GOT-V1-1-2

The Identification of Life

Informational Regime, Attribution Locus, and Potential Throughput

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Abstract

Paper 1 defined life as driven thermodynamic constraint-maintenance supported by Information Processing Locus-mediated Non-Trivial Computation. That definition establishes the life discriminator: life is not a substance, essence, checklist, taxonomic familiarity, metabolic rate, reproductive capacity, membrane enclosure, or lineage label. It is a driven constraint-bearing regime whose persistence depends on distinction-conditioned organisation making counterfactually testable differences to the maintenance, redirection, or completion of that regime.

The discriminator is necessary. It is not sufficient for attribution.

A life condition may be realised inside a candidate frame without the initially framed object being the correct living locus. A host cell may contain a parasite. A body may contain organs, cells, symbionts, tumours, prostheses, artificial supports, dormant tissues, and post-death remnants. A terminal organism may spend reserves while still completing a life-realising phase. A dormant organism may suspend most active throughput without being dead. A non-life-realised candidate may preserve identity-bearing distinctions capable of entering later life-realising completion. A dead target locus may leave constituents that require separate classification.

These cases do not show that life lacks a boundary. They show that familiar matter-state barriers do not identify life by themselves.

The present paper therefore distinguishes definition from attribution. Definition asks what physical relation earns the term life. Attribution asks where, when, and for which locus that relation is realised, intrinsically resumable, extrinsically completable, or closed; where a tested relation is not warranted, it asks whether that relation is positively excluded under the stated reference conditions or deferred to residual.

The central move is a shift from familiar matter-state classification to informational regime identification. Life is not located by asking which visible object resembles a familiar organism, which container encloses biological material, or which lineage label has been inherited. It is located by identifying the driven constraint-bearing regime whose maintenance depends on distinction-conditioned organisation, then determining which locus carries that regime, which identity-bearing informational throughput it preserves, and which continuity relation remains open.

This paper develops the canonical attribution layer required for life claims. It defines candidate frame, informational regime, life-realisation, maintained boundary, Attribution Locus, DTS completion, organisational identity, intrinsic resumability, continuity-preserving suspension, potential informational throughput, throughput identity, continuity status, death as branch-closure, post-death constituent reframing, residual deferral, and relationship topology. These concepts do not replace the Paper 1 life discriminator. They determine where that discriminator applies.

Potential informational throughput receives special emphasis because it preserves the attribution bridge between Complex Chemistry and Life without weakening the three-class ladder. A candidate is not Life-in-Potential merely because it contains biological material, stores a sequence, triggers a living process, or could be used by a future system to reconstruct life. It qualifies only where a non-life-realised organisation preserves identity-relevant distinctions capable of entering an admissible life-realising completion pathway such that those distinctions become counterfactually operative in the later regime. Life-in-Potential is a formal attribution class, not ordinary potential life. It is not weak life. It is identity-bearing potential throughput requiring extrinsic DTS completion.

Death is correspondingly defined as the closed-continuity status of a formerly living target locus: the closure of future counterfactual branch-realisation for that locus as that locus. Death does not erase all classificatory structure inside the dead system. It closes the target identity. Its constituents require renewed framing.

The formal ladder is therefore:

Complex Chemistry.

Life-in-Potential.

Life.

Death is not a fourth class. It is a continuity status of a formerly living target locus whose future branch-realisation has closed. Dormant life and terminal active life are continuity modes inside Life. Reconstruction and incorporation are not resumption. They are cross-locus descriptors for what happens after identity-bearing continuity has failed, or after material has transitioned back into Complex Chemistry before entering another regime.

Compressed:

Paper 1 defines life. This paper defines life attribution.

Life attribution identifies informational regime, not familiar matter-state alone.

Life is realised informational throughput maintaining a driven constraint-bearing regime.

Dormancy is intrinsically resumable informational throughput in the same Attribution Locus.

Life-in-Potential is identity-bearing potential throughput awaiting extrinsic life-realising completion.

Death is closure of future counterfactual branch-realisation for the target locus.

Post-death constituents must be reframed.

The ladder gives primary class: Complex Chemistry, Life-in-Potential, or Life.

Continuity gives branch status: active, dormant, terminal active, potential, or closed.

Closure/death is closed continuity of a formerly living target locus, not a primary class.

Reconstruction and incorporation are cross-locus descriptors, not intrinsic resumption and not primary classes.

Residual deferral manages unresolved discriminator conditions and states the update condition; it is not a class, continuity status, topology modifier, or hidden field value.

Topology gives relation among already-attributed loci.

The attribution architecture locates the relation.

Canonical ownership note: Paper 1 remains the canonical home of the Nested Multiscale Framework, Trivial Computation, Non-Trivial Computation, Baseline Dynamics, Information Processing Locus, Driven Thermodynamic System, and life as driven thermodynamic constraint-maintenance supported by IPL-mediated NTC.

The present paper does not redefine those terms. It defines the attribution layer by which the inherited life discriminator is located, bounded, continued, suspended, potentialised, terminated, decomposed, and related across candidate frames.

