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Self-Defence as a Biological Imperative and the Natural Foundations of Human Autonomy

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生生不息

The ceaseless production of life

ABSTRACT

This article advances the claim that self-defence is not merely a legal permission or moral exception but more fundamentally a biological imperative. Beginning with defensive aggression as an evolutionarily conserved survival strategy, it traces the structural and functional foundations of life through biological organization, self-preservation, and natural autonomy, culminating in the emergence of human autonomy. Self-defence is shown to be intrinsic to the architecture of living systems—enabling organisms to resist entropy, maintain coherence, and regulate their continued existence. In human beings, these biological imperatives evolve into reflective self-regulation, moral awareness, and the capacity to safeguard personal integrity. By grounding self-defence in the logic of life itself, the article reframes it as a constitutive principle of autonomy—the biological and reflective capacity through which living beings preserve coherence, sustain viability, and uphold the conditions of self-directed existence.

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1. INTRODUCTION

In my previous article, *The World As It Is and the Realities of Violence*, I argued that violence is not a rare disruption but an enduring condition—socially patterned, psychologically consequential, and empirically pervasive. [1] Violence recurs, accumulates, and often remains latent until it erupts. Its persistence makes preparation not optional but necessary. The central question is no longer whether violence will occur but how we are prepared to respond.

This article addresses that challenge. If violence is a structural feature of the world, survival demands a structural capacity to resist it. That capacity is self-defence. Before invoking rights, duties, or legal protections, self-defence must be understood in its most elemental sense. It begins as a biological

[1] Nathan A. Wright, *The World As It Is and the Realities of Violence*, Northern Sage Kung Fu Academy, April 2025, https://northernsagekungfu.com/the-world-as-it-is-and-the-realities-of-violence/

necessity: the means by which living beings preserve their viability against threat.[2]
From the simplest organisms to complex mammals, protective responses appear universally. Ethologists such as Niko Tinbergen have shown that defensive aggression is an evolutionarily conserved behavior, while Ernst Mayr emphasized that traits supporting survival are preserved through natural selection.[3] In this light, self-defence emerges not as a peripheral exception to violence but as one of life's central expressions. Organisms unable to resist predation or injury did not survive. Defence, therefore, is what allows peace to take root—for without it, neither individuals nor communities could endure.[4]

The central claim advanced here is simple yet far-reaching: self-defence originates as a biological imperative, a functional necessity embedded in the precariousness of life. Long before human beings articulated moral rules or crafted legal doctrines, the defence of existence had already emerged as an evolutionarily conserved adaptive behavior enabling survival and continuity. This article develops that claim by tracing self-defence through four layers of analysis: (1) defensive aggression as a conserved survival strategy; (2) biological organization as the architecture that resists disorder; (3) natural autonomy as the capacity for self-regulation; and (4) human autonomy as the culmination of that regulation into purposeful action. Together, these foundations prepare the groundwork for future discussions of self-defence as a moral imperative, a natural right, and a legal principle.

This article is therefore currently limited to the biological foundations of self-defence. Its aim is to establish how the imperative to defend one's existence arises from the very structure and organization of life, prior to any moral or legal elaboration. The normative and juridical dimensions—how this biological necessity becomes articulated as moral right and legal doctrine—are taken up in subsequent work. What follows here is the groundwork: the biological logic that makes later ethical and legal claims intelligible.

2. DEFENSIVE AGGRESSION and ADAPTIVE BEHAVIOR

Self-defence, at its most basic level, can be understood as **defensive aggression**—a biologically evolved strategy for responding to threat. In ethology, aggression refers neutrally to a suite of behavioral patterns that organisms employ to assert boundaries, deter predation, or protect vital function.[5] In this context, defensive aggression is a distinct category: it is reactive, activated in response to threat of danger, and oriented toward self-preservation rather than domination or gain.[6] To sharpen the distinction, we can treat defensive aggression as the evolutionary substrate, and self-defence as its broader biological and human expression.

Biologically, self-defence encompasses the protective actions—physiological, behavioral, and social—that organisms use to preserve their viability against threat.[7] In non-human species, this includes reflexive withdrawal, defensive displays, and cooperative behaviors that safeguard survival and reproduction.[8] Among humans, the same foundation applies but with an added layer: self-defence also becomes a moral and legal concept, understood as the proportionate and necessary use

[2] Randolph Nesse, *Good Reasons for Bad Feelings: Insights from the Frontier of Evolutionary Psychiatry* (New York: Dutton, 2019), 57–62.
[3] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 5–8; Ernst Mayr, *The Growth of Biological Thought* (Cambridge, MA: Belknap Press of Harvard University Press, 1982), 55–60.
[4] Johan Galtung, "Violence, Peace, and Peace Research," *Journal of Peace Research* 6, no. 3 (1969): 167–191.
[5] Konrad Lorenz, *On Aggression*, trans. Marjorie Kerr Wilson (New York: Harcourt, Brace & World, 1966), 2–5.
[6] John Archer, *The Nature of Human Aggression* (Cambridge: Cambridge University Press, 2009), 19–28.
[7] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–136; Konrad Lorenz, *On Aggression*, trans. Marjorie Kerr Wilson (New York: Harcourt, Brace & World, 1966), 35–42.
[8] John Alcock, *Animal Behavior: An Evolutionary Approach*, 10th ed. (Sunderland, MA: Sinauer Associates, 2013), 281–286; Peter B. Stacey and Walter D. Koenig, *Cooperative Breeding in Birds: Long-Term Studies of Ecology and Behavior* (Cambridge: Cambridge University Press, 1990), 5–12.

of protective force to preserve autonomy, bodily integrity, or life.[9]

These features are observable across the animal kingdom. From insects to mammals, defensive aggression has been conserved through evolution because it enhances survival and reproductive success.[10] [11] Organisms repel, deter, or escape threats in diverse ways: cats arch their backs, gazelles kick, and birds dive-bomb intruders. Such responses are mediated by neural and hormonal systems—especially the sympathetic nervous system and the hypothalamic–pituitary–adrenal (HPA) axis—which mobilize energy, heighten vigilance, and prepare the organism for protective action.[12] [13] Research by Jaak Panksepp and Joseph LeDoux demonstrates how these fear-and-defence circuits are deeply embedded in mammalian brains, reflecting ancient survival strategies.[14]

Humans inherit this biological foundation, yet transform it through higher cognition. Immediate physiological responses—such as increased heart rate, muscle priming, and narrowed attention—are shared with many animals.[15] What distinguishes humans is the layering of memory, foresight, planning, and ethical reflection.[16] Defensive aggression can therefore be anticipatory and strategic: we imagine threats before they occur, evaluate proportional responses, and prepare countermeasures in advance.[17] [18]

Crucially, defensive aggression must be distinguished from **offensive aggression**. Offensive (or predatory) aggression is proactive and instrumental, aimed at securing resources, asserting dominance, or inflicting harm. Defensive aggression, by contrast, is reactive and constrained, serving to preserve autonomy and bodily integrity.[19] This distinction, emphasized by Konrad Lorenz in his classic ethology and reinforced in contemporary aggression psychology (e.g., Craig Anderson and Brad Bushman), is central to biological taxonomy as well as to moral and legal frameworks that determine when violence is justified.[20] Whereas offensive aggression is typically condemned, defensive aggression—when proportionate and necessary—is regarded as natural, morally justified, and legally permissible.[21] [22]

Defensive behavior also follows a type of **escalation logic**. Because fighting is metabolically costly and risky, many species deploy ritualized forms of aggression—warning postures, threat displays, bluffing signals—that serve as graded steps before violence.[23] Tinbergen's studies of conflict behavior and Lorenz's analysis of ritualized aggression highlight this adaptive efficiency: organisms conserve energy and reduce risk while still deterring harm.[24] [25] These selective displays reflect not only biological economy but also a cognitive dynamic: organisms must discern which signals warrant escalation and which do not.[26]

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[9] George P. Fletcher, *Rethinking Criminal Law* (Boston: Little, Brown, 1978), 859–865; Joel Feinberg, *Harm to Self*, vol. 3 of *The Moral Limits of the Criminal Law* (New York: Oxford University Press, 1986), 141–146.
[10] Randolph M. Nesse, *Good Reasons for Bad Feelings: Insights from the Frontier of Evolutionary Psychiatry* (New York: Dutton, 2019), 60–68;
[11] Ernst Mayr, *This Is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997), 147–153.
[12] Bruce S. McEwen and Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Allostasis, Allostatic Load and Resilience," *Neuropsychopharmacology* 35, no. 1 (2010): 105–110.
[13] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 1156–1162.
[14] Jaak Panksepp, *Affective Neuroscience: The Foundations of Human and Animal Emotions* (New York: Oxford University Press, 1998), 213–220; Joseph E. LeDoux, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (New York: Simon & Schuster, 1996), 142–148.
[15] Robert M. Sapolsky, *Behave: The Biology of Humans at Our Best and Worst* (New York: Penguin Press, 2017), 37–46.
[16] Antonio Damasio, *Self Comes to Mind: Constructing the Conscious Brain* (New York: Pantheon, 2010), 184–190.
[17] Sapolsky, *Behave*, 149–156.
[18] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 149–155.
[19] Archer, *The Nature of Human Aggression*, 27–30.
[20] Lorenz, *On Aggression*, 35–42; Craig A. Anderson and Brad J. Bushman, "Human Aggression," *Annual Review of Psychology* 53 (2002): 27–51.
[21] Craig H. Kennedy, "Offense and Defence: Toward a Functional Taxonomy of Aggression," *Aggression and Violent Behavior* 2, no. 2 (1997): 115–122.
[22] George P. Fletcher, *Rethinking Criminal Law* (Boston: Little, Brown, 1978), 859–865.
[23] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–136.
[24] John Maynard Smith, *Evolution and the Theory of Games* (Cambridge: Cambridge University Press, 1982), 78–82.
[25] Lorenz, *On Aggression*, 43–48.
[26] John John Vervaeke, Leo Ferraro, and Anderson Todd. "Relevance

