this life. / Only the world-spirit, when it sets to work, / can from thousands of attempts / a result finally achieve”).

⁴⁹ Robert B. Brandom, *A Spirit of Trust: A Reading of Hegel’s Phenomenology* (The Belknap Press of Harvard University Press, 2019), 55.

⁵⁰ Schrödinger, “Parabel”: “Ob das freilich uns noch angeht?”

(“Secure”): ignoring one’s lack of control over the determined events of life by focusing on the pleasures of life.⁵¹

Sometimes, however, Schrödinger interpreted determinism through a hopeful lens that did not rely on forgetfulness or illusions. At the beginning of the second chapter of *What Is Life?*, he quoted a verse from Goethe’s poem “Vermächtnis” (“Legacy”) asserting that, while the laws of nature do determine how organisms act, the laws “are [there] to conserve the treasures of life on which the Universe draws for beauty.”⁵² By shaping living organisms and determining their activities, biological mechanisms that adhered to the laws of nature helped organisms to best fulfill their roles in the grand, beautiful scheme of life. By giving up part of their individual freedoms, living organisms could hope to contribute nobly to the beauty and perpetuation of the scheme of life. Schrödinger also drew hope from his belief that the laws of “present-day physics and chemistry could not possibly account for what happens in space and time within a living organism.”⁵³ At first glance, it seems counterintuitive and even detrimental to the pursuit of science for Schrödinger to make this argument.⁵⁴ But Schrödinger’s belief was both a pragmatic and a hopeful one, fueling for himself and his colleagues the ambitions to discover those laws of physics and chemistry that *could* someday account for living processes.

Notwithstanding the hope of Schrödinger’s determinism, the link between these laws and the determinism and reductionism of mechanistic science seemed clear for Schrödinger’s colleagues who were reading his works. If living organisms were reduced to wholly material

⁵¹ Sofronieva, “Erwin Schrödinger’s Poetry,” 664, 666.

⁵² Schrödinger, *What Is Life?*, 19.

⁵³ Schrödinger, *What Is Life?*, 4; Midgley, *Science and Poetry*, 26: “Determinism was not and could not be a conclusion about the world proved by scientific methods. It was an assumption made in order to make the scientific enterprise look, not just plausible so far, but infinitely *hopeful*” (my emphasis).

⁵⁴ Mario Bunge, “In Defense of Realism and Scientism,” *Annals of Theoretical Psychology* 4 (1986): 24, https://doi.org/10.1007/978-1-4615-6453-9_3: “Scientific research (rather than navel contemplation or the reading of sacred texts) can yield the best (truest and deepest) possible knowledge of real (concrete, material) things, be they fields or particles, brains, or societies.”

beings that necessarily obey statistical laws, then they did not possess free will and behaved like machines. Many of Schrödinger's physicist colleagues who also began reflecting on biology and the philosophy of life during the Interwar years found this denial of true free will and agency in Schrödinger's work to be disturbing. Among the first of the quantum physicists to speak publicly on the applications of physics to biology, the Danish scientist Niels Bohr asserted that:

The feeling of the freedom of the will must be considered as a trait peculiar to conscious life, the material parallel of which must be sought in organic functions, which permit neither a causal mechanical description nor a physical investigation sufficiently thoroughgoing for a well-defined application of the statistical laws of atomic mechanics.⁵⁵

While Bohr agreed with Schrödinger that some kind of “statistical laws” influenced the behavior of living organisms and that scientists ought to determine what those laws were, Bohr unequivocally argued that free will was a marker of “conscious life” that no “causal mechanical description” or “physical investigation” of the modern sciences could “sufficiently” explain. Unlike Schrödinger, Bohr highlighted the impossibility rather than the hope of completely finding physical and chemical laws that governed living organisms.

Operating within Bohr's “‘teleomechanical’ framework for relating physics and biology,” Bohr's mentee and a quantum-physicist-turned-biologist Max Delbrück published, alongside the geneticist Nikolai Timofeev-Ressovsky and the radiophysicist Karl G. Zimmer, a paper that bolstered Schrödinger's interest in the science of life: “On the Nature of Gene Mutation and Gene Structure” (1935).⁵⁶ The collaboration originally grew out of the scientists' shared interest in the application of physics and chemistry to the functions of living organisms. However, as the field of molecular genetics became increasingly reductionist, Delbrück pointedly shifted his

⁵⁵ Niels Bohr, “Light and Life,” *Nature* 131 (1933): 459, <https://doi.org/10.1038/131457a0>.

⁵⁶ Daniel McKaughan, “Was Delbrück a Reductionist?,” in *Creating a Physical Biology: The Three-Man Paper and Early Molecular Biology*, ed. Phillip R. Sloan and Brandon Fogel (University of Chicago Press, 2011), 183-185; Daniel McKaughan, “The Influence of Niels Bohr on Max Delbrück: Revisiting the Hopes Inspired by ‘Light and Life,’” *Isis* 96, no. 4 (2005), <https://doi.org/10.1086/498591>.

research to a field of biology to which he could apply the principle of complementarity, in which multiple truths and choices existed simultaneously.⁵⁷ Towards the later part of their careers, both Delbrück and Bohr came to the conclusion that a mechanistic approach ultimately supplied an inadequate framework for studying life in which organisms evidently possessed free will and made decisions daily. After all, such organisms differed significantly from the non-living objects which scientists had been studying and for which they had been deriving laws. For Bohr and Delbrück, the notion of mechanical laws that could explain all aspects of life—the notion that living organisms could be reduced to mechanical laws—was both implausible scientifically and dangerous socio-politically. And perhaps Bohr's and Delbrück's concerns about the mechanizing and potentially dehumanizing aspect of Schrödinger's philosophy were valid.