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1. From matter-state barriers to informational regime identification

1.1. The attribution problem

If life is driven thermodynamic constraint-maintenance supported by IPL-mediated Non-Trivial Computation, then life is not identified by resemblance to familiar organisms. It is identified by a physical relation: a driven constraint-bearing regime whose maintenance depends on distinction-conditioned organisation.

That relation may be realised inside familiar biological objects. It may also be nested, distributed, suspended, host-completed, terminal, scaffolded, potential, fragmented, or closed. The visible object and the life-realising relation therefore cannot be assumed to coincide.

A cell may be a living locus. A host cell may also contain another candidate whose throughput is distinct. A body may be a living organism while containing living cells, non-living material, symbionts, tumours, organs, artificial supports, and transient contents. A free virion-like candidate may preserve identity-bearing distinctions without presently maintaining a life-realising DTS. A seed may preserve intrinsic resumability while active throughput is reduced. A corpse may contain biological structure, living subloci, potential throughput candidates, and non-identity-bearing chemistry.

The attribution problem is not whether these cases are strange.

The problem is that ordinary life-language begins too often with the wrong unit.

It begins with the visible object, the familiar noun, the membrane, the body, the cell, the genome, the lineage, the movement, the metabolism, the reproductive capacity, or the biological material. Those features matter. They provide cues, carriers, constraints, and candidate frames. But none of them alone identifies the life-realising informational regime.

The present paper therefore asks a narrower and more disciplined question:

For which Attribution Locus is identity-bearing informational throughput realised, intrinsically resumable, extrinsically completable, or closed; and where those relations are not warranted, is the tested relation positively excluded under the stated reference conditions or deferred to residual?

1.2. Matter-state barriers are not enough

Life is materially instantiated. It is carried by matter, constrained by chemistry, driven by energy and matter throughput, and bounded by physical interfaces. No informational regime floats above substrate. No life attribution is made without material support.

But matter-state alone does not settle attribution.

A membrane may enclose a living cell, a dead cell, a vesicle, an organelle, a parasite, or a chemical compartment. A capsid may enclose identity-bearing throughput without active life-realisation. A body may enclose living tissues after organismal integration has failed. A fossil may preserve morphology without preserving life-status. A genome may preserve sequence without preserving organisational identity. A nutrient may be chemically important to life without carrying life-status.

The mistake is not to consider matter. The mistake is to treat familiar matter-state barriers as final discriminators.

A visible boundary may be too broad. It may contain several distinct loci. It may include components that support life without being living loci themselves. It may persist after the target locus has died. It may remain intact while the regime it once supported has closed.

A visible boundary may also be too narrow. It may isolate a candidate whose life-relevant throughput requires a host, developmental environment, symbiotic partner, scaffold, or completion system. The free candidate may not be Life, but neither does it necessarily collapse into undifferentiated chemistry. It may preserve potential informational throughput.

The attribution question therefore cannot be: what kind of matter-state is this?

It must be: what informational regime does this material organisation support, and what continuity relation does that regime preserve?

1.3. Informational regime

An informational regime is a physically supported organisation in which identity-relevant distinctions are preserved, made operative, resumed, transmitted, completed, or closed under specified reference conditions.

The term does not mean information in the weak sense of any describable difference. Many physical differences can be described. Many structures can be interpreted. Many patterns can be encoded by an observer. That is not enough.

An informational regime exists in the relevant life-attribution sense where distinctions belong to the candidate organisation in a way that can affect downstream trajectory selection, maintenance, resumption, completion, propagation, or branch-closure. The distinction must not merely be readable from outside. It must be physically carried by the candidate relation.

In active life, the informational regime is realised as distinction-conditioned constraint-maintenance. Distinctions are not merely stored. They are operative in maintaining, redirecting, repairing, inhibiting, developing, reproducing, or otherwise completing the driven regime.

In dormant life, the informational regime is intrinsically resumable. Active throughput may be reduced, inhibited, or suspended, but the same Attribution Locus preserves intrinsic resumability by which life-realisation can resume when permissive conditions return.

In Life-in-Potential, the informational regime is not presently life-realised and not intrinsically resumable as a living DTS, but it preserves identity-bearing throughput into an admissible

extrinsic completion pathway. Its distinctions may become operative only through a host, coupled completion system, developmental environment, or other life-realising regime.

In death, the informational regime of the target locus has closed. Some material structure may remain. Some records may remain. Some constituents may retain their own status. But future branch-realisation for the target locus as that locus is no longer open.

Informational regime therefore names the continuity-bearing object of attribution.

1.4. Definition does not complete attribution

A definition states the relation that earns a term.

Attribution determines where that relation is realised.

Paper 1 defined life by separating it from complexity, persistence, metabolism, reproduction, feedback, adaptation, lineage, and computation understood as redescription. A system is alive where driven thermodynamic constraint-maintenance depends on localisable, comparator-testable, distinction-conditioned organisation. That definition answers the threshold question: what physical relation qualifies as life?

It does not answer every attribution question.