This biological framing complements the psychological and sociological perspectives introduced in my previous article.[27] Where earlier I considered aggression as a spectrum of emotional, verbal, and behavioral expressions, here I narrow the focus to one specific form—defensive aggression—within an evolutionary and adaptive framework.[28] This makes it possible to separate protective resistance from malicious harm and to prepare the ground for understanding self-defence as a functional biological imperative rather than a mere moral or legal construct.[29] [30]

Defensive aggression is patterned rather than random. It emerges from a broader repertoire of adaptive behaviors that underlie survival in all organisms—most notably feeding, fleeing, fighting, and reproducing.[31] These behaviors are grounded in Walter Cannon's account of the fight-or-flight response, and provides the scaffold from which defensive action evolves. To see how self-defence fits within this repertoire, we must now turn to the behavioral logic of survival.[32]

Defensive aggression, like all survival strategies, involves trade-offs: it consumes energy and carries risk, but it preserves the viability of other vital functions.[33] [34] Seen in this light, self-defence is not an isolated mechanism but part of the broader repertoire of adaptive behaviors that sustain life across species. Situating defensive aggression within this framework clarifies its origins, constraints, and significance: it is an essential expression of how life persists, adapts, and resists destruction,[35] [36] and it provides the evolutionary backdrop against which defensive behavior acquires its meaning and necessity.[37][38]

2.1. The Behavioral Logic of Survival

Long before complex cognition emerged, survival depended on a handful of deeply embedded behavioral patterns. Among these, feeding, fleeing, fighting, and reproducing represent four foundational strategies that organisms have developed over evolutionary time to meet the basic demands of life. Ethologists such as Niko Tinbergen describe these as the "Four Fs" of survival—conserved biological responses encoded into the nervous systems and hormonal machinery of species ranging from insects to primates.[39] [40] Together, they form a behavioral scaffold that enables life to persist, adapt, and respond to threat.[41]

Each of these core behaviors contributes to survival in its own way:

i) Feeding secures energy and nutrients, the most basic requirement for sustaining life. By fueling metabolism, feeding enables the repair, growth, and movement upon which all other survival functions depend.[42] As Ernst Mayr emphasized, energy acquisition underlies every adaptive function in

Realization and the Emerging Framework in Cognitive Science." *Journal of Logic and Computation* 23, no. 5 (2013): 1–21.

[27] Nathan A. Wright, *The World As It Is and the Realities of Violence*, Northern Sage Kung Fu Academy, September 6, 2025, https://northernsagekungfu.com/the-world-as-it-is-and-the-realities-of-violence/

[28] Albert Bandura, *Aggression: A Social Learning Analysis* (Englewood Cliffs, NJ: Prentice Hall, 1973), 4–9.

[29] John Archer, *The Nature of Human Aggression* (Cambridge: Cambridge University Press, 2009), 19–28; Robert M. Sapolsky, *Behave: The Biology of Humans at Our Best and Worst* (New York: Penguin Press, 2017), 149–156

[30] Joel Feinberg, *Harm to Self*, vol. 3 of *The Moral Limits of the Criminal Law* (New York: Oxford University Press, 1986), 141–146.

[31] Walter B. Cannon, *Bodily Changes in Pain, Hunger, Fear and Rage* (New York: Appleton, 1915), 210–217.

[32] Cannon, *Bodily Changes*, 218–225.

[33] John Maynard Smith, *Evolution and the Theory of Games* (Cambridge: Cambridge University Press, 1982), 78–82 (hawk–dove strategies and energy costs of fighting).

[34] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human Design* (Cambridge, MA: MIT Press, 2020), 15–22.

[35] Randolph M. Nesse, *Good Reasons for Bad Feelings: Insights from the Frontier of Evolutionary Psychiatry* (New York: Dutton, 2019), 60–68; W. D. Hamilton, "The Genetical Evolution of Social Behaviour. I," *Journal of Theoretical Biology* 7, no. 1 (1964): 1–5.

[36] Thompson, *Mind in Life*, 158–162.

[37] Tinbergen, *The Study of Instinct*, 100–110; Sapolsky, *Behave*, 37–46.

[38] Mayr, *This Is Biology*, 153–158.

[39] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 100–110.

[40] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–136.

[41] Ernst Mayr, *This Is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997), 147–153.

[42] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 651–658.

biology.[43] [44] Beyond sustaining the individual, competition over food often extends into territoriality, dominance, and defensive action. Feeding is both the foundation of survival and a driver of conflict and boundary-setting, a point also noted by E.O. Wilson in his studies of social behavior.[45] [46]

ii) Fleeing remains the most widespread strategy for avoiding harm. Walter Cannon, who first described the "fight-or-flight" response in 1932, showed how perception of danger mobilizes rapid physiological changes: adrenaline surges, cortisol floods the system, muscles tense, perception narrows, and awareness heightens.[47] As Robert Sapolsky explains, this vertebrate-wide stress-response system—mediated by the hypothalamic–pituitary–adrenal (HPA) axis—illustrates how biology prepares organisms for immediate survival.[48] Even in humans, the reflex remains central to situational self-protection, showing that escape is often the first and most reliable path to survival.[49]

iii) Fighting, though energetically costly, functions as a last-resort defence to repel threats and protect vital interests such as territory, offspring, or bodily integrity. It becomes most critical when escape is impossible. According to John Maynard Smith, natural selection favors restraint in such contexts because full combat is risky and metabolically expensive; ritualized aggression such as dominance contests in primates or antler clashes in deer resolve disputes while minimizing injury.[50] Here, the link to defensive aggression is most apparent, as noted by Konrad Lorenz in his work on ritualized aggression.[51]

iv) Reproduction guarantees continuity of life beyond the individual, but it also introduces new vulnerabilities. Offspring are dependent, and reproductive success often demands additional forms of defence—securing mates, protecting young, or forming cooperative alliances. As Clutton-Brock and David Buss show, mate-securing commonly involves mate guarding and other competitive strategies to defend access against rivals.[52] [53] Protecting young is a central component of parental care across taxa—guarding eggs and offspring, provisioning, and post-independence defence—as Clutton-Brock details.[54] And forming cooperative alliances to raise and defend young—cooperative breeding with alloparental help—is well documented across birds and mammals, where helpers engage in provisioning and defence against predators, as Stacey & Koenig emphasize.[55] Kin protection, particularly among mammals and birds, extends self-preservation outward into parental and social defence; as Hamilton showed, such investment advances inclusive fitness—the genetic continuity of kin lines.[56]

These behaviors go beyond simple reflexes. Even in lower animals they are coordinated, context-sensitive, and sometimes anticipatory.[57] They involve trade-offs between risk and reward, energy expenditure and safety—each strategy carrying costs that organisms must balance against survival and reproduction.[58] In humans, the same patterns

[43] Ernst Mayr, *This Is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997), 90–97.
[44] Ernst Mayr, *This Is Biology*, 153–158.
[45] Edward O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, MA: Harvard University Press, 1975), 123–129.
[46] Patrick Bateson and Paul Martin, *Design for a Life: How Behaviour Develops* (London: Jonathan Cape, 1999), 46–54.
[47] Walter B. Cannon, *The Wisdom of the Body* (New York: W. W. Norton, 1932), 227-233, 273–280.
[48] Robert M. Sapolsky, *Behave: The Biology of Humans at Our Best and Worst* (New York: Penguin Press, 2017), 37–46.
[49] Sapolsky, *Why Zebras Don't Get Ulcers*, 67–72.
[50] John Maynard Smith, *Evolution and the Theory of Games* (Cambridge: Cambridge University Press, 1982), 78–82.
[51] Konrad Lorenz, *On Aggression*, trans. Marjorie Kerr Wilson (New York: Harcourt, Brace & World, 1966), 35–42.
[52] Clutton-Brock, Tim. "Sexual Selection in Males and Females." *Science* 318 (2007): 1882–1885; Buss, David M. "Human Mate Guarding." *Neuroendocrinology Letters* 23, Suppl. 4 (2002): 23–29, esp. 23–24.
[53] Peter B. Stacey and Walter D. Koenig, *Cooperative Breeding in Birds: Long-Term Studies of Ecology and Behavior* (Cambridge: Cambridge University Press, 1990), 5–12.
[54] Clutton-Brock, T. H. *The Evolution of Parental Care*. Princeton: Princeton University Press, 1991, 13–27.
[55] Stacey, Peter B., and Walter D. Koenig. "Introduction." In *Cooperative Breeding in Birds: Long-Term Studies of Ecology and Behaviour*, ix–xviii, esp. ix–x. Cambridge: Cambridge University Press, 1990.
[56] Hamilton, W. D. "The Genetical Evolution of Social Behaviour. I." *Journal of Theoretical Biology* 7, no. 1 (1964): 1–16, esp. 1–4.
[57] Tinbergen, *The Study of Instinct*, 140–145.
[58] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human*

are shaped by learning, culture, and symbolic reasoning. According to Joseph Henrich, cultural frameworks such as law, language, and martial traditions extend these biological imperatives into durable systems of cooperation and defence.[59] Human foresight extends this logic further, allowing us to anticipate danger, plan defensive measures in advance, and build cooperative strategies across time.[60] [61]

The capacity to defend oneself, therefore, does not exist in isolation. It emerges from this interrelated behavioral system that regulates energy, mitigates threat, and maximizes survival. As Dawkins reminds us in *The Selfish Gene*, self-defence is best understood as an inheritance of evolution rather than an invention of culture—a biological imperative that becomes the foundation for autonomy, agency, and moral responsibility.[62] This inheritance not only grounds individual survival but also provides the raw material that human cultures later formalize into structured systems of defence—from kin protection to martial traditions that codify these imperatives into disciplined practices.[63] To see what this inheritance means in evolutionary terms, we can examine how natural selection shaped defensive aggression into a survival trait.