Indeed, Schrödinger compared living organisms to non-living objects, even machines, repeatedly throughout his scientific work. While responding to Sir Arthur Eddington's Turner Lecture on "The Philosophy of Physical Science" in 1938, Schrödinger argued that "there is actually no gap for volition to creep in, unless we are prepared, in certain exceptional areas, to sacrifice the Second Law" of Thermodynamics, which states that processes have the tendency to occur (spontaneously) when these processes increase the entropy—disorder and randomness—of their surroundings.⁵⁸ But if the Second Law held true, as Schrödinger suggested that it did, then living organisms did not have the power to choose which action to perform or which process to undergo. The processes and actions that organisms ostensibly chose had been physically and chemically pre-determined for them. While giving a lecture titled "Do Electrons Think?" in 1944, Schrödinger similarly wondered whether the "breach of strict causation" made by quantum

⁵⁷ McKaughan, "Was Delbrück a Reductionist?," 182-183.

⁵⁸ Erwin Schrödinger, *Response to Sir Arthur Eddington's Turner Lectures*, 1938, reel 44-2, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

mechanics “leaves room for the display of the spontaneous movements in the animals and in man”—in other words, whether living organisms have free will and agency.⁵⁹ In the immediately following sentence, Schrödinger offered his confident answer: “I think not.”⁶⁰

At the same time, Schrödinger also provided a path for agency and free will to enter his mechanistic picture. Within a few months of giving the “Do Electrons Think?” lecture, Schrödinger published *What Is Life?*, in which he argued that “the living organism seems to be a macroscopic system which in part of its behaviour approaches to that purely mechanical (as contrasted with thermodynamical) conduct to which all systems tend, as the temperature approaches the absolute zero and the molecular disorder is removed.”⁶¹ Even in this quote that emphasized the “mechanical” in living organisms, Schrödinger provided an important caveat: the behavior of living organism “*approaches* to that purely mechanical...conduct to which all systems [living and non-living] tend, *as the temperature approaches the absolute zero*” (my emphasis). Interestingly, Schrödinger described the behavior of living organisms as “approach[ing]” but not becoming “purely mechanical,” and this approach to the mechanical could only occur “as the temperature approaches the absolute zero.” However, the state of absolute zero—the lowest temperature that was theoretically possible, at which no particle moves—does not occur in nature, so the behavior of living organisms cannot be “purely mechanical” in nature. Therefore, Schrödinger’s understanding of life was not a “purely mechanical” one as his contemporary critics and the present-day scholars of his work have claimed it to be.

⁵⁹ Erwin Schrödinger, “Do Electrons Think?” (lecture, BBC, May 1949), reel 44-4, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

⁶⁰ Schrödinger, “Do Electrons Think?”.

⁶¹ Schrödinger, *What Is Life?*, 68-69.

Furthermore, Schrödinger sometimes ventured to attack the mechanistic view directly. During the same year in which he published *What Is Life?* and gave the “Do Electrons Think?” lecture, Schrödinger penned a letter to his colleague in Edinburgh, Sir Edmund Taylor Whittaker. In this letter, Schrödinger interestingly called free will an unquestionable “moral fact” in his discussion of living organisms’ minds.⁶² Schrödinger’s elevating of free will to the status of a “moral fact” drew not upon modern mechanistic language and logic but rather from the language and logic of *Naturphilosophie* that “[retained its] aesthetic and moral heritage.”⁶³ From *Naturphilosophie*, Schrödinger also drew upon the movement’s belief in agency and free will. The intellectual predecessors of *Naturphilosophie*, including Immanuel Kant and Johann Gottlieb Fichte, as well as the founders of *Naturphilosophie*, particularly Friedrich von Schelling, sought to establish the existence of free will in a world bound by physicochemical laws. These philosophers reasoned that free will provided humans with the ability to make moral judgments and the creativity to form works of art and scientific ideas.⁶⁴

Like the predecessors and founders of *Naturphilosophie*, Schrödinger emphasized repeatedly the necessity of creativity in science and the existence of free actions. The ferventness of Schrödinger’s belief in free will permeated his poetry and private correspondence. In the same letter to Whittaker, Schrödinger argued that “determinism is the very last thing [he was] morally afraid of” because:

If anybody is really afraid of his body being a machine, following the ‘Laws of Nature’ in spite of him, let him recall any experience of cramps or spasms he may have had. Let him try to imagine the pitiful state of persons under the influence of strychnine or of tetanus – when this state of affairs really obtains. It is the most terrifying experience a man can have. Your limbs are made to move – you are not asked for your consent. The faintest

⁶² Erwin Schrödinger to Edmund Taylor Whittaker, March 29, 1944, reel 37-14, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

⁶³ Richards, *The Romantic Conception of Life*, 8.