A broad frame may contain life without itself being the living locus. A narrow frame may preserve identity-bearing throughput without present life-realisation. A coupled frame may contain several loci whose relations cannot be reduced to one organism. A post-death frame may contain Complex Chemistry, Life-in-Potential, living subloci, incorporated material, and residual-bearing remnants at once.

The word life therefore requires two disciplines.

Attribution discipline asks where, when, and for which locus that relation is realised, resumable, potential, or closed; where the tested relation is not warranted, attribution records whether it is positively excluded under the stated reference conditions or deferred to residual.

Without threshold discipline, life collapses into familiarity. Without attribution discipline, life is assigned to the wrong unit.

1.5. Familiar biological nouns do not settle attribution

Ordinary biological language begins from nouns: cell, organism, organ, organelle, virus, seed, spore, gamete, zygote, corpse, parasite, symbiont, mitochondrion, tumour, tissue, lineage.

These nouns are useful. They compress observed regularities, taxonomic histories, functional roles, material boundaries, developmental phases, and experimental practices. They help select candidate frames.

They do not replace the discriminator.

A mitochondrion may be called an organelle without deciding whether it is a nested living sublocus, a constitutively dependent maintained organisation, a functional component of the cell-level DTS, or a residual-bearing attribution case. A liver may be an organ without becoming a life form at organismal scale. A free virion may be a virus particle without being active Life. A tumour may be a biological growth without automatically settling its topology relative to the host. A corpse may be a body without being the living organism it once carried.

Familiar nouns may point to relations.

They do not settle which relation is present.

The attribution architecture therefore begins from candidate framing, not noun inheritance. The candidate frame states what is under evaluation. The maintained informational regime determines whether that frame survives.[1]

1.6. Containment does not establish identity

Life is often attributed by container.

A membrane encloses a cell. A body encloses organs. A capsid encloses viral material. A womb encloses a developing organism. A host contains parasites or symbionts. A culture vessel contains cells. A machine may enclose supported tissues or organisms.

Containment is a useful beginning because it proposes a boundary. It does not certify the living locus.

A physical container may contain several informational regimes. It may contain a living locus and non-living components. It may contain one living regime nested within another. It may contain a potential throughput candidate that is not active life at the framed scale. It may persist after death while no longer preserving the prior target identity.

Conversely, a life-realising regime may cross visible boundaries. It may depend on scaffolded support, developmental completion, ecological exchange, or coupled regulation. The fact that a candidate requires support does not by itself deny life-status. The question is whether the candidate's own identity-bearing organisation remains the locus whose regime is being maintained, resumed, completed, or potentialised.

The boundary that matters for life attribution is therefore not merely the boundary that contains matter.

It is the maintained interface of the informational regime.[2]

1.7. Coupling does not establish unity

Living systems interact. They exchange matter and energy, alter one another's trajectories, regulate one another, infect one another, depend on one another, and sometimes form stable associations.

Coupling matters. It may be the condition under which a regime is completed. It may be the channel through which potential throughput becomes operative. It may produce mutual maintenance or asymmetric cost. It may support higher-order organisation.

But coupling does not by itself establish unity.

A parasite and host are coupled. That does not make them one locus. A symbiont may be deeply integrated. That does not automatically erase its continuity. A machine may support an organism. That does not automatically create a machine-organism life form. A gestational environment may complete development. That does not necessarily make the developing locus identical with the environment.

Counterfactual interaction shows consequence. It does not settle topology.

To determine unity, the attribution must ask which maintained boundaries remain, where DTS completion occurs, what identity-bearing throughput is preserved, and whether the coupled relation stabilises a higher-order regime beyond the participating loci.

1.8. Dependence does not establish non-life

No living system is independent in an absolute sense. Every living system depends on matter, energy, compatible boundary conditions, environmental regularity, physical law, and some horizon of viable exchange. Many living systems depend on ecological partners, developmental environments, hosts, symbionts, parental care, technological supports, or institutional infrastructures. Dependence must therefore be decomposed.

Resource dependence occurs where an environment supplies matter, energy, substrate, permissive conditions, or ordinary support while the candidate's own organisation performs the constitutive maintenance operations. Resource dependence does not weaken life-status.

Constitutive dependence occurs where another organised locus performs operations required to complete the candidate's maintenance or throughput relation. Constitutive dependence does not by itself deny life-status, but it changes the attribution question. It asks where the living regime is actually completed and which locus carries continuity.

Coupled completion occurs where no component alone completes the relevant regime but the organised interaction does. In such cases, the candidate may be a lower-order locus, a potential throughput carrier, a component of a higher-order locus, or a residual-deferral case depending on maintained boundary, DTS completion, and identity-bearing continuity.

Dependency is therefore not a verdict.

It is an attribution variable.

1.9. Lineage does not settle present life-status

Lineage matters, but it cannot define present life-status by itself. Cells divide from prior cells. Organisms descend from prior organisms. Mitochondria divide from prior mitochondria. Viral candidates arise through host-completed cycles. Seeds, spores, gametes, embryos, tumours, and transmissible lineages all require continuity analysis.