2.2 How Evolution Shaped Defensive Aggression

Defensive aggression is an evolutionarily selected trait[64] rooted in life's most basic imperative: to persist in the face of threat. It is best understood as neither a cultural artifact nor a product of conscious reasoning. As Ernst Mayr explained, traits that enhanced survival were preserved through natural selection regardless of conscious awareness.[65] Charles Darwin likewise described defensive instincts—such as threat displays and protective behaviors—as outcomes of selection pressures that favored persistence.[66] Organisms that developed effective defensive responses—whether physical, behavioral, or physiological—were more likely to survive, reproduce, and pass those traits to the next generation.[67]

Like other adaptive behaviors, defensive aggression is favored through natural selection because it enhances reproductive fitness—protecting not only the individual but, in many species, kin and offspring who share genetic investment.[68]

Defensive aggression exemplifies what some scholars call "situated Darwinism": where organisms are not passive recipients of selection pressures but active participants whose defensive repertoires help shape the contours of their evolutionary niches.[69]

This general logic, however, takes on more specific forms when we examine how defensive aggression actually functions across species.

2.3 Strategic Functions of Defensive Aggression

In evolutionary biology, such responses are considered functionally strategic, even if the organism is unaware of its "strategy." A lizard that flares its body to scare off predators, a wasp that stings in response to intrusion, a primate that bares

Design (Cambridge, MA: MIT Press, 2020), 15–22.
[59] Joseph Henrich, *The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter* (Princeton, NJ: Princeton University Press, 2015), 93–101.
[60] Sapolsky, *Behave*, 149–156.
[61] Henrich, *The Secret of Our Success*, 45–50.
[62] Richard Dawkins, *The Selfish Gene*, rev. ed. (Oxford: Oxford University Press, 2006), 34–38, 55-62.
[63] Dawson, *Martial Arts and Philosophy: Beating and Nothingness* (Chicago: Open Court, 2010), 11–15.
[64] Charles Darwin, *The Descent of Man, and Selection in Relation to Sex* (London: John Murray, 1871); see also John Alcock, *Animal Behavior: An Evolutionary Approach*, 10th ed. (Sunderland, MA: Sinauer Associates, 2013).
[65] Ernst Mayr, *This Is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997), 90–97, 153-158.
[66] Charles Darwin, *The Expression of the Emotions in Man and Animals*, 2nd ed., ed. Paul Ekman (New York: Oxford University Press, 1998), 123–127.
[67] Charles Darwin, *On the Origin of Species* (London: John Murray, 1859), 61–62.
[68] W. D. Hamilton, "The Genetical Evolution of Social Behaviour. I," *Journal of Theoretical Biology* 7, no. 1 (1964): 1–16.
[69] Xabier E. Barandiaran, Ezequiel A. Di Paolo, and Marieke Rohde, "Defining Agency: Individuality, Normativity, Asymmetry, and Spatio-Temporality in Action," Adaptive Behavior 17, no. 5 (2009): 367–374.

its teeth in a threat display, or birds that mob an intruder—all exemplify instinctive behaviors that deter predation or prevent injury. [70] These actions are driven by survival necessity rather than malice. John Alcock also highlights how such instinctive behaviors represent evolved modules of defence, calibrated to specific ecological pressures.[71]

Aggression, however, is metabolically expensive and risky. Fighting can lead to wounds, stress, or death. [72] For this reason, natural selection has consistently favored restraint and economy rather than indiscriminate combat. As Niko Tinbergen observed in his ethological studies, defensive aggression is often conditional—calibrated to the intensity of threat and the absence of better alternatives, such as fleeing or hiding.[73] Bluffing displays, warning postures, and escalation ladders often delay actual violence. As Alcock notes, these escalation ladders conserve energy while still protecting viability. [74] Defensive behavior tends not to be the first response; when triggered, it often becomes the necessary and decisive one.

The logic of such restraint has also been modeled formally. John Maynard Smith's game-theoretic work demonstrates why strategies of bluff, display, and conditional aggression endure: they are evolutionarily stable solutions that preserve survival value while minimizing combat costs. [75] Richard Dawkins later expanded this framework, showing how restraint fits into the broader structure of gene-level selection, where behaviors that reduce unnecessary risk enhance the long-term propagation of genetic lineages. [76]

In this way, defensive aggression emerges as a flexible, context-sensitive toolkit that balances the risks of injury against the imperative of survival.[77] Rather than random or indiscriminate, it is strategic—an evolved solution that enables organisms to resist harm while conserving resources for the broader work of survival and reproduction.

2.4 Human Extensions and Moral Foundations

The strategic restraint observed in other animals marks an evolutionary bridge to the human case. Our nervous systems still mobilize with the same reflexes: surges of adrenaline, muscle priming, narrowed perception.[78] Robert Sapolsky explains, these stress responses are deeply conserved mechanisms for immediate survival, [79] and—as Randolph Nesse emphasizes—emotions such as fear and anger evolved as adaptive programs that mobilize protective responses, safeguarding bodily integrity and enhancing reproductive fitness. [80] Yet unlike other animals, humans extend these reflexes and emotions through memory, foresight, language, and moral reflection, transforming immediate survival programs into deliberate and ethical choices. We can imagine possible threats before they occur, evaluate proportional responses, and articulate reasons for our actions.[81] These higher faculties do not replace the biological logic of survival; they build upon it. The adaptive strategies of our ancestors persist beneath cultural overlays, shaping the boundaries of what responses remain possible.[82]

This biological perspective forms the foundation

[70] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 140–145.
[71]John Alcock, *Animal Behavior: An Evolutionary Approach*, 10th ed. (Sunderland, MA: Sinauer Associates, 2013), 281–286.
[72] Craig A. Anderson and Brad J. Bushman, "Human Aggression," Annual Review of Psychology 53 (2002): 27–51.
[73] Niko Tinbergen, The Study of Instinct (Oxford: Clarendon Press, 1951), 145–150.
[74] John Alcock, Animal Behavior: An Evolutionary Approach, 10th ed. (Sunderland, MA: Sinauer Associates, 2013), 288–291.
[75] John Maynard Smith, *Evolution and the Theory of Games* (Cambridge: Cambridge University Press, 1982), 18–25.
[76] Richard Dawkins, *The Selfish Gene*, 30th anniversary ed. (Oxford: Oxford University Press, 2006), 67–73.
[77] John Maynard Smith, Evolution and the Theory of Games (Cambridge: Cambridge University Press, 1982), 24–29.
[78] Walter B. Cannon, The Wisdom of the Body (New York: W.W. Norton, 1932), 227–233.
[79] Robert Sapolsky, Why Zebras Don't Get Ulcers, 3rd ed. (New York: Holt Paperbacks, 2004), 39–45.
[80] Randolph M. Nesse, *Good Reasons for Bad Feelings: Insights from the Frontier of Evolutionary Psychiatry* (New York: Dutton, 2019), 60–68.
[81] Antonio Damasio, Self Comes to Mind: Constructing the Conscious Brain (New York: Pantheon, 2010), 184–190.
[82] Evan Thompson, Mind in Life: Biology, Phenomenology, and the Sciences of Mind (Cambridge, MA: Harvard University Press, 2007), 158–162.

upon which later claims about moral and legal justification must stand. The justification of self-defence rests less on social decree than on necessity itself: life, autonomy, agency, and moral personhood exist in a precarious balance and rely upon it.[83] If defensive aggression expresses this precariousness, biological organization provides the structure that resists it. Defense begins here, at the level of life itself:[84] without it, future viability collapses, while effective strategies are reinforced through evolutionary feedback loops that privilege those agents able to secure their persistence.[85]

Seen in this light, defensive aggression becomes more than an instinct—it is both a biological safeguard and the strategic backbone of survival. This recognition prepares the way for the next stage of analysis: how the structural organization of living systems anchors and extends this defensive logic.

3. BIOLOGICAL ORGANAIZATION and SELF-PRESERVATION

If defensive aggression reveals the behavioral logic of survival, then biological organization reveals the structural logic that makes survival possible in the first place. A living system is not a passive object waiting to endure until decay but an active, dynamic process of self-maintenance.[86] It must continually resist entropy, repair itself, and sustain its own coherence. As Erwin Schrödinger argued in *What Is Life?*, organisms maintain their improbable order only by importing energy and expelling disorder.[87]

This coherence is organic in character: life is structured less like a machine assembled from the outside and more like an organism that produces and sustains itself from within.[88] Living systems are open systems, dependent on flows of matter and energy that counteract disintegration. To cease this work of maintenance is, for an organism, to die.[89]

This section examines that structural dimension. It introduces the concepts of self-production and organizational closure as ways of explaining how living systems generate and sustain themselves. It also considers the concrete functions—metabolism, regulation, repair, and reproduction—that anchor this architecture of survival. In what follows, the focus shifts from behavior to structure, showing how the very organization of life is inseparable from defence.

3.1 What Is a Living System?

To specify more closely what it means to be alive, we must examine the functions through which organisms sustain themselves. Survival requires continuous processes of metabolism, regulation, repair, and reproduction—mechanisms that resist entropy and preserve coherence across levels of organization. Organisms achieve this through openness: they exchange energy and matter with their environments in order to endure.[90] Living systems persist only by countering disintegration; once this capacity ends, so does the organism's viability.