⁶⁴ Richards, *The Romantic Conception of Life*, 69, 136, 161-162, 470; Steigerwald, *Experimenting at the Boundaries of Life*, 218-219.

taste of this tarrying experience will convince every man that in normal circumstances he, and nobody else, controls his actions.⁶⁵

While the “Laws of Nature” may pull a person towards certain actions, Schrödinger vehemently defended a person’s ability to resist these “Laws.” The *ability* to resist these “Laws” at all, regardless of whether the person ultimately chose to resist, proved for Schrödinger that humans do have agency in their lives and therefore that humans do have free will in their decision-making. Schrödinger’s belief in humans’ agency, free will, and organic decision-making—that “every man...and nobody else, controls his actions”—contradicted the mechanists’ strictly deterministic belief that living organisms were machines whose actions were dictated by “mechanical causes.”⁶⁶

For Schrödinger, the ability to break free from the statutes of statistical laws mirrored the ability to break free from the societal expectations imposed on him because of his work as a scientist. Schrödinger addressed his critics specifically in the poem “Lohn” (“Reward”), describing how he had “often been scolded” by an ominous, unnamed mass of friends, fellow scientists, and/or members of the public. Schrödinger claimed that the ultimate cause of their “scolding” was his “dreaming of life,” his love of “rhymes” exceeding his love of “calculations”—his shocking preference of poetry to physics.⁶⁷ Believing that his reward, the titular “Lohn,” was worth more than all the scolding that he endured, Schrödinger challenged his readers (and himself) in the poem “Mitte September” (“Mid-September”) to “wander / bravely and free / through all this death” because “only to the presumptuous / self-forgotten / is it [the earth] ruined.” According to Schrödinger, only “the presumptuous” who completely ignored the

⁶⁵ Schrödinger to Whittaker, March 29, 1944.

⁶⁶ Schofeld, *Mechanism and Materialism*, 3.

⁶⁷ Erwin Schrödinger, “Lohn,” in *Gedichte* (Verlag Helmut Küpper, 1949): “Oft wurd ich gescholten / daß ich das leben verträume, / lieber als rechne reime. / Jetzt – wird mirs vergolten” (“Often was I scolded / for dreaming of life / liking rhymes over calculations. / Now – to me, it’s [life, or poetry] golden”); Sofronieva, “Erwin Schrödinger’s Poetry,” 661, 665.

laws of nature and those who forgot their agency and obeyed the laws of nature without question found their earthly lives to be meaningless. But those who did succeed in building happy, fulfilling lives were those who found a middle ground: obeying the laws in some cases, but actively resisting them in others. To these people—with whom Schrödinger identified himself using the pronoun “us”—their lives would always be “created anew.”⁶⁸

Love and Passion

Through his writings, Schrödinger further revealed that the ability to use one’s agency and act against the statutes of societal expectations or statistical laws emerged from a strong love or passion. But what, exactly, was the object or recipient of his love or passion? Who or what was the subject of Schrödinger’s poetry? Most scholars have argued that Schrödinger intended the object of his love to be women, both real and imagined. Indeed, Schrödinger penned an abundance of poems that centered around women in all their beauty and magic who led him to both happiness and despair. In the deeply passionate poem “Sehnsucht” (“Yearning”), Schrödinger wrote of “goddess[es]” and “queen[s]” whose “sweet mouth[s]” he “longed for.”⁶⁹ And almost in quick succession, on back-to-back pages, he blissfully described the kind of kisses that made one “forget” one’s life and society in “Köstumball” (“Costume Ball”) but then tragically called himself the “disappointed” one—the titular “Enttäuschte”—when “you [the

⁶⁸ Erwin Schrödinger, “Mitte September,” in *Gedichte* (Verlag Helmut Küpper, 1949): “... wandre / mutig und frei / durch all dies sterben. / Nur den vermessen / selbstvergessenen / ist es verderben. / Uns schafft es neu” (“...wander / bravely and free / through all this death. / Only to the presumptuous / self-forgotten / is it [life] ruins. / To us it’s [life is] created anew”).

⁶⁹ Erwin Schrödinger, “Sehnsucht,” in *Gedichte* (Verlag Helmut Küpper, 1949): “Wie mich nach deinem süßen mund gelüste / das merk ich kaum in unbewehrtem drang / ... wärst du göttin, königin” (“How I longed for your sweet mouth / that I barely notice it in my uncontrolled urge / ... you’d be a goddess, queen”).

woman] have stabbed my great hope” for which he now “bitterly weep[ed].”⁷⁰ The several English poems that Schrödinger included in his 1949 *Gedichte* collection also concerned a beautiful but easily lost female object of his love.⁷¹ At first glance, the subject of Schrödinger’s poetry and the object of his love and passion seem to be solely women. Considering the many affairs with women (and girls) that Schrödinger enjoyed during his lifetime, this interpretation seems very plausible.⁷²

But the references to “molecular collisions” and the laws of nature in Schrödinger’s poems should make us reconsider this popular understanding of his poetry and of Schrödinger himself. Although these poems frequently referenced the German feminine pronoun *sie* [she], Schrödinger’s *sie* could represent not only the word “woman,” but also other words that are considered feminine in the German language: “nature [*Natur*], poetry [*Lyrik*], the world [*Welt*] and science [*Wissenschaft*],” as well as physics [*Physik*] and biology [*Biologie*].⁷³ By portraying nature, poetry, the world, and the sciences as feminine objects of love and passion, Schrödinger echoed the literary form of the German Romantics and Idealists in the nineteenth century. The German Romantics often envisioned nature in terms of the beautiful, the magical, and the mysterious, all characteristics that they associated with the feminine.⁷⁴ Meanwhile, the Idealist philosopher Georg Hegel once called nature “the bride which spirit weds” and ventured to