But a lineage relation can survive where present life-realisation does not. A fossil may preserve ancestral form. A dead genome may preserve sequence. A corpse may have descendants. A stored record may describe a once-living organism. A viral particle may belong to a lineage without presently maintaining a living DTS.

Lineage is derivative of continuity, not a replacement for it.

It becomes attribution-relevant only after organisational identity or throughput identity has been established. Descent informs how regimes branch, propagate, transform, or close. It does not by itself determine whether the present candidate is Complex Chemistry, Life-in-Potential, Life, a formerly living target locus with closed continuity, incorporated material, or residual-deferred.

1.10. Death does not classify every constituent in the same way

Death must also be attributed.

A target locus dies when future counterfactual branch-realisation for that locus, as that locus, has closed. That closure applies to the target identity.

It does not automatically assign the same status to every constituent inside the former system.

After death, the remains must be reframed. Some constituents may have no identity-bearing continuity and return to Complex Chemistry. Some may be incorporated into another living system. Some may serve as reconstruction material without preserving the prior identity. Some may retain Life-in-Potential because their own identity-bearing throughput remains open. Some lower-order cellular loci may remain alive for a limited horizon after higher-order organismal integration has failed. Some relations may require residual deferral.

A dead organism is therefore not one undifferentiated status spread across all matter inside the former body.

Death closes a target locus. It does not erase the attribution problem.

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2. Candidate frame and reference-indexed attribution

2.1. Candidate frame

Life attribution begins by framing a candidate. A candidate frame is the provisional reference-indexed delimitation of the system, subsystem, process, relation, or coupled organisation proposed as the site of life-realisation, intrinsic resumability, potential informational throughput, death, incorporation, reconstruction, or post-death remnant status.

The candidate frame states what is being tested. It does not establish what the candidate is. A frame may be selected by visible boundary, instrument, taxonomic convention, experimental isolation, ordinary language, lineage history, ecological role, clinical relevance, or theoretical interest. These selection practices are unavoidable. They are not final.

The candidate frame must specify the relevant boundary, scale, horizon, interface, driving conditions, discrimination regime, comparator assumptions, and continuity relation strongly enough for the attribution being made. A frame that cannot support these conditions may remain a useful question. It cannot yet support a strong life claim.

2.2. Candidate frame fixes evaluability, not truth

A candidate frame is proposed by an observer or investigator.

The physically supported organisation decides whether the frame survives.

Initial frames are often too broad, too narrow, composite, unstable, or misleading. A whole body may be too broad when organismal integration has failed but cellular loci remain temporarily alive. A free virion may be too narrow to contain active life-realisation but strong enough to preserve potential throughput. An infected cell may be too broad if the host cell and viral candidate carry different continuity relations. A perfusion apparatus may contain living tissue without forming a higher-order living locus.

The frame makes the question answerable. It does not answer it.

This prevents attribution from being captured by the first object named. A visible thing may be a candidate, a container, a component, a carrier, a scaffold, a locus, a remnant, or a composite. The frame opens the attribution problem. The informational regime determines which relation is present.

2.3. Informational regime attribution

A life attribution is an attribution of informational regime under reference conditions.

This means that the candidate is evaluated according to the identity-bearing distinctions it preserves and the regime in which those distinctions become operative, intrinsically resumable, extrinsically completable, or closed. Where those relations are not warranted, the audit records whether the tested relation is positively excluded under the stated reference conditions or deferred to residual.

At the active-life threshold, the relevant distinctions are operative in maintaining, redirecting, or completing a driven constraint-bearing regime. At the dormant-life threshold, the same Attribution Locus preserves intrinsic resumability by which active life-realisation can resume when permissive conditions return. At the potential-throughput threshold, a non-life-realised candidate preserves identity-bearing distinctions capable of entering admissible extrinsic life-realising completion. At the closure threshold, a formerly living target locus no longer preserves future branch-realisation as that locus.

These are not four primary classes. They are attribution modes and continuity relations that determine how the inherited Paper 1 life relation, or a warranted negative result under stated reference conditions, belongs to a locus. Where a discriminator condition remains incomplete, the relation is not converted into a hidden field value; it is deferred to residual with an update condition.

This does not make life arbitrary.

The world constrains which regimes exist, which boundaries are maintained, which distinctions are discriminable, which completion paths are admissible, which continuities survive, which relations are positively excluded, and which frames fail. Informational regime attribution is not interpretive freedom. It is reference-indexed realism applied to life.

The question is not whether an observer can assign meaning to a biological structure.

The question is whether the candidate organisation carries identity-bearing distinctions in a way that can realise, resume, complete, or close a life-relevant regime, or whether that relation is positively excluded or remains residual under the stated reference conditions.

2.4. Frame correction

Frame correction is the adjustment of the candidate frame when the initial delimitation fails to match the maintained regime, completion relation, or continuity path.

A frame may be retained when the proposed boundary and continuity relation correspond to the life-realising regime. It may be narrowed when life-realisation occurs inside the proposed system but belongs to a smaller Attribution Locus. It may be expanded when the proposed object excludes operations required to complete the regime. It may be split when one apparent object contains several loci with distinct maintained boundaries or divergent continuities. It may be coupled when no component alone completes the relevant regime. It may be held in residual deferral where boundary, scale, continuity, or comparator conditions are insufficient.