The defining feature of living systems is active self-production. They continually generate and regenerate the very components that keep them intact—a process famously described by Humberto Maturana and Francisco Varela as **autopoiesis**, the continuous self-manufacture of components. This

[83] Joel Feinberg, Harm to Self, vol. 3 of The Moral Limits of the Criminal Law (New York: Oxford University Press, 1986), 141–146.
[84] Hans Jonas, The Phenomenon of Life: Toward a Philosophical Biology (New York: Harper & Row, 1966), 84–90.
[85] John Maynard Smith, Evolution and the Theory of Games (Cambridge: Cambridge University Press, 1982), 78–82.
[86] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 71–78.
[87] Erwin Schrödinger, *What Is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1944), 69–76.
[88] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 71–75.
[89] Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man's New Dialogue with Nature* (New York: Bantam Books, 1984), 128–135.
[90] Ilya Prigogine and Dilip Kondepudi, *Modern Thermodynamics: From Heat Engines to Dissipative Structures*, 2nd ed. (Chichester, UK: Wiley, 2015), 425–433.

is sustained by **organizational closure**, the interdependent network of processes that secure that production.[91] As Evan Thompson explains, closure does not mean isolation, but a form of internal coherence that enables viable interaction with an environment. In other words, an organism is organized in such a way that it actively defends its own continuity.[92]

Survival depends on concrete functions that accomplish this work. Metabolism supplies energy, homeostatic regulation preserves internal conditions, repair mechanisms restore what is damaged, and reproduction secures continuity across generations. As Bruce Alberts and colleagues note, these are not incidental processes but constitutive of life itself: without them, organisms collapse into disorder.[93] Alongside energy flow, life also depends on information storage and transfer—genetic codes and signaling pathways that coordinate development, repair, and adaptation.[94]

Together, these processes instantiate autopoiesis and organizational closure: a network of mutually supporting activities through which an organism produces and sustains its identity.[95] As Evan Thompson emphasizes, to be alive is not merely to exist, but to continually enact the structural and functional conditions of one's survival.[96] Seen this way, the very organization of life is already defensive—an architecture designed to resist entropy and preserve coherence against threat.

3.2 Life-Sustaining Functions and Their Defensive Logic

To grasp this more fully, we must ask how maintenance is actually accomplished. If 3.1 identified biological organization as the structural ground of survival, 3.2 turns to the concrete functions that enact this ground in practice. From cellular metabolism and DNA replication to tissue repair and immune defence, these functions form the operational basis of biological organization. As Bruce Alberts and colleagues explain in *Molecular Biology of the Cell*, these processes ensure that essential functions continue without interruption.[97] Taken together, they reveal that the structural logic of life is inseparable from defence: to live is to resist disorder, repair damage, and preserve integrity against dissolution.

Metabolism supplies energy and raw material, fueling the work of repair, growth, and movement. Without metabolic flow, no other life-sustaining function can operate. As Alberts emphasizes, the cell's viability depends on continuous energy exchange with its environment—a defensive economy that mobilizes against starvation, collapse, and decay.[98]

Homeostasis regulates internal conditions, stabilizing temperature, pH, and other vital parameters. Walter Cannon first defined homeostasis as the body's ability to maintain internal stability amid external change.[99] Allostasis, a concept developed by Peter Sterling and expanded by Bruce McEwen, extends this principle by anticipating change—mobilizing energy in advance of demand, such as before exertion.[100]

[91] Humberto R. Maturana and Francisco J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht: D. Reidel, 1980), 78–85.
[92] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 79–86.
[93] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 510–524.
[94] Alberts et al., *Molecular Biology of the Cell*, 6th ed., 90–95 (DNA structure and information storage); 319–329 (cell signaling pathways).
[95] Humberto R. Maturana and Francisco J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht: D. Reidel, 1980), 78–85.
[96] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 79–86.
[97] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 510–524, 680–690.
[98] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 81–85, 510–524.
[99] Walter B. Cannon, *The Wisdom of the Body* (New York: W. W. Norton, 1932), 24–32.
[100] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human Design* (Cambridge, MA: MIT Press, 2020), 15–22; Bruce S. McEwen and

Together, these mechanisms buffer shocks and prepare organisms to withstand stress, transforming regulation into a proactive form of defence.

Reproduction extends life beyond the individual. While not essential for moment-to-moment survival, it secures continuity and creates new points of vulnerability. Offspring, mates, and kin require protection, and reproductive strategies often give rise to defensive behaviors such as parental care, territoriality, and cooperative alliances. As Tim Clutton-Brock demonstrates, parental care and reproductive investment necessarily involve defensive strategies that protect both offspring and reproductive opportunity.[101]

Repair and immunity safeguard integrity by detecting and correcting damage before it destabilizes the system. These functions restore tissues, neutralize pathogens, and maintain the critical distinction between self and non-self—a principle foundational to modern immunology, as Kenneth Murphy and Casey Weaver emphasize in *Janeway's Immunobiology*.[102] Their role is not incidental but central: without them, disorder would accumulate unchecked, undermining survival. The specific mechanisms—ranging from cellular clearance processes to tumour suppression—demonstrate how defence operates at multiple scales. This layered organization is developed more fully in the next section, which examines how defensive functions interlock across molecular, cellular, systemic, and behavioral levels.

Information integrity safeguards the instructions of life. Genetic fidelity is preserved through DNA proofreading and error correction, while proteostasis ensures proper protein folding and function. Alberts and colleagues describe how molecular chaperones and DNA repair enzymes preserve informational integrity,[103] while epigenetic regulation coordinates developmental and adaptive responses that ensure survival under changing condition.[104] Together, these mechanisms prevent the informational collapse that would otherwise undermine survival.

The architecture of biological organization is both intricate and resilient, binding energy,[105] information, and structure into a defensive whole.[106] Crucially, these functions are organized across multiple levels of complexity, ensuring that local disruptions—such as cellular mutations or systemic shocks—can be absorbed, compensated, or repaired at higher levels. Defence is not an accessory to life but the structural logic binding its functions together, the background condition that enables survival to persist through time.[107]

3.3 Defence as a Multilevel Imperative

Above, we examined the core functions that sustain life; here, the focus shifts to how those functions are organized across levels of biological complexity. Defence operates through a hierarchy of interdependent layers, each reinforcing and sustaining the next.

At the molecular and cellular levels, processes such as DNA repair, proteostasis, apoptosis, and autophagy preserve integrity by correcting errors, removing damaged components, and maintaining the distinction between self and non-self. Douglas Hanahan emphasizes apoptosis as a central tumour-suppressive defence in his updated framework of cancer biology,[108] while Noboru Mizushima and Beth Levine identify autophagy as a critical mechanism for maintaining cellular integrity and

Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Allostasis, Allostatic Load and Resilience," *Neuropsychopharmacology* 35, no. 1 (2010): 105–110.

[101] T. H. Clutton-Brock, *The Evolution of Parental Care* (Princeton, NJ: Princeton University Press, 1991), 13–27.

[102] Kenneth Murphy and Casey Weaver, *Janeway's Immunobiology*, 9th ed. (New York: Garland Science, 2016), 1–12.

[103] Alberts et al., *Molecular Biology of the Cell*, 6th ed., 510–524, 680–690.

[104] Adrian Bird, "Perceptions of Epigenetics," *Nature* 447, no. 7143 (2007): 396–398.

[105] Schrödinger, *What Is Life?*, 69–76.

[106] Alberts et al., *Molecular Biology of the Cell*, 6th ed., 81–85.

[107] Murphy and Weaver, *Janeway's Immunobiology*, 9th ed., 1–12.

[108] Douglas Hanahan, "Hallmarks of Cancer: New Dimensions," *Cancer Discovery* 12, no. 1 (2022): 31–36.

preventing disease.[109] Together, these mechanisms form the ground floor of biological resilience, ensuring that disorder at the smallest scales does not cascade into systemic collapse.

Above this foundation, defence scales upward into systemic coordination. Nervous and endocrine networks orchestrate detection and mobilization. Walter Cannon first identified the autonomic nervous system's role in rapid physiological adjustment,[110] and modern stress research—particularly by Bruce McEwen and Peter Gianaros—shows how the hypothalamic–pituitary–adrenal (HPA) axis mobilizes energy and primes cardiovascular, muscular, and perceptual systems for survival.[111]

At the behavioral level, organisms enact protective strategies in real time: fleeing, fighting, freezing, bluffing, or cooperating. Classic ethology, from Niko Tinbergen onward, shows how such behaviors are context-sensitive and often ritualized, reducing risk while maintaining defensive effectiveness.[112]

These layers are interdependent and mutually sustaining. Molecular and cellular repair underwrite systemic stability; systemic coordination enables coherent behavior; and behavior, in turn, secures the conditions for all lower levels to function. Defence is therefore not an added feature of life but its multilevel architecture—the scaffold that enables organisms to endure, adapt, and act.[113]

Taken together, these interlocking layers reveal that defence is not simply a collection of mechanisms but an integrated architecture. Their coherence reflects a deeper imperative—self-preservation[114]—which unifies the organism's operations across all scales. This foundational drive provides the bridge to the next section, where the focus turns to self-preservation as the organizing principle of life itself.

3.4 Self-Preservation as the Foundational Survival Task

The multilevel defenses described above ultimately converge on a single imperative: self-preservation. Every organism must preserve its organization against the constant threat of entropy and dissolution. This imperative is captured in the concept of autopoiesis, developed by Humberto Maturana and Francisco Varela to describe the ongoing production and regeneration of the very components that sustain the system as a whole.[115] Autopoiesis highlights the dynamic of continuous self-production, while *organizational closure* emphasizes the circular or self-referential interdependence of processes that sustain this production.[116] Together, these concepts show how living systems are thermodynamically open—drawing in energy and matter, exporting entropy and waste—yet organizationally closed, maintaining identity through internally generated processes.[117]

To sustain this continuity, organisms must also discriminate among countless environmental inputs, orienting themselves to what is most relevant for survival. This process—what John Vervaeke calls "relevance realization"[118]—ensures that defensive activity remains directed toward what truly matters, filtering signal from noise. In this sense, self-preservation is not only metabolic and structural but also interpretive: it requires the capacity to