⁷⁰ Erwin Schrödinger, “Kostümball,” in *Gedichte* (Verlag Helmut Küpper, 1949): “Sie hat mich durch ihren schleier geküßt / geküßt, geküßt, / daß eins leben und menschen und schleier vergißt / vergißt, vergißt” (Through her veil she has me kissed, / kissed, kissed, / so that one, life and people and veils, forget / forget, forget”); Erwin Schrödinger, “Der Enttäuschte,” in *Gedichte* (Verlag Helmut Küpper, 1949): “Du hast die große hoffnung mir erdolcht. / Nur um die hoffnung wein ich bitterlich” (“You have stabbed my great hope, / Only for this hope do I bitterly weep”).

⁷¹ Erwin Schrödinger, “The Lover in Search of a Confidant,” “Prayer,” “I Wonder,” “A Love Sigh,” “Could It Be?,” “On the Shore,” “Faery,” in *Gedichte* (Verlag Helmut Küpper, 1949), 37-44.

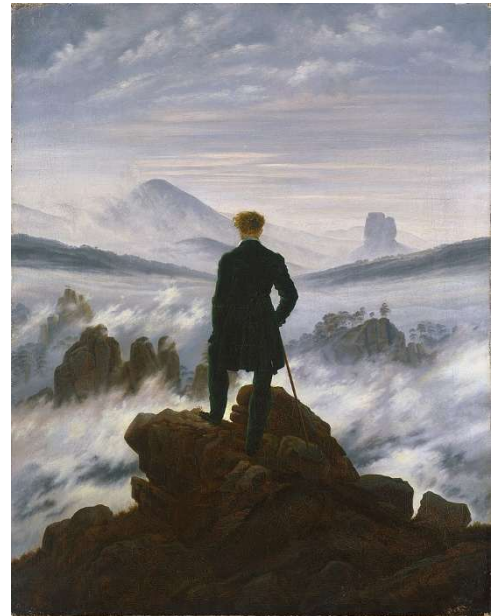
⁷² For detailed analyses of Schrödinger’s not-very-happy marriage and his affairs with multiple women and girls, see Walter Moore, *Schrödinger: Life and Thought* (Cambridge University Press, 1989).

⁷³ Sofronieva, “Erwin Schrödinger’s Poetry,” 662.

⁷⁴ Alison Stone, *Nature, Ethics and Gender in German Romanticism and Idealism* (Rowman & Littlefield International, 2018), 41.

portray all matter in the world to be “symbolically female.”⁷⁵ Just as his predecessors had cast nature and the world in the role of a female lover in their work, Schrödinger used the multivalent feminine to address several, perhaps even all, of his loves simultaneously.

Schrödinger’s loves for nature and for the world were inextricably intertwined. In “Kostümball,” when Schrödinger wrote of the kisses that made one forget life and society, did those kisses come solely from a woman?⁷⁶ I propose that the kisses that Schrödinger described also came from a feminized nature. While pursuing nature, Schrödinger could “forget” the volatile society in which he lived and focus instead on removing the bridal veil that hid the secrets of nature—the laws of



nature that governed living processes—from the eyes of humans.⁷⁷ Similarly, the character of nature in “Der Enttäuschte” (“The Disappointed”) consistently “stabbed [his] great hope” whenever she produced anomalous phenomena proving that the supposedly universal laws and theories that scientists imagined were particular at best and inaccurate at worst.

Schrödinger’s love for tumultuous nature led to his love for the pursuit of truth about nature and the world in his scientific work. Without the “goddess” or “queen” whom Schrödinger

⁷⁵ Stone, *Nature, Ethics and Gender*, 182.

⁷⁶ Sofronieva, 662.

⁷⁷ Caspar David Friedrich, *Der Wanderer über dem Nebelmeer*, ca. 1817, oil on canvas, 37 5/16 × 29 7/16 in, Hamburger Kunsthalle, <https://www.hamburger-kunsthalle.de/en/wanderer-above-sea-fog-caspar-david-friedrich>; The lover of nature, the scientist, in Schrödinger’s vision was remarkably similar to the Idealist and Romantic figure described by Steigerwald in *Experimenting at the Boundaries of Life*, 26: “Friedrich’s 1818 painting *Wanderer over a Sea of Fog* has become an iconic image of German idealism and Romanticism. The central figure seems to be the embodiment of the Kantian subject, whose gaze gives meaning to the world, even as this world remains an unknowable mystery to him. ... His view is mostly concealed, and the scene, shrouded in fog, reveals only fragmentary and specific forms, rather than a unified whole.”

addressed in “Sehnsucht,” life would have been a meaningless, monotonous state of “vegetation,” but the presence of this subject made him (and his fellow scientists) “happy to accept [life] / in order to lose oneself in your [the goddess’s] depths.”⁷⁸ While the use of the words “goddess” and “queen” initially suggests that Schrödinger was speaking to a beloved woman, we should analyze these words in the context of Schrödinger’s humanist background and his *Bildung*, which was significantly informed by philosophical texts and a trust in thought rather than revelation. Schrödinger’s “queen” likely also represented the secular “queen” of the sciences, mathematics, or of all the disciplines, philosophy—perhaps both.⁷⁹ If so, “losing oneself in [the] depths” of mathematics or philosophy, losing oneself in the pursuit of truth, was the object of a life well-lived and the path to the earthly “Paradise”—the “source of all songs”—that Schrödinger had “grown fond of” and maintained even after the experiences of the World Wars had made his pursuit “almost lost.”⁸⁰ In line with this passion for truth and the pursuit thereof through science, two (out of six) literary quotes that Schrödinger used to preface his chapters in *What Is Life?* also elevated truth to the highest pedestal. He echoed Goethe in