Frame correction must not convert topology, containment, dependence, or familiar naming into class assignment.

Frame correction is not a procedural defect. It is part of attribution.

A life claim becomes stronger when the candidate frame is corrected toward the informational regime that actually carries the relation.

2.5. Threshold, mode, and attribution

Threshold and attribution are distinct operations.

The attribution question asks which locus carries that life-realisation, intrinsic resumability, identity-bearing potential throughput, branch closure, reconstruction relation, incorporation relation, or remnant status; where those relations are not warranted, it records whether the tested relation is positively excluded under the stated reference conditions or deferred to residual.

A candidate that does not show full active life-realisation in the current window must not be prematurely moved to Complex Chemistry or Life-in-Potential until intrinsic resumability, extrinsic completion, throughput identity, branch closure, positive exclusion, and residual have been assessed.

A broad frame may pass the threshold because life is present somewhere inside it. That does not make every component inside the frame alive. A narrow frame may fail active life-realisation while preserving potential informational throughput into a later life-realising regime. That does not make it Complex Chemistry by default. A dead higher-order locus may contain living lower-order loci. That does not make the dead locus alive.

The threshold tells us whether a life-relevant condition is present somewhere in the frame.

Attribution tells us where the condition belongs, whether the tested relation is positively excluded under the stated reference conditions, or whether the missing discriminator condition must be carried as residual.

2.6. Reference-indexed attribution

A life attribution is reference-indexed when the locus, boundary, interface, scale, operational horizon, discrimination regime, driving conditions, comparator assumptions, and continuity relation are specified strongly enough for the claim being made.

The ordinary question “is it alive?” is compressed.

The disciplined question is: alive as what locus, at what scale, over what horizon, through what maintained boundary, with what DTS completion, by what identity-bearing throughput, and with which future branches open?

This does not require every ordinary use of life-language to carry a full technical index. Ordinary use can remain compressed. But disciplined use requires the index to be recoverable when the case becomes contested.

Where the index cannot be recovered, the claim must be weakened.

3. Life-realisation as realised informational throughput

3.1. From candidate frame to life-realisation

Candidate framing makes the life claim evaluable. It does not establish life.

A candidate may be chemically complex, bounded, persistent, reactive, catalytic, reproductive, developmentally important, or biologically familiar without satisfying the life condition. A vesicle may hold a gradient. A crystal may preserve structure. A flame may persist under fuel flow. A polymer may store sequence. A virion may preserve organised distinctions. None of these facts alone establishes Life.

Life-realisation names the actual occurrence of the Paper 1 life relation within a candidate frame: driven constraint-bearing organisation maintained, redirected, or completed through localisable distinction-conditioned organisation over a specified operational horizon.

Life-realisation is realised informational throughput. Identity-relevant distinctions are not merely present. They are operative in the maintenance, redirection, or completion of the candidate regime.

This establishes that the life condition is present somewhere in the frame. It does not yet establish that the initially framed object is the correct living locus.

3.2. Driven constraint-bearing regime

The first requirement of life-realisation is a driven constraint-bearing regime.

A driven constraint-bearing regime is a nonequilibrium organisation in which sustained throughput supports a reproducible pattern of constraints that restricts the accessible trajectories of the system or its components over an operational horizon.

Driven means the candidate is not merely a stable object. It is maintained away from simple relaxation, dissolution, or undifferentiated equilibration by throughput of matter, energy, charge, chemical potential, mechanical work, environmental cycling, or other relevant driving.

Constraint-bearing means the candidate preserves organised restrictions on possible trajectories. Some exchanges are permitted and others blocked. Some transitions are stabilised and others inhibited. Some pathways are available and others suppressed.

This condition does not establish life by itself. Flames, vortices, catalytic networks, reaction-diffusion patterns, electrochemical gradients, and engineered control environments may all be driven and constraint-bearing.

Life requires that the regime’s constraint-maintenance depends on distinction-conditioned organisation.

3.3. Operative distinction

The second requirement is operative distinction.

A driven regime may persist because its material properties, boundary conditions, or external driving maintain a pattern. It may respond lawfully to variation. It may be describable under a computational encoding. It may even display complex dynamics.

None of that is enough. Life-realisation requires discriminable distinctions to become organisation-dependent determinants of downstream trajectory selection. An operative distinction exists where a difference available within the candidate regime changes which later outcome classes are realised, stabilised, inhibited, repaired, amplified, excluded, resumed, or made available, and where that dependence is mediated by identifiable organisation rather than external description.

This is where Trivial Computation remains separate from Non-Trivial Computation. A physical process may be computationally redescribed after the fact. Non-Trivial Computation is present only where the system's own organisation makes downstream trajectories depend counterfactually on which distinction is present.

For life, this NTC must be maintenance-relevant. A non-living control system may route signals, switch states, or classify inputs. It may exhibit NTC without being alive. Life requires the distinction-conditioned organisation to contribute to the persistence, redirection, resumption, or completion of the system's own constraint-bearing regime.