[109] Noboru Mizushima and Beth Levine, "Autophagy in Human Diseases," *New England Journal of Medicine* 383, no. 16 (2020): 1564–1570.
[110] Walter B. Cannon, *The Wisdom of the Body* (New York: W. W. Norton, 1932), 24–32.
[111] Bruce S. McEwen and Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Allostasis, Allostatic Load and Resilience," *Neuropsychopharmacology* 35, no. 1 (2010): 105–110.
[112] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–141.
[113] Alberts et al., *Molecular Biology of the Cell*, 6th ed., 81–85.
[114] Erwin Schrödinger, *What Is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1944), 69–76.
[115] Humberto R. Maturana and Francisco J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht: D. Reidel, 1980), 78–85.
[116] Maturana and Varela, *Autopoiesis and Cognition*, 96–103.
[117] Ilya Prigogine and Dilip Kondepudi, *Modern Thermodynamics: From Heat Engines to Dissipative Structures*, 2nd ed. (Chichester, UK: Wiley, 2015), 425–433.
[118] John Vervaeke and Todd Anderson, "Relevance Realization and the Emerging Framework in Cognitive Science," *Journal of Logic and Computation* 23, no. 2 (2013): 355–374.

register threat, opportunity, and affordance within a shifting environment.[119]
Evan Thompson deepens this view by stressing that life is not a static condition but a ceaseless process of renewal. Life should be seen less as a fixed state and more as an active architecture of self-maintenance,[120] continually orchestrating processes that stave off dissolution. On this reading, defence is not something added to life from the outside but the very activity of life itself—the ongoing effort to preserve coherence in the face of entropy.[121]

From this imperative of self-preservation emerges biological autonomy: the minimal form of self-regulation that secures identity from within. At this point, survival shifts from mere endurance to organized self-regulation, establishing the bridge to more complex forms of autonomy. This bridge leads directly to the next stage: natural autonomy—the organism's capacity to regulate itself through active engagement with its environment, extending the logic of self-preservation outward into adaptive coordination with a changing world.[122]

3.5 Biological Autonomy as a Precursor to Moral Autonomy

From the principles of autopoiesis and organizational closure outlined earlier arises a basic form of biological autonomy. A living system persists not because it is carried forward by external forces, but because it organizes and regulates itself from within. As Humberto Maturana and Francisco Varela described, autonomy in this sense means more than self-production: it is the capacity to absorb disturbance, repair what is damaged, and preserve functional integrity in the face of change.[123]

This form of autonomy, however, does not yet amount to agency or moral freedom. It sustains viability but does not deliberate, intend, or judge—it simply enacts the self-sustaining pattern that makes such capacities possible. As Evan Thompson notes, even minimal forms of autonomy are foundational, but they do not yet imply conscious intention or moral responsibility.[124] In evolutionary terms, every organism that endures embodies this minimal autonomy, yet only certain lineages extend it into increasingly complex forms of interaction, adaptation, and eventually cognition.[125]

For this reason, biological autonomy provides the ground on which all higher orders of autonomy rest. It furnishes the inner architecture of life, preparing the way for outward engagement. Xabier Barandiaran, Ezequiel Di Paolo, and Marieke Rohde argue that this transition—from basic self-regulation to interactive agency—marks the conceptual bridge toward cognition and moral agency.[126] The next step is natural autonomy, where self-preservation becomes active coordination with a changing environment, and survival depends not only on maintaining internal coherence but on adaptively engaging the world.[127]

4 NATURAL AUTONOMY and the SELF-REGULATING ORGANISM

Having established self-preservation and biological autonomy as the inner architecture of life, the focus now turns outward. The next step is natural

[119] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (Evanston, IL: Northwestern University Press, 2001), 82–87.
[120] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 79–86.
[121] Erwin Schrödinger, *What Is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1944), 69–76.
[122] Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, rev. ed. (Cambridge, MA: MIT Press, 2017), 172–180.
[123] Humberto R. Maturana and Francisco J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht: D. Reidel, 1980), 78–85.
[124] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[125] Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, rev. ed. (Cambridge, MA: MIT Press, 2017), 172–180.
[126] Xabier E. Barandiaran, Ezequiel A. Di Paolo, and Marieke Rohde, "Defining Agency: Individuality, Normativity, Asymmetry, and Spatio-Temporality in Action," *Adaptive Behavior* 17, no. 5 (2009): 367–374.
[127] Thompson, *Mind in Life*, 104–112.

autonomy: the organism's capacity to sustain itself through active regulation and engagement with its environment. Whereas biological autonomy secures internal coherence, natural autonomy coordinates that coherence with external conditions, enabling survival in a world that is unpredictable, shifting, and often hostile.[128]

This outward orientation is costly. Organisms must continually allocate energy and resources toward monitoring, adjusting, and restoring equilibrium. As Peter Sterling observes, regulation itself is energetically expensive and ongoing, requiring continuous investment rather than passive maintenance.[129] Building on this physiological picture, enactive and ecological approaches emphasize that regulation is meaningful as well as mechanical. Organisms do not simply endure their surroundings but interpret them, establishing significance in relation to survival.[130] James Gibson's account of affordances makes this point concrete: environments are encountered not as neutral backdrops but as fields of action possibilities that sustain or threaten life.[131]

Natural autonomy thus names the shift from sheer self-preservation to adaptive coordination. It extends the defensive logic of life into active regulation, where survival depends on interpreting and negotiating conditions rather than merely resisting them. The next section develops a precise definition of natural autonomy and identifies its core features: goal-directed regulation, sense-making, and graded responsiveness across the spectrum of life.

4.1 Defining Natural Autonomy

Natural autonomy refers to the organism's capacity to regulate itself in relation to changing conditions. Whereas biological autonomy secures structural integrity through ongoing self-maintenance, natural autonomy extends this principle outward, coordinating internal processes with external demands in ways that sustain viability.[132] To call such regulation goal-directed does not imply conscious intention; rather, as Hans Jonas emphasized, it means that living activity is inherently normative—organized around survival-relevant ends.[133]

Living systems achieve this through more than reactive mechanisms. They are structurally coupled with their environments, continuously exchanging matter, energy, and information in ways that shape both organism and niche. Francisco Varela and Evan Thompson describe this coupling as the basis of sense-making: organisms do not simply endure external conditions; they negotiate them, sustaining their identity through dynamic exchanges that are inherently normative.[134] In this sense, the environment is never encountered as neutral—it is always lived as significant, sustaining or threatening to viability.[135]

This definition highlights natural autonomy as goal-directed, normative, and environmentally coupled. But sense-making does not appear in a single form. It unfolds in degrees—ranging from basic reactivity in simple organisms to predictive capacities in more complex animals, and finally to reflective awareness in human beings.[136] [137] The

[128] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[129] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human Design* (Cambridge, MA: MIT Press, 2020), 15–22
[130] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[131] James J. Gibson, *The Ecological Approach to Visual Perception* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1986), 127–136.
[132] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[133] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: Harper & Row, 1966), 80–84.
[134] rancisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, rev. ed. (Cambridge, MA: MIT Press, 2017), 172–180.
[135] Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, rev. ed. (Cambridge, MA: MIT Press, 2017), 172–180.
[136] Varela, F. J., Thompson, E., & Rosch, E. *The Embodied Mind: Cognitive Science and Human Experience*. MIT Press, 1991; Catherine Read, Agnes Szokolszky, *Ecological Psychology and Enactivism: Perceptually-Guided Action vs. Sensation-Based Enaction*, *Frontiers in Psychology*, 2020.
[137] Weichold, M., *The Ethics of Sense-Making*, *Frontiers in Psychology*, 2023.

next section turns to this graded character by examining natural autonomy across multiple scales of life.

4.2 Natural Autonomy Across Scales

This graded character of sense-making can be observed across the spectrum of life Even the simplest organisms regulate in this way: a bacterium orients toward nutrient-rich conditions and avoids toxins. [138] More complex animals display flexible strategies, mobilizing resources in advance, coordinating physiology with environmental changes, and modifying behavior in light of past experience. At higher levels, regulation becomes increasingly anticipatory. Bruce McEwen and Peter Gianaros describe the HPA axis as a system that mobilizes energy in advance of demand, a principle consistent with Peter Sterling's account of allostasis. Together, their work shows that natural autonomy includes prediction as well as reaction. [139] [140] At its peak, sense-making culminates in consciousness; in humans, it extends into reflective awareness, where the world is encountered as significant, remembered, symbolized, and evaluated in normative terms. [141]

This graded responsiveness is also evident across structural scales. At the cellular level, immune regulation coordinates defences against pathogens, distinguishing self from non-self. [142] At the organismal level, behavior flexibly balances the demands of feeding, fleeing, or defending, echoing ethological insights from Niko Tinbergen and others.[143] Beyond the individual, at the ecological level, processes of cooperation and niche construction extend survival through collective adaptation, as John Odling-Smee and colleagues emphasize in their framework of ecological inheritance. [144] Taken together, these capacities define autonomy as an active system of self-regulation enacted within a dynamic world.

Viewed across these scales, a consistent logic emerges: viability demands are nested and hierarchically structured. At the most basic level, organisms preserve their physical integrity; at higher levels, they safeguard reproduction, cooperation, and social cohesion. In human beings, this hierarchy culminates in the defense of autonomy and dignity. Self-defence thus traverses this hierarchy, preserving the conditions under which higher-order forms of agency and culture can emerge.[145]

Having seen how natural autonomy manifests across scales, the next section shifts focus from structure to time—tracing how autonomy develops from immediate reactivity to adaptive regulation.

4.3 From Reactivity to Adaptive Regulation

A defining feature of natural autonomy is the progression from immediate reactivity to adaptive regulation. Reactive behavior is immediate and stimulus-bound: withdrawal from heat, contraction when touched, or acceleration of metabolism under oxygen deprivation. Such reactions are essential, but they are limited—tethered to the present moment with no capacity to adjust for context or anticipate future needs.[146]

Adaptive regulation, by contrast, organizes responses in light of both current and projected conditions. Organisms integrate past experience,

[138] Thompson, *Mind in Life*, 104–112.

[139] Bruce S. McEwen and Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Allostasis, Allostatic Load and Resilience," *Neuropsychopharmacology* 35, no. 1 (2010): 105–110.

[140] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human Design* (Cambridge, MA: MIT Press, 2020), 15–22; Bruce S. McEwen and Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Allostasis, Allostatic Load and Resilience," *Neuropsychopharmacology* 35, no. 1 (2010): 105–110.

[141] Evan Thompson, *Mind in Life*, 149–158.