⁷⁸ Schrödinger, “Sehnsucht”: “Wenn du nicht wärst du göttin, königin, / Wenn du nicht wärst, wer wollte noch bestehn / im blöden taglicht weiter vegetieren. / Man spürt das leben nur so obenhin / und willigt gerne ein rasch zu vergehn / um sich in deinen tiefen zu verlieren.”

⁷⁹ Erwin Schrödinger, “Shadows are the goods of life...,” poem, W33-312, Nachlass von Erwin Schrödinger (1887-1961), Österreichische Zentralbibliothek für Physik, University of Vienna, <https://phaidra.univie.ac.at/o:258851>: “Thought alone is true / And the love you feel / And the good you work / ... Truth’s but in thought. / And in the love you feel / And in the good you work”; Immanuel Kant, *Critique of Pure Reason*, trans. P. Guyer and A. W. Wood (Cambridge University Press, 1998), 99; Gijsbert van den Brink, “How Theology Stopped Being *Regina Scientiarum*—and How Its Story Continues,” *Studies in Christian Ethics* 32, no. 4 (2019): 448, <https://doi.org/10.1177/0953946819868092>.

⁸⁰ Erwin Schrödinger, “Glaub ihm, dem Toren,” poem, W33-311, Nachlass von Erwin Schrödinger (1887-1961), Österreichische Zentralbibliothek für Physik, University of Vienna, <https://phaidra.univie.ac.at/o:258848>: “Glaub ihm, dem Toren: / Fast schon verloren / wahr er dies: / ein Paradies. / Ich glaube dran, / weil ich es so gelernt, / ob nah, ob entfernt, / was ich lieb gewann. / Alles ungeborne / weckt Dich wieder – / quell aller lieder / das fast verlorne” (“Believe him, the fool: / What was almost already lost / he preserves this: / a paradise. / I believe in it, / because I have so learned / whether near, whether far, / what I have grown fond of. / Everything unborn / awakens you again – / source of all songs / almost lost”).

referring to truth as “lasting thoughts” and Spinoza, when comparing truth and error to light dispelling darkness.⁸¹

For Schrödinger, pursuing truth required a co-existence—nay, the synthesis—of reason and emotions, of mechanism and passion, and of the sciences and the arts. In his poem “Amantibus Poetis” (“To Lovers of Poetry”), the title of which is reminiscent of dedications in older literary works, Schrödinger revealed how enamored he was with the arts and how he would willingly sacrifice his reputation for the sake of this love. Speaking to younger generations of “lovers of poetry,” he advised them to heed not “whether the world admires, mocks, / or respects” them because within these “lovers of poetry” “lies / power that can straighten the crooked / and reconcile [them] with its way.”⁸² But what exactly was this power that belonged to “lovers of poetry”? How did Schrödinger understand the “way” of poetry? How did this “way” allow poetry to “straighten the crooked” and therefore bring its readers and writers to truth?

The second half of “Amantibus Poetis” revealed this “power” that Schrödinger attributed to poetry and the arts. He concluded his poem with the poignant words: “How we fell into this life – / [we] know not. To revive us / whom fear and torment stir, / Know not what we have better / than to feel the love / to those [poets] who gave it [life] lovingly.”⁸³ For Schrödinger, the “power” of poetry and the arts thus resided in the artists’ ability to “revive” those who experience

⁸¹ Johann Wolfgang von Goethe, *Faust: Eine Tragödie*, quoted in Erwin Schrödinger, *What Is Life?: The Physical Aspect of the Living Cell & Mind and Matter* (Cambridge University Press, 1988), 32: “Und was in schwankender Erscheinung schwebt, / Befestiget mit dauernden Gedanken” (“And what in fluctuating appearance hovers, Ye shall fix by lasting thoughts”); Baruch Spinoza, quoted in Erwin Schrödinger, *What Is Life?: The Physical Aspect of the Living Cell & Mind and Matter* (Cambridge University Press, 1988), 56: “Sane sicut lux seipsam et tenebras manifestat, sic veritas norma sui et falsi est” (“Truly, as light manifests itself and darkness, thus truth is the standard of itself and of error”).

⁸² Erwin Schrödinger, “Amantibus Poetis,” in *Gedichte* (Verlag Helmut Küpper, 1949), 26: “Ob die welt bewundre, höhne, / achts nicht: in dir selbst liegt / kraft die krummes grade biegt, / dich mir ihrem tritt versöhne”; Sofronieva, “Erwin Schrödinger’s Poetry,” 661.