3.4. Regime constraint maintenance

Regime constraint maintenance is the point at which operative distinction becomes life-relevant.

A distinction may alter downstream trajectory selection without maintaining the regime that carries it. It may produce an output, route a signal, change a state, or trigger a one-off transition. That may be non-trivial computation. It is not yet life.

Life-realisation occurs where distinction-conditioned organisation contributes to maintaining, redirecting, resuming, repairing, regulating, reproducing, developing, inhibiting, transforming, or completing the driven constraint-bearing regime whose identity is at stake.

Maintenance must therefore be read broadly. A living regime does not merely preserve a static structure. It may preserve itself by repair, boundary regulation, metabolic control, reserve mobilisation, developmental transformation, immune discrimination, movement, dormancy entry, dormancy exit, reproduction, terminal phase completion, regeneration, or phase transition. A candidate may be alive while changing form, redistributing resources, suspending ordinary activity, or spending a terminal reserve.

The discriminator is not stasis.

The discriminator is distinction-conditioned preservation of the regime relation over the relevant horizon.

3.5. Informational throughput

Informational throughput is the physically supported passage of identity-relevant distinctions through a regime such that those distinctions remain available to affect maintenance, resumption, completion, propagation, or branch-closure.

The term throughput is used because life attribution concerns more than stored content. It concerns whether distinctions move through a regime in a way that remains attributable to the candidate organisation.

In active Life, throughput is realised. Distinctions are presently operative in regime maintenance.

In dormant Life, throughput is intrinsically resumable. The regime may suspend or reduce active operations while preserving intrinsic resumability.

In Life-in-Potential, throughput is potential. The candidate is not presently life-realised, and may not intrinsically resume as a living DTS, but its identity-bearing distinctions can enter an admissible extrinsic completion pathway.

In death, throughput for the target locus is closed. The candidate no longer preserves future branch-realisation as that locus.

This continuum is the conceptual bridge between life definition and life attribution. Paper 1 defines the threshold at which distinctions maintain a driven regime. The present paper defines how such distinction-bearing continuity is attributed across active, suspended, potential, terminal, and post-death cases.

3.6. Reflexivity without consciousness

Life-realisation requires a physical reflexivity relation. The organisation that applies distinctions must contribute to maintaining, redirecting, resuming, or completing the regime in which that organisation is realised. The regime does not merely contain information. It uses distinction-conditioned organisation in the persistence of its own constraint structure.

This reflexivity is not consciousness. It is not self-awareness, intention, belief, subjective experience, semantic representation, or organismal psychology. A cell may regulate, repair, divide, inhibit, route, or maintain without reflective awareness. A plant seed may preserve intrinsic resumability without knowing anything. A host-completed candidate may preserve throughput without active metabolism in its free phase.

The reflexivity is physical and organisational.

Distinctions matter because they are made consequential for the continuation, resumption, or completion of the regime that carries or transmits them.

3.7. Life-realisation is not attribution closure

Life-realisation within a candidate frame does not close attribution.

A frame may contain a life-realising regime but not be identical with the Attribution Locus. A host cell may contain a parasite. A body may contain living subloci. A coupled system may complete a regime that no component alone completes. A supported organism may remain the locus while the support system remains scaffold. A tissue may contain living cells without itself becoming a higher-order life form.

The existence of life-realisation answers only one part of the question.

It says that realised informational throughput is present somewhere in the frame.

The next question is which locus carries it.

4. Maintained boundary, Attribution Locus, and DTS completion

4.1. From life-realisation to locus

Once life-realisation is established within a candidate frame, attribution must locate the Attribution Locus.

An Attribution Locus is the operational unit to which a life-relevant regime relation is attributed. It is not necessarily the visible object, the conventional biological noun, the container, the genome, the lineage, or the largest system involved.

The Attribution Locus is the bearer whose informational regime is preserved, redirected, resumed, completed, potentialised, closed, reconstructed, or incorporated. Where the tested relation is not warranted for that bearer, the attribution records positive exclusion under the stated reference conditions or residual deferral. At this stage the task is not yet to assign a primary class. It is to identify whose regime relation is under evaluation.

This is the life-specific expression of reference discipline. A claim must state the 'for what' of the relation. A distinction may be operative for one locus and inert for another. A boundary may maintain one regime while merely enclosing another. A completion pathway may belong to a coupled system rather than to either component alone.

Life attribution therefore cannot stop at the presence of a life-realising relation.

It must identify whose relation it is.

4.2. Maintained boundary

A maintained boundary is the interface through which a life-realising or life-relevant informational regime preserves its organised distinction from what lies outside it.

It may coincide with a membrane, wall, skin, capsule, tissue envelope, developmental boundary, immune boundary, behavioural boundary, scaffolded boundary, or coupled interface. It need not be a simple surface. It may be distributed, nested, dynamic, porous, or maintained through active exchange.