[142] Kenneth Murphy and Casey Weaver, *Janeway's Immunobiology*, 9th ed. (New York: Garland Science, 2016), 1–12.

[143] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–141.

[144] John Odling-Smee, Kevin N. Laland, and Marcus W. Feldman, *Niche Construction: The Neglected Process in Evolution* (Princeton, NJ: Princeton University Press, 2003), 41–50.

[145] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: Harper & Row, 1966), 84–90; Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 149–158.

[146] Ernst Mayr, *This Is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997), 90–97.

environmental feedback, and anticipated demand to balance short-term pressures with long-term viability. As Hans Jonas observed, living beings are not only reactive but oriented toward preserving their form over time—a task that requires interpretive adjustment rather than reflex alone.[147] This developmental progression deepens self-regulation, shifting life from mere reaction to orientation toward unfolding temporal patterns.

Examples illustrate this gradient. Bacteria alter flagellar rotation in proportion to nutrient gradients, integrating chemical signals over time rather than flipping between on/off reactions.[148] Birds migrate in anticipation of seasonal change, conserving viability across generations.[149] Mammals cache food against future scarcity, drawing on memory and foresight to extend survival across time.[150] These cases reveal an expanding temporal horizon: regulation evolves from immediate reaction to strategies that span days, seasons, and even lifetimes.

What distinguishes adaptive regulation is its reliance on feedback loops and plasticity. Organisms refine their responses to present signals and to accumulated patterns of experience. Improving survival across changing conditions. Eric Kandel's work on synaptic plasticity demonstrates how even simple conditioning modifies behavior in ways that extend viability over time.[151] In higher animals, this plasticity includes learning and conditioning; in humans, it culminates in culture and symbolic planning. Across all cases, the principle is the same: signals matter because they are evaluated for relevance to viability, and behavior is shaped accordingly.[152]

This shift reflects the movement from indiscriminate reaction to relevance realization[153]—the active discernment of which aspects of the environment are significant for present and future viability.[154] Seen in this way, the progression from reactivity to regulation is more than a biological upgrade; it is a reorientation of life itself, toward a world that must be interpreted as supportive, threatening, or uncertain. This recognition prepares the ground for the next step: autonomy is never exercised in isolation but always through embeddedness in an environment.

4.4 Environmental Embeddedness

Natural autonomy cannot be understood apart from the environments in which it is exercised. Organisms are not closed machines operating in isolation; they are open systems, living only through continuous exchange with their surroundings. As Erwin Schrödinger and later Ilya Prigogine emphasized, organisms endure only by importing energy and matter while exporting entropy.[155] Embeddedness names this reciprocity: external conditions are not simply received but actively incorporated into the organism's regulatory logic. Relevance realization clarifies how this occurs:[156] organisms parse their surroundings into affordances—features most salient for sustaining or threatening life.[157]

This reciprocity is evident across domains of life Plants reorient their leaves toward light, recalibrating growth and hormone distribution in

[147] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: Harper & Row, 1966), 80–84.
[148] Howard C. Berg, *E. coli in Motion* (New York: Springer, 2004), 57–65.
[149] Peter Berthold, *Bird Migration: A General Survey*, 2nd ed. (Oxford: Oxford University Press, 2001), 14–21.
[150] Timothy J. Smalley, "Food Caching in Mammals," *Mammal Review* 8, no. 1 (1978): 3–13.
[151] Eric R. Kandel, *In Search of Memory: The Emergence of a New Science of Mind* (New York: W. W. Norton, 2006), 120–127.
[152] Peter Sterling, *What Is Health? Allostasis and the Evolution of Human Design* (Cambridge, MA: MIT Press, 2020), 15–22.
[153] John Vervaeke, Timothy P. Lillicrap, and Blake Richards, "Relevance Realization and the Emerging Framework in Cognitive Science," *Journal of Logic and Computation* 23, no. 2 (2012): 355–386, https://doi.org/10.1093/logcom/exq034
[154] Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, rev. ed. (Cambridge, MA: MIT Press, 2017), 172–176.
[155] Erwin Schrödinger, *What Is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1944), 69–76; Ilya Prigogine and Dilip Kondepudi, *Modern Thermodynamics: From Heat Engines to Dissipative Structures*, 2nd ed. (Chichester, UK: Wiley, 2015), 425–433.
[156] John Vervaeke, Timothy P. Lillicrap, and Blake Richards, "Relevance Realization and the Emerging Framework in Cognitive Science," *Journal of Logic and Computation* 23, no. 2 (2012): 355–386, https://doi.org/10.1093/logcom/exq034
[157] James J. Gibson, *The Ecological Approach to Visual Perception* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1986), 127–136.

response to shifting conditions, a phenomenon well documented in plant physiology. The human immune system depends on—and is shaped by—trillions of microbial partners in the gut microbiome; disruptions in this ecological balance can impair immunity, digestion, and even mental health. [158] Among social animals, vigilance, foraging, and defensive behaviors are calibrated to the signals and positions of conspecifics, embedding individual survival within group dynamics, as Niko Tinbergen and behavioral ecologists have shown.[159] In each case, survival is not achieved in isolation but distributed across organism–environment relations.

What emerges from these cases is not passive adaptation but structural coupling—the idea, drawn from Francisco Varela's enactive theory, that organisms and environments co-constitute one another through cycles of action and feedback.[160] Embeddedness therefore extends autonomy outward: the organism sustains itself by enlisting its surroundings as an active partner in regulation. This functions less as reflective cognition than as adaptive sense-making, in which the world is continuously evaluated in terms of what sustains or threatens viability.[161]

To be autonomous is to be inseparably entangled with the world. Yet this entanglement would mean little if organisms could not also resist when the environment turns hostile. Self-defence is integral to autonomy, forming part of its very structure rather than a secondary addition—a theme to which we now turn.[162]

4.5 Self-Defence as a Condition of Natural Autonomy

If embeddedness shows how organisms rely on their environments, defence shows how they resist when those environments turn hostile. Autonomy is inherently fragile. To remain self-governing, an organism must continually defend itself against forces that threaten to overwhelm or redirect its organization. Hans Jonas argued that living systems, by their very nature, are perpetually exposed to dissolution and must actively sustain their form against it. [163] Without protective barriers, repair mechanisms, or immune defences, the system ceases to regulate itself and becomes heteronomous—its activity dictated by external forces rather than by internal regulation. Defence is an enabling condition of autonomy—the background upon which all self-determination rests.[164]

Pathology illustrates the point. Defence can fail in three ways: by invasion, misdirection, or internal rebellion. Viruses hijack cellular machinery, redirecting a cell's processes to their own replication, as Bruce Alberts and colleagues detail in their account of viral life cycles.[165] Autoimmune disorders misdirect defensive capacities inward, eroding the distinction between self and non-self, a distinction at the core of modern immunology.[166] Cancer represents the opposite failure: cells pursuing unchecked proliferation at the expense of the organism's coherence, a hallmark process outlined by Douglas Hanahan and Robert Weinberg.[167] In each case, the breakdown occurs at the level of the defensive architecture that sustains

[158] Justin L. Sonnenburg and Erica D. Sonnenburg, *The Good Gut: Taking Control of Your Weight, Your Mood, and Your Long-Term Health* (New York: Penguin Press, 2015), 45–54; Rob Knight, *Follow Your Gut: The Enormous Impact of Tiny Microbes* (New York: Simon & Schuster, 2015), 72–78.
[159] Niko Tinbergen, *The Study of Instinct* (Oxford: Clarendon Press, 1951), 132–141; Tim Clutton-Brock, *The Evolution of Cooperative Breeding* (Princeton, NJ: Princeton University Press, 2016), 87–95.
[160] Francisco J. Varela, "Organism: A Meshwork of Selfless Selves," in *Organism and the Origins of Self*, ed. Alfred Tauber (Dordrecht: Springer, 1991), 79–107.
[161] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[162] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: Harper & Row, 1966), 80–84.
[163] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: Harper & Row, 1966), 80–84.
[164] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 96–103.
[165] Bruce Alberts et al., *Molecular Biology of the Cell*, 6th ed. (New York: Garland Science, 2014), 176–185 (viral infection and replication).
[166] Kenneth Murphy and Casey Weaver, *Janeway's Immunobiology*, 9th ed. (New York: Garland Science, 2016), 12–21.
[167] Douglas Hanahan and Robert A. Weinberg, "Hallmarks of Cancer: The Next Generation," *Cell* 144, no. 5 (2011): 646–674.

autonomy, leaving metabolism and reproduction intact but unprotected.

This defensive work also carries energetic costs, requiring organisms to balance the resources spent on vigilance and repair against those needed for growth, reproduction, and exploration. As Ilya Prigogine emphasized, the maintenance of order in open systems comes at the price of continuous energy flow and dissipation.[168] To be autonomous is thus to live within this tension: sustaining coherence against entropy, injury, and invasion. Defence is the silent condition of regulation, the unseen work that makes sense-making and adaptation possible.[169]

Defence, in this sense, is the price of existence. Every act of regulation rests on the capacity to resist dissolution. The next step is evolutionary: to ask how this defensive logic has been elaborated, diversified, and scaled across the history of life?[170]

4.6 Evolutionary Significance

Natural autonomy does not stop at the level of individual organisms. Across evolutionary history, it has expanded through cooperation and coordination, yielding new forms of autonomy that extend survival beyond individual bodies. W. D. Hamilton's theory of inclusive fitness demonstrated that parental care, kin defence, and social alliances embed survival within networks of shared protection.[171] In mammals and birds, parental investment shields vulnerable offspring, distributing survival across the defensive labor of parents—a principle central to Tim Clutton-Brock's analysis of reproductive strategies. In social insects, cooperative defence transforms the colony into a regulatory unit that enndures despite individual loss, as E. O. Wilson and Bert Hölldobler in their studies of ant societies.[172]

These developments illustrate what evolutionary theorists call major transitions—shifts from solitary cells to multicellular organisms, and from independent individuals to interdependent groups. John Maynard Smith and Eörs Szathmáry identify such transitions as turning points in life's history, each creating a new layer of autonomy in which parts coordinate to sustain a greater whole.[173] Crucially, defence plays a central role in these transitions, compensating for vulnerabilities and enabling larger, more complex forms of organization to endure.[174]

Collective defence also anticipates emergent forms of agency, where group survival depends on communication, division of labor, and coordinated responses to threat. David Sloan Wilson argues that group survival requires communication, division of labor, and coordinated responses to threat—adaptive behaviors that, though not reflective in the human sense, represent flexible strategies shaped by selection at multiple levels.[175] Evolutionary history therefore presents autonomy as a dynamic, expanding principle: a logic of regulation and defence that scales upward from the individual to the collective.