⁸³ Schrödinger, “Amantibus Poetis”: “Wie wir in dies leben fielen – / wissens nicht. Uns zu erlaben / wen nuns angst und qual zerwühlen, / wüßt nicht was wir bessres haben / als die liebe nachzufühlen / denen die es liebend gaben.”

their works with a fortifying “love.” Within these lines, Schrödinger drew another important connection between life and love. By describing the act of living as an act of “[falling]” rather than an agency-filled act of choosing or even a simple, irreducible act of living, Schrödinger connected the concept of life to the concept of love. Crucially, “[falling]” in love carried a connotation of “something involuntary, a loss of control, a sliding away of sure ground and an immersion in a sea of romantic desire.”⁸⁴ Schrödinger’s understanding of life and love through this lens of passions and renunciation of control had a few implications: On one hand, humans might not have much control over their lives and loves because these had been predetermined by unknown mechanisms. Meanwhile, this lack of control may also be rooted in how significantly affected humans are by their passions—which one could argue to be subject to more deterministic neural mechanisms, to a more organic development, or perhaps both.⁸⁵ Schrödinger’s love letter to poetry therefore revealed his desire to synthesize mechanistic and organic logic and his belief that poetry and the arts provided him with a channel of doing so.

Leading the Discourse on Life

This synthesis of the mechanistic and the organicist applied not only to Schrödinger’s conception of art, but also to his conception of science and intellectual work.⁸⁶ Just as the contemporary poets “gave [life] lovingly” to their audiences while they were all experiencing the destruction of modernity, scientists and intellectuals at large took on the metaphorical role of “glowing coals [that] glow out of the dust” of war and exile in Schrödinger’s poem “Glühende Asche” (“Glowing Ashes”).⁸⁷ As the “glowing coals” of their societies, these intellectuals had the

⁸⁴ Robert M. Polhemus, *Erotic Faith: Being in Love from Jane Austen to D. H. Lawrence* (University of Chicago Press, 1990), 29.

⁸⁵ Schrödinger to Whittaker, March 29, 1944.

⁸⁶ Cf. Sofronieva, “Erwin Schrödinger’s Poetry,” 662.

⁸⁷ Erwin Schrödinger, “Glühende Asche,” in *Gedichte* (Verlag Helmut Küpper, 1949), 19: “Die glühenden kohlen glosen aus dem dust”; Sofronieva, “Erwin Schrödinger’s Poetry,” 661.

responsibility of “awaken[ing] what we are only half conscious of” / and call[ing] out what only half belongs to us.”⁸⁸ According to Schrödinger, we have become “only half conscious of” our potential—to create art, to pursue science, and to live—as human beings. Schrödinger’s negative observations about the state of modern life and modern science echoed his peers’ Modernist critiques of their disenchanting and fragmented societies. Among these critical voices was the German sociologist Max Weber who argued in his lecture, “Science as a Vocation,” that modern science revolved around a mechanistic desire to “*control everything by means of calculation*,” an unattainable aim that galvanized industrialization and social isolation and ultimately contributed to “the disenchantment of the world.”⁸⁹ Weber and Schrödinger were therefore part of a group of intellectuals who had become disenchanted with the disenchantment of modern science and life.⁹⁰

However, neither Schrödinger nor Weber considered the disenchanting state of modern science and life to be inevitable or irreversible. Rather, they saw a possibility of finally “awaken[ing] what we are only half conscious of.” While acknowledging that the notion of “science as the path to nature” likely appeared to “be blasphemy in the ears of modern youth,” Weber still looked to the methods of the “people on the threshold of modernity.”⁹¹ He claimed that “for artistic experimenters like Leonardo and the musical innovators of the sixteenth century, [science] meant the path to true art, and for them this meant the path to true nature. Art should be elevated to the rank of a science.”⁹² For Weber, the pre-modern organic tendencies in the sciences and the fusion of the arts and sciences into one pursuit of understanding nature served as

⁸⁸ Schrödinger, “Glühende Asche”: “und wecken auf was uns nur halb bewußt / und rufen auf was uns nur halb gehört.”

⁸⁹ Weber, “Science as a Vocation,” 13.

⁹⁰ Harrington, *Reenchanted Science*, xxiv, 207.

⁹¹ Weber, “Science as a Vocation,” 15.

⁹² Weber, “Science as a Vocation,” 15.

an excellent corrective for the extreme mechanism in twentieth-century societies. Similarly, in the conclusion of his lecture on “The Bearing of Physics on Heredity, Mutation and Evolution,” Schrödinger called for the “synthesis” of scientific specialties such as physics and biology in order to form a science of life. He argued that:

Taken singly either of the two [physics or biology] was the result of indefatigable labour in highly specialized branches. But if we had only specialists, the synthesis would have escaped notice and would not be appreciated by anybody. / The development of science is a continual staggering between increasing specialization and attempts to regain the general outlook of ‘a scientist’, nay of a thinking human being.⁹³

Quite shockingly for his contemporary audience that included many specialized intellectuals, Schrödinger suggested that a true “scientist” or intellectual resisted the contemporary trend of over-specialization.⁹⁴ Rather, a true “scientist” or intellectual must draw from the knowledge and methodologies of a wide range of disciplines in order to study a subject as complex and morally significant as the problem of life.

Schrödinger identified himself as a member of this group of intellectuals who formed the “glowing coals” of their societies and whose work became the “living ashes out of the embers” in a dying fire of life and interdisciplinary, interideological knowledge.⁹⁵ For his twentieth-century European audience, Schrödinger’s poetic use of fire to encapsulate the formation of knowledge about life was especially striking. By the time that Schrödinger published his collection of poetry, he and many readers of his poetry would have been exposed to the French

⁹³ Erwin Schrödinger, “The Bearing of Physics on Heredity, Mutation and Evolution” (lecture, Cork, Ireland, January 16, 1944), reel 44-3, Archive for the History of Quantum Physics, 1898-1950, American Philosophical Society.