A maintained boundary is not merely a line around matter. It is a functional and informational interface. It regulates what enters, leaves, is sensed, ignored, repaired, excluded, incorporated, or made available to the regime. It participates in preserving the conditions under which identity-bearing distinctions remain operative.

This is why a visible container is not enough.

A physical wall may enclose material without maintaining a life-relevant regime. A membrane may remain after death while no longer preserving the target locus. A host cell may enclose a viral candidate without making the viral candidate identical with the host. A machine may enclose an organism without becoming the organism's living boundary.

The boundary of life is the maintained interface of the regime.

4.3. Boundary is not identity

Boundary supports identity, but it is not identical with identity.

A living locus can change material, repair damage, grow, divide, develop, transform, enter dormancy, exit dormancy, regenerate, or complete a terminal phase while remaining the same attributable locus over the relevant horizon. Conversely, a boundary may persist while the identity-bearing organisation has failed.

A cell membrane may remain briefly after lethal internal collapse. A corpse may preserve bodily outline after organismal branch-realisation has closed. A seed coat may remain while the germinal organisation is dead. A capsid may preserve potential throughput even though it does not maintain a living DTS in the free phase.

The question is not whether a boundary exists.

The question is whether that boundary participates in preserving identity-bearing informational throughput.

4.4. Attribution Locus

An Attribution Locus is the operational unit to which a life-relevant regime relation is attributed: active life-realisation, intrinsic resumability, identity-bearing potential throughput, target-locus closure, reconstruction relation, or incorporation relation. Where the tested relation is not warranted for the candidate locus, the output records positive exclusion under the stated reference conditions or residual deferral.

The Attribution Locus is not simply the largest enclosing system. Nor is it always the smallest discriminable component. It is the level at which the relevant regime relation holds. It is identified by regime relation, not by naming convention. It is the bearer of attribution.

The Information Processing Locus identifies where distinction-conditioned causal work is done. The Attribution Locus identifies whose regime, continuity, class, topology, closure, or residual is being attributed. In simple cases they may coincide. In nested, host-completed, scaffolded, distributed, post-death, or residual-bearing cases they may not.

A cell may be an Attribution Locus. An organism may be an Attribution Locus. A dormant seed may be an Attribution Locus through intrinsic resumability. A host-completed candidate may be an Attribution Locus for identity-bearing potential throughput without being an active living locus in its free phase. A symbiotic association may become a higher-order Attribution Locus only where the coupled relation stabilises a regime beyond the parts. A tissue may contain living cells without becoming an organismal Attribution Locus.

It is the bearer of attribution.

4.5. Functional sublocus

A functional sublocus is a component whose organisation contributes to a larger life-realising regime without thereby becoming a life form at the claimed scale.

This concept prevents component inflation.

A ribosome, membrane channel, metabolic pathway, organ, protein complex, scaffold, or artificial support may be indispensable to life-realisation. It may participate in distinction-conditioned maintenance. It may even be a site of highly structured causal work. But functional necessity is not the same as life-status.

A functional sublocus becomes independently life-attributable only where its own maintained boundary, driven regime, operative distinction, and continuity relation satisfy the relevant threshold at its own reference scale.

Otherwise, it remains a component of another Attribution Locus.

4.6. Nested and distributed loci

Living regimes may be nested.

A cell may be part of an organism. An organism may contain symbionts. A host may contain parasites. A multicellular organism may contain living cellular subloci whose local life continues under the higher-order organismal regime. A eukaryotic cell may contain organelles whose attribution requires care because historical lineage, functional dependence, maintained internal organisation, and cell-level integration do not all point to the same conclusion.

Nested attribution does not imply contradiction.

A lower-order locus may be alive while participating in a higher-order living locus. A component may be living at cellular scale but functional at organismal scale. A higher-order locus may die while some lower-order cellular loci remain temporarily alive. A lower-order candidate may preserve potential throughput while the containing system has died.

Living regimes may also be distributed.

A locus may depend on spatially extended coupling, environmental structure, scaffolding, or recurrent exchange. Distribution does not invalidate attribution, but it raises the burden. The maintained boundary, completion relation, and continuity path must be specified strongly enough that the attribution does not dissolve into background ecology.

4.7. DTS completion

DTS completion identifies where the driven thermodynamic system is actually performed as a life-realising regime.

The term is needed because familiar independence language fails. A candidate may be resource-dependent, constitutively dependent, host-completed, scaffolded, or coupled. These relations are not equivalent.

If external conditions merely provide water, nutrients, temperature, oxygen, substrate, light, or ordinary permissive context while the candidate’s own organisation performs the life-realising regime, DTS completion belongs to the candidate locus.

If another organised system performs constitutive operations required to realise the candidate’s throughput, the completion relation must be localised. The candidate may be a potential throughput carrier, a dependent living locus, a component of a coupled higher-order locus, or a residual-deferral case.

If no component alone completes the regime, but the organised relation between components does, the attribution may shift toward coupled completion or higher-order locus status.

A shift toward higher-order locus status is warranted only where the coupled relation itself stabilises a maintained informational regime. The question is not whether components interact, depend on one another, or jointly produce effects. The question is whether the coupled organisation carries its own boundary or interface, identity-bearing throughput, continuity relation, and DTS-completion pattern at the claimed scale.