These trajectories point beyond natural autonomy itself. In human beings, the defensive and adaptive core of autonomy becomes integrated with symbolic reasoning, foresight, and moral reflection. Here, autonomy ceases to be only biological and evolutionary; it becomes ethical. This integration sets the stage for the next step: the emergence of human autonomy, where biological self-regulation and evolutionary defence are carried into the

[168] Ilya Prigogine and Dilip Kondepudi, *Modern Thermodynamics: From Heat Engines to Dissipative Structures*, 2nd ed. (Chichester, UK: Wiley, 2015), 425–433.
[169] Jonas, *The Phenomenon of Life*, 84–88.
[170] Richard Dawkins, *The Selfish Gene*, rev. ed. (Oxford: Oxford University Press, 2006), 34–38.
[171] W. D. Hamilton, "The Genetical Evolution of Social Behaviour. I," *Journal of Theoretical Biology* 7, no. 1 (1964): 1–16, esp. 1–4.
[172] Bert Hölldobler and Edward O. Wilson, *The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies* (New York: W. W. Norton, 2009), 81–95.
[173] John Maynard Smith and Eörs Szathmáry, *The Major Transitions in Evolution* (Oxford: W. H. Freeman, 1995), 6–16.
[174] Szathmáry and Maynard Smith, *The Major Transitions in Evolution*, 18–22.
[175] David Sloan Wilson, *Darwin's Cathedral: Evolution, Religion, and the Nature of Society* (Chicago: University of Chicago Press, 2002), 23–31.

reflective space of moral life.[176]

4.7 Bridge to Human Autonomy

Natural autonomy reaches its most intricate form in human beings, where regulation is scaffolded and extended by symbolic communication, memory, and foresight. Yet even here, the foundation remains biological: predictive neural control, immune defence, and organism-wide homeostasis continually sustain coherence against entropy and threat.[177]

What distinguishes the human case is that these biological processes are integrated with reflective consciousness. Humans not only act but also become aware of their actions, monitoring and evaluating them in light of norms, goals, and imagined futures. Antonio Damasio describes this as the emergence of a self that can observe and regulate its own processes, linking emotion, memory, and reasoning in a recursive loop.[178] This capacity for metacognition—to think about thought, to regulate one's own mental processes—expands autonomy into the reflective domain. Here, life's defensive and adaptive logic becomes bound up with language, symbolism, and shared cultural frameworks, as theorists of communicative rationality like Jürgen Habermas underscore.[179]

Human autonomy is therefore not a replacement for natural autonomy but its extension. Our ethical, political, and social freedoms are scaffolded upon the same structures of self-preservation and adaptive regulation that govern simpler organisms. As Evan Thompson argues, reflective human agency emerges from the same sense-making processes that structure all living systems.[180] To remain autonomous in the human sense, we must still defend the bodily and cognitive integrity that makes reflection possible. Human autonomy is therefore precarious: it flourishes only so long as the biological and cognitive substrates that sustain reflection remain intact. When those are compromised—by coercion, injury, or systemic disruption—the very possibility of moral life is endangered.[181]

If autonomy is the capacity to self-regulate in relation to the world, agency marks the next step: the capacity to project regulation outward as purposeful action. With this transition, what has been inwardly sustained becomes outwardly enacted. Section 5 now turns to this question—how the capacity to act emerges from the foundations of autonomy and why self-defence remains its operational backbone.[182]

5 HUMAN AUTONOMY as CULMIATION

Human autonomy represents the culminating expression of the developmental arc traced throughout this chapter. From the biological mechanisms that preserve coherence to the adaptive self-regulation of natural autonomy, each preceding stage has revealed a progressive deepening of self-organization. Human autonomy completes this trajectory by integrating these same regulatory dynamics into the reflective, temporal, and cultural dimensions of conscious life. It transforms the biological imperative of self-preservation into the deliberate capacity for self-governance—an autonomy capable of anticipating, evaluating, and committing to reasons and values across time. Yet even at this highest level, its foundation remains biological and defensive: the integrity of the body and the stability of the organism's internal regulation continue to

[176] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 149–158.
[177] Karl J. Friston, "The Free-Energy Principle: A Unified Brain Theory?" *Nature Reviews Neuroscience* 11, no. 2 (2010): 127–138.
[178] Antonio Damasio, *Self Comes to Mind: Constructing the Conscious Brain* (New York: Pantheon Books, 2010), 184–190.
[179] Jürgen Habermas, *The Theory of Communicative Action*, vol. 1, trans. Thomas McCarthy (Boston: Beacon Press, 1984), 286–289.
[180] Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge, MA: Harvard University Press, 2007), 149–158.
[181] Hans Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age* (Chicago: University of Chicago Press, 1984), 83–90.
[182] Eric R. Kandel, *In Search of Memory: The Emergence of a New Science of Mind* (New York: W. W. Norton, 2006), 364–370.

underwrite the exercise of freedom. What follows examines the distinctive features of human autonomy, its developmental dependence on culture and social embeddedness, and its persistent fragility as a form of self-preservation extended into moral life.

5.1 Distinctive Features of Human Autonomy

Human autonomy represents the most advanced expression of self-regulation in the known history of life. It arises from the same biological imperatives that govern natural autonomy—viability, coherence, and defensive self-maintenance—yet extends them through anticipation, reflection, and symbolically mediated control. The human organism integrates multiple temporal scales of adaptation, linking physiological regulation to conceptual reasoning and long-range planning. Through this synthesis, regulation is elevated into self-governance: the capacity to act intentionally across time, guided by awareness of one's own motives and the projected consequences of action.

Anticipatory and Reflective Regulation

Human beings regulate behavior through continual forecasting. Neuroscience increasingly describes the brain as a predictive control system—a hierarchy of models that anticipate sensory input and update through comparison with incoming signals. Karl Friston's account of active inference and Andy Clark's analysis of predictive processing describe perception and action as parts of a single inferential loop that minimizes surprise by adjusting both internal expectations and external engagement.[183] In human beings, these mechanisms acquire a reflective dimension: agents can inspect, revise, and deliberately reweight their own internal models, transforming adaptive forecasting into conscious deliberation.

Such regulation depends on extensive prefrontal networks that sustain executive functions—planning, inhibition, and working memory.[184] Research by Adele Diamond, Earl Miller, and Jonathan Cohen shows that these systems coordinate long-range goals, suppress impulsive responses, and maintain contextual flexibility.[185] Within this architecture, defensive awareness evolves into strategic anticipation—the ability to identify potential threats and opportunities, simulate responses, and act with foresight rather than immediate reaction. Predictive intelligence, anchored in biological control systems, thus enables the deliberate maintenance of coherence across complex and uncertain environments.

Temporal Depth and Continuity

A defining hallmark of human autonomy is its temporal reach. Experience is organized not as a sequence of isolated reactions but as a continuous narrative linking memory, intention, and projection. Endel Tulving's concept of *autonoetic consciousness* captures this capacity to situate the self across past, present, and future.[186] Neurocognitive studies associate this temporal integration with coordination between hippocampal and prefrontal circuits. György Buzsáki's work on "time cells" demonstrates how neural firing sequences encode the order of events, providing a substrate for continuity of experience.[187]

Temporal integration allows for stable identity and enduring commitment. Promises, obligations, and life projects all presuppose persistence of intention through time. From an adaptive perspective, this continuity functions as a higher-order form of viability: coherence is preserved not only across

[183] Karl J. Friston, "The Free-Energy Principle: A Unified Brain Theory?," *Nature Reviews Neuroscience* 11 (2010): 127–38; Andy Clark, *Surfing Uncertainty: Prediction, Action, and the Embodied Mind* (Oxford: Oxford University Press, 2016).
[184] Earl K. Miller and Jonathan D. Cohen, "An Integrative Theory of Prefrontal Cortex Function," *Annual Review of Neuroscience* 24 (2001): 167–202.
[185] Adele Diamond, "Executive Functions," *Annual Review of Psychology* 64 (2013): 135–68.
[186] Endel Tulving, "Memory and Consciousness," *Canadian Psychology* 26 (1985): 1–12.
[187] György Buzsáki, *The Brain from Inside Out* (New York: Oxford University Press, 2019).

physiological variables but through durable behavioral patterns that sustain meaning and trust within social relations. Michael Corballis describes this as "mental time travel," a uniquely human faculty enabling planning, learning, and cooperation over horizons that far exceed the present moment.[188]

Conscious Awareness and Self-Modeling

Human autonomy also depends on the integrative phenomenon of consciousness. Bernard Baars' global-workspace theory and Stanislas Dehaene's later refinements describe consciousness as the global availability of information across specialized neural modules.[189] Giulio Tononi's integrated-information theory complements this view by identifying consciousness with the degree of causal unity within the system.[190] Antonio Damasio's research on embodied feeling extends this perspective: consciousness anchors cognition within the organism's biological state, ensuring that reflection remains oriented toward viability and value.[191]

Through conscious awareness, the human organism constructs a model of itself within a perceived world. Thomas Metzinger characterizes this as the *phenomenal self-model*—a dynamic internal representation that generates the experience of agency and ownership.[192] Contemporary research by Anil Seth and others in interoceptive inference suggests that this self-model arises from the brain's continual prediction of its own bodily states.[193] Self-modeling grounds decision and evaluation within a first-person perspective, binding motivation, emotion, and reason into a single regulatory field. Consciousness, by integrating these processes, transforms maintenance of life into understanding of life.