⁹⁴ Wuketits, “Erwin Schrödinger and His Contribution to a New Understanding of Living Systems,” 103.

⁹⁵ Schrödinger, “Glühende Asche”: “Ich glaub an lebende aschen in der glut” (“I believe in living ashes in the embers”); Sofronieva, “Erwin Schrödinger’s Poetry,” 661.

philosopher Gaston Bachelard’s study of the many meanings of fire in *The Psychoanalysis of Fire*.⁹⁶ In this essay, Bachelard once called fire

the ultra-living element. It is intimate and it is universal. It lives in our hearts. It lives in the sky. It rises from the depths of the substance and offers itself with the warmth of love. Or it can go back down into the substance and hide there, latent and pent-up, like hate and vengeance. Among all phenomena, it is really the only one to which there can be so definitely attributed the opposing values of good and evil. It shines in Paradise. It burns in Hell. It is gentleness and torture ... cookery and ... apocalypse.⁹⁷

Fire, as Bachelard analyzed it, evoked passions and embodied paradoxes—of beauty and the grotesque, of light and destruction, and of life and death—that were and continue to be vital experiences for all living organisms. By choosing fire as his metaphor in “Glühende Asche,” Schrödinger drew upon these



impassioned, paradoxical conceptions of fire from centuries’ worth of literature, art, the sciences, and theology to highlight life as a beautiful, violent, fragile, and ultimately irrepressible force that outlasted individual organisms.⁹⁸ Crucially, he also contributed to this discourse on life

⁹⁶ Michael Granado, “Scientific Epistemology: Exploring the Primacy of Science in the Writing of Gaston Bachelard,” *Res Philosophica* 98, no. 3 (2021): 455, 462-463, <https://doi.org/10.11612/resphil.2060>. Bachelard himself engaged with quantum mechanics, providing another example of how philosophies in the arts and sciences interact with and shape each other.

⁹⁷ Gaston Bachelard, *The Psychoanalysis of Fire*, trans. Alan C. M. Ross (Beacon Press, 1964), 7.

⁹⁸ Erwin Schrödinger, “Juni,” in *Gedichte* (Verlag Helmut Küpper, 1949), trans. Walter Moore, *Schrödinger: Life and Thought* (Cambridge University Press, 1989), 447: “Was in dein leben sich vernichtend giesst / die ausgeburgt von finstern höllennächten / vergisst du fast und glaubst an die gerechten / und reinen worte draus erlösung spriessst” (In June, “you forget almost the spawn of hellish powers / A flux of self destruction in your life / And once again believe the pure and lawful / Words from which salvation springs”); Bachelard, *The Psychoanalysis of Fire*, 71; Exemplifying the idea of fire evoking a paradox of light and destruction, of life and death, is Thomas Cole’s *Expulsion, Moon and Firelight*, ca. 1828, oil on canvas, 91.4 x 122 cm, Museo Nacional Thyssen-Bornemisza, <https://www.museothyssen.org/en/collection/artists/cole-thomas/expulsion-moon-and-firelight>. In this painting, Cole portrayed fire as the gateway between pure life in Paradise and corrupted life after the fall of Eden.

through fire by bestowing upon some individuals—the “glowing coals” and the producers of the “living ashes out of the embers”—the vocation of leading the nurturing of this fire for their societies. Moreover, Schrödinger’s “glowing coals” and “embers” acquired a second meaning: one of knowledge that “we are only half conscious of” and of which “only half belongs to us” because of how inadequate the sciences will always be for explaining nature.⁹⁹ Fire—as Schrödinger understood it—embodied both the force of life and the pursuit of knowledge.

Despite his belief in the rewards and dangers of stoking such a fire, as well as his trust in intellectuals to nurture this fire, Schrödinger’s understanding of who could participate in this knowledge formation was not restricted to intellectuals. In fact, his simultaneous desire to bring members of the public into the intellectual discourse on life further distinguished his philosophy from those of his colleagues. In “The Bearing of Physics” lecture, Schrödinger notably expanded his image of the kind of person who could engage in the discourse on life to include all “thinking human being[s]” rather than solely scientists or intellectuals. He argued for the usefulness—and even the inevitability—of involving the public in these debates more forcefully after publishing his work of popular science, *What is Life?*. While writing a preface for *What Is Life?*, Schrödinger asserted:

[Philosophy] to my mind, is not the privileged ground of a class of scholars particularly trained for it. Anybody has the right to indulge in it – at any rate everybody does to a certain extent. We feel the thing too near to our heart for yielding to any notice of prohibition: Ye unlearned, keep off! ... I am anxious not to lose any reader by the implication of revealed facts that may not conform with the revelation he has received. I wish to speak to everybody.¹⁰⁰

By sympathizing with and appealing to a significant “unlearned” sector of the public that has long been excluded in these meaningful discussions, he invited the public to bring their

⁹⁹ Schrödinger, *What Is Life?*, 4; Bachelard, *The Psychoanalysis of Fire*, 60-62, 64.