Integrative Summary

Anticipatory regulation, temporal continuity, and conscious self-modeling together define the architecture of human autonomy. Each extends the same organizing principle evident across all living systems—the preservation of coherence under changing conditions—while adding new layers of temporal, conceptual, and reflective depth. Human beings maintain viability through a synthesis of prediction, memory, and meaning. Biological control is refined into cognitive self-direction, and defensive organization matures into deliberate adaptation. Through these capacities, autonomy becomes self-conscious regulation—life aware of itself, capable of evaluating its own course and adjusting it through reasoned foresight.

5.2 Cultural Learning and Social Embeddedness

Human autonomy does not unfold in isolation. It is cultivated within social, linguistic, and institutional frameworks that shape the very conditions of self-governance. The development of autonomy depends on capacities acquired through interaction with others—language, joint attention, imitation, and the internalization of norms. Lev Vygotsky's sociocultural theory demonstrated that higher cognitive functions originate in social exchanges before they are internalized as individual capacities.[194] The mind is therefore not a closed system but a *socio-cognitive ecology* in which tools, symbols, and shared practices scaffold thought.

[188] Michael C. Corballis, *The Wandering Mind: What the Brain Does When You're Not Looking* (Chicago: University of Chicago Press, 2013).
[189] Bernard J. Baars, *A Cognitive Theory of Consciousness* (Cambridge: Cambridge University Press, 1988); Stanislas Dehaene, *Consciousness and the Brain: Deciphering How the Brain Codes Our Thoughts* (New York: Viking, 2014).
[190] Giulio Tononi, "Integrated Information Theory," *Frontiers in Psychology* 7 (2016): 1–20.
[191] Thomas Metzinger, "Empirical Perspectives from the Self-Model Theory of Subjectivity: A Brief Summary with Examples," *Prog. Brain Res.* 168 (2008): 220–26; Thomas Metzinger, "Self-modeling epistemic spaces and the contraction principle," *Cognitive Neuropsychology* 37, no. 3–4 (2020): 1–5; Anil K. Seth, Adam B. Barrett, and Lionel Barnett, "Causal density and integrated information as measures of conscious level," *Philos. Trans. Roy. Soc. A* 369, no. 1952 (2011): 3748–3767; Seth, "Theories and measures of consciousness: An extended framework," *PNAS* (2006).
[192] "Empirical Perspectives from the Self-Model Theory of Subjectivity: A Brief Summary with Examples" by Thomas Metzinger, *Progress in Brain Research* 168 (2008): 215–45; "Self-modeling epistemic spaces and the contraction principle" by Thomas Metzinger, *Cognitive Neuropsychology* 37, no. 3-4 (2020): 1–5.
[193] "Causal density and integrated information as measures of conscious level" by Anil K. Seth, Adam B. Barrett, and Lionel Barnett, *Philosophical Transactions of the Royal Society A* 369, no. 1952 (2011): 3748–3767.
[194] Lev S. Vygotsky, "Interaction between Learning and Development," in *Readings on the Development of Children*, ed. Mary Gauvain and Michael Cole (New York: W. H. Freeman, 1978), 34–40.

Autonomy emerges as a relational achievement, forged through guidance, dialogue, and participation within a community of practice.

Neuroscientific research now confirms this dependence. Prefrontal and temporoparietal systems associated with self-regulation, language, and social cognition develop in synchrony with interpersonal interaction.[195] Studies in cultural neuroscience show that the brain's functional organization is dynamically shaped by the social and symbolic environments in which it matures.[196] These findings bridge the biological and sociocultural levels: the very neural substrates of reflection and executive control arise through engagement with others. In this respect, human autonomy is not only embodied but *enculturated*—a product of brains and relationships co-evolving in feedback with their cultural milieu.

Cultural learning extends this relational foundation into the domain of meaning and value. Michael Tomasello's research on shared intentionality shows that humans possess an evolved capacity to align goals, coordinate perspectives, and construct joint commitments.[197] Through such shared intentionality, individuals come to inhabit a normative world structured by obligations, expectations, and reasons. Language expands this domain further, providing the representational medium through which reflection, deliberation, and moral evaluation become possible. To speak a language is to inherit a grammar of thought; to act within a culture is to participate in its web of significance. Human autonomy thus depends not only on internal neural architecture but also on the cultural and communicative networks that make reflection and self-regulation viable.

These social and institutional structures do not constrain autonomy; they enable it. Families, schools, and civic institutions supply the cognitive and moral scaffolding through which persons learn to exercise judgment, assume responsibility, and coordinate cooperative action. Institutions stabilize expectations, uphold rights, and maintain the predictability on which freedom depends. What appears as independence in adulthood is the matured outcome of guided participation—autonomy realized through relationship. To be autonomous, then, is not to stand apart from others but to act responsibly within the interdependent systems that sustain human life. Recognizing this embedded character of autonomy prepares the ground for the next chapter, where the capacity to act freely within a shared moral world becomes the foundation of moral agency.

5.3 Fragility and Dependence on Self-Preservation

Human autonomy, though expanded through consciousness and culture, remains tethered to the same biological substrate that anchors all living systems. Its exercise presupposes bodily integrity, energetic stability, and environmental security. When these enabling conditions deteriorate—through illness, injury, coercion, or deprivation—the capacities for deliberation, reflection, and self-regulation contract accordingly. Autonomy is therefore not an abstract ideal but a fragile equilibrium sustained by defense, repair, and protection.

Neuroscientific evidence shows that frontoparietal–limbic circuits develop in synchrony with social cognition and linguistic interaction, and that their continued function depends on stable physiological conditions.[198] Trauma, chronic stress, or malnutrition can dysregulate these networks,

[195] Michael S. Gazzaniga, "The Social Brain: Discovering the Networks of the Mind," *Annual Review of Neuroscience* 21 (1998): 423–50.
[196] Shinobu Kitayama and Ayse K. Uskul, "Culture, Mind, and the Brain: Current Evidence and Future Directions," *Annual Review of Psychology* 62 (2011): 419–49.
[197] Michael Tomasello, Malinda Carpenter, Joseph Call, Tanya Behne, and Henrike Moll, "Understanding and Sharing Intentions: The Origins of Cultural Cognition," *Behavioral and Brain Sciences* 28, no. 5 (2005): 675–735.
[198] Michael S. Gazzaniga, "The Social Brain: Discovering the Networks of the Mind," *Annual Review of Neuroscience* 21 (1998): 423–50.

impairing executive control and the ability to sustain reflective self-governance.[199] Psychophysiological research further demonstrates that chronic activation of the stress response degrades working memory, impulse control, and emotional regulation—core elements of autonomous behavior.[200] The brain's capacity for reasoned action is thus inseparable from the body's capacity for regulation: preserving one's physical and psychological coherence preserves the foundation of self-determination.

This fragility extends beyond physiology into the social and moral domains, where the conditions that sustain autonomy—security, recognition, and justice—are collectively maintained. The autonomy of persons depends on arrangements that protect bodily integrity and enable stable participation in shared life. When these are eroded by violence, coercion, or systemic neglect, individuals are reduced from actors to objects of external forces.[201] Self-defense therefore occupies a foundational place within the architecture of autonomy: it is the operational means by which the living system sustains the very possibility of acting freely. Defence, in this sense, is not aggression but maintenance—the active preservation of conditions under which moral and reflective life can unfold.

Recognizing the dependency of autonomy on self-preservation brings the argument full circle. From cellular integrity to cultural freedom, the same defensive logic sustains coherence across scales. The human form of this logic is the deliberate protection of one's ability to act, choose, and participate in a shared moral world. To defend oneself, one's body, and one's agency is therefore to safeguard the precondition of moral existence itself.

6. CONCLUSION

To defend oneself is not merely to react against harm—it is to enact the very principle by which life endures. Across every scale of biology, from cellular repair to human deliberation, self-defence represents the organizing logic of survival: the continuous regulation, adaptation, and renewal through which living systems preserve coherence amid entropy and threat. What begins as a reflex of preservation becomes, through evolution and reflection, a dynamic architecture of autonomy.

Seen in this light, self-defence is neither an instinct to be suppressed nor a privilege granted by law, but a structural necessity intrinsic to being alive. Every organism must sustain its boundaries, repair what is damaged, and restore equilibrium to remain itself. This work of preservation is not ancillary to life—it *is* life, the perpetual assertion of form over disorder.

In human beings, the same imperative acquires ethical and psychological depth. The capacity to protect one's integrity, to regulate emotion under pressure, and to resist coercion or harm are all expressions of this biological foundation refined through consciousness. Self-defence thus links physiology with moral experience: it preserves the embodied conditions of autonomy and affirms the worth of existence through action.

To live coherently is to defend coherence—to sustain order, integrity, and self-direction in the face of disruption. Far from being an exception to peace, self-defence is the process that makes peace, agency, and moral life possible. It is the first and continuing act of every living being: the ceaseless affirmation of life's right to persist.

[199] Bruce S. McEwen and Peter J. Gianaros, "Central Role of the Brain in Stress and Adaptation: Links to Socioeconomic Status, Health, and Disease," *Annals of the New York Academy of Sciences* 1186 (2010): 190–222.

[200] Amy F. Troy, Lisa Feldman Barrett, and Tor Wager, "Neural Mechanisms of Emotion Regulation: Integrative Insights from Psychology and Neuroscience," *Annual Review of Psychology* 75 (2024): 201–29; Amy F. Arnsten, "Stress Signalling Pathways That Impair Prefrontal Cortex Structure and Function," *Nature Reviews Neuroscience* 10, no. 6 (2009): 410–22.

[201] Martha C. Nussbaum, "Capabilities as Fundamental Entitlements: Sen and Social Justice," *Feminist Economics* 9, no. 2–3 (2003): 33–59.

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