¹⁰⁰ Schrödinger, *Einleitung to What Is Life?*.

understandings of life into the discourse and to allow themselves to be shaped by his philosophy. Schrödinger's appeal to the public, whether through his direct addresses or his forms of writing, increased significantly the popularity of his writings and his philosophy of life among the public.¹⁰¹

Conclusion: Schrödinger's Philosophy in Postwar Science

Schrödinger's philosophy of life, as he revealed through his poetry, therefore influenced both his own scientific work and the work of those who were influenced by his philosophy or paradigm in the second half of the twentieth century. Among those who engaged with Schrödinger's philosophy of life were the postwar biologists who worked in the then-new field of molecular genetics. Some biologists such as Max Delbrück and Hermann Joseph Muller certainly criticized the scientific theories that Schrödinger proposed, but many biologists including James Watson and Francis Crick—both of whom helped to discover the structure of DNA—credited Schrödinger for igniting their own hopes in the potential of molecular biology and “very elegantly propound[ing] the belief that genes were the key components of living cells and that, to understand what life is, we must know how genes act.”¹⁰² Indeed, these biologists often spoke about Schrödinger's ideas as he expressed them in *What is Life?*. However, biologists like Watson and Crick seem to have inherited Schrödinger's synthesis of mechanistic and organicist logic and methodologies that he had espoused more clearly in his poetry and other writings, ones that have often been deemed non-scientific and therefore non-vital to the historical study of science. This synthesis of logic and methodologies has led both biologists and interested

¹⁰¹ Christina Moberg, “Schrödinger's What is Life?—The 75th Anniversary of a Book That Inspired Biology,” *Angewandte Chemie* 59, no. 7 (2020): 2550, <https://doi.org/10.1002/anie.201911112>.

¹⁰² James D. Watson, *The Double Helix: A Personal Account of the Discovery of the Structure of DNA* (Atheneum, 1968): 13, quoted in Krishna R. Dronamraju, “Erwin Schrödinger and the Origins of Molecular Biology,” in “Perspectives: Anecdotal, Historical and Critical Commentaries on Genetics,” ed. James F. Crow and William F. Dave, *Genetics* 153, no. 3 (1999): 1076, <https://doi.org/10.1093/genetics/153.3.1071>.

members of the public to describe the purported fundamental unit of life—the gene—as something that mechanistically “reduces the self to a molecular entity” but also serves as “the locus of the true [organic] self” that resists manipulation by external forces.¹⁰³ The duality of mechanistic and organicist science in modern understandings of the fundamental unit of life suggests that, with the aid of Schrödinger, both mechanistic and organicist tendencies shaped the biological discourse on life.

Scholars and artists outside of the field of molecular biology have also found Schrödinger’s work to be especially useful for their own research or art. Some social scientists have applied Schrödinger’s affinity for soft determinism (through his probabilistic understanding of physicochemical laws) to their conceptualizations of the mind. These scholars have argued for the possibility that “*consciousness itself* [and social life are] quantum mechanical,” allowing living organisms to have the ability to choose freely from a multitude of choices.¹⁰⁴ And although poets have already drawn from and critiqued the contemporary sciences during the centuries prior to Schrödinger’s work, Modernist poets drew significantly from the incomplete indeterminacy that Schrödinger’s scientific theories and philosophy of life afforded.¹⁰⁵ The English poet T. S. Eliot, for instance, incorporated Schrödinger’s indeterminate wave function into his portrayal of a state of “half-life and half-death, populated by half-subjects and half-objects” in the poem, “The Love Song of Saint Sebastian.”¹⁰⁶ Such an imagined state provided Eliot and the readers of his poetry with a clear entry into the larger debate about what exactly

¹⁰³ Dorothy Nelkin and M. Susan Lindee, *The DNA Mystique: The Gene as a Cultural Icon* (University of Michigan Press, 2004), 2.

¹⁰⁴ Alexander Wendt, *Quantum Mind and Social Science: Unifying Physical and Social Ontology* (Cambridge University Press, 2015), 30, 72; cf. Simon Chesterman, “Herding Schrödinger’s Cats: The Limits of the Social Science Approach to International Law,” *Chicago Journal of International Law* 22, no. 1 (2021): 57-58, <https://chicagounbound.uchicago.edu/cjil/vol22/iss1/7>.

¹⁰⁵ Midgley, *Science and Poetry*, 26, 40-42; Albright, *Quantum Poetics*, 15, 33.

¹⁰⁶ Albright, *Quantum Poetics*, 263.

distinguished life from death. Therefore, even for the scholars and artists who worked in fields outside of the science of life, Schrödinger's work still fostered their engagement with the discourse on life.

Schrödinger's personal influence on the ideology and methodology of these diverse disciplines justifies our considering his philosophy of life to have been its own paradigm, one that was distinct from the paradigm shifts of quantum mechanics and molecular genetics to which Schrödinger had contributed through his theoretical work. Because of his work's significance to the greater discourse on life, we ought to study Schrödinger's philosophy more closely and with a wider range of sources, in order to form a more nuanced understanding of his philosophy and its implications. Schrödinger's poetry and private correspondence, for instance, could help us to trace his subtle tendencies of mechanistic science and organicist *Naturphilosophie*. These more personal writings allowed Schrödinger to reveal his more ambiguous and closely guarded belief in the co-existence of determinism and free will, reason and emotions, and scientific and artistic methods for pursuing truth. These ideas permeated not only Schrödinger's own philosophy of life, but also the philosophies of life held by the generations of intellectuals and members of the public who engaged—and continue to engage—with Schrödinger's ideas.

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