DTS completion therefore asks not whether a candidate depends, but where life-realising informational throughput becomes actual.

4.8. Scaffolded and machine-supported regimes

External support does not automatically destroy life-status.

A machine-supported organism may remain the Attribution Locus where its organismal integration, boundary regulation, identity-bearing organisation, and life-realising throughput remain attributable to it. The machine may supply ventilation, circulation assistance, filtration, temperature control, nutritional support, or other conditions without becoming the living locus.

However, support can change topology. A candidate may remain alive, become scaffolded, degrade into fragmented lower-order loci, lose higher-order integration, or require residual deferral. The same support may preserve one regime while failing to preserve another.

The discriminator is not whether support is natural or artificial.

The discriminator is whether the candidate's informational regime remains the attributable locus of maintenance, resumption, completion, or closure.

4.9. Developmental and gestational completion

Developmental cases show why attribution cannot be reduced to current independence.

A developing organism may require gestational support, maternal physiology, artificial womb conditions, cellular environment, or ecological context. Such dependence does not automatically erase the developing locus. Nor does it automatically make the support system identical with the developing organism.

The attribution depends on whether the candidate preserves identity-bearing continuity through development, whether the support supplies permissive conditions or constitutive completion, and where DTS completion occurs over the operational horizon.

Development is not mere construction from outside. It may be the candidate's own informational regime unfolding through a completion environment.

Where the candidate's retained organisation directs its own developmental continuity through supplied conditions, the locus remains attributable to the candidate. Where an external system reconstructs the candidate after identity-bearing continuity has failed, the relation is reconstruction, not intrinsic development by the same Attribution Locus.

4.10. Relationship topology

Locus topology describes how candidate loci relate once attribution has located the relevant informational regimes.

A locus may be condensed, where the maintained regime is carried within one relatively coherent boundary. It may be nested, where one living locus operates inside another. It may be functional, where a sublocus supports a larger regime without carrying life-status at the claimed scale. It may be scaffolded, where external support preserves or enables maintenance without becoming the locus. It may be constitutively dependent, where another organised system performs operations required for completion. It may be coupled, where no component alone completes the regime. It may be higher-order, where the coupled relation stabilises a

maintained regime beyond the parts. It may be fragmented, where a formerly integrated locus has lost higher-order unity while lower-order regimes or remnants require separate attribution. Where available conditions do not support a stronger topology assignment, the topology field is deferred to residual.

These topology terms are not primary life classes.

They describe relations among regimes after attribution has identified what is being related.

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5. Identity, continuity, and potential throughput

5.1. The continuity problem

Life attribution is temporal.

A located life-realising regime may remain actively maintained, enter a terminal lifecycle phase, suspend active throughput while preserving intrinsic resumability, lose intrinsic resumability while preserving identity-bearing throughput into extrinsic completion, die, fragment into lower-order living subloci and non-living remnants, or contribute material to another organism without continuing as itself.

The central continuity question is not whether the same matter persists.

Nor is it whether a name, lineage, shape, record, visible activity, or genetic sequence remains.

The question is whether identity-bearing informational throughput remains attributable to the candidate locus.

Continuity is therefore the preservation of an identity-bearing organisation through which future branch-realisation remains attributable to the candidate. The main continuity possibilities are active realisation, intrinsic resumability, extrinsic completion with throughput identity, closed continuity, reconstruction, incorporation, or residual deferral.

5.2. Organisational identity

Organisational identity is the continuity of the regime-relevant relations that make the candidate the same attributable locus across change.

It is not sameness of every molecule, boundary shape, metabolic rate, location, or visible form. Living systems constantly exchange material and alter structure. A seedling is not materially identical with the seed from which it emerged. A regenerated structure may not contain the same matter as the damaged structure it replaces. A metamorphosed organism may change morphology while preserving continuity. A terminal organism may spend bodily reserves while completing a lifecycle phase.

Identity is preserved where the organisation that carries the maintenance relation, intrinsic resumability, or potential throughput remains continuous enough that future branch-realisation is attributable to the same locus.

Organisational identity is therefore reference-indexed. At cellular scale, it may involve membrane continuity, regulatory state, repair, genome use, metabolic control, and division path. At organismal scale, it may involve bodily integration, immune discrimination, nervous

and endocrine coordination, developmental history, behavioural coupling, and ecological continuity. At potential scale, it may involve preserved sequence, structure, packaging, and completion pathway.

The question is not whether everything remains the same.

The question is whether the same identity-bearing organisation remains operative, resumable, or throughput-capable under the reference conditions.

5.3. Intrinsic resumability and continuity-preserving suspension

Intrinsic resumability is the preserved organisation by which a dormant or suspended candidate can resume active life-realisation as the same Attribution Locus when permissive conditions return.

Continuity-preserving suspension is the dormancy relation in which active life-realising throughput is reduced, inhibited, or suspended over an operational horizon while intrinsic resumability remains preserved.

This concept is needed because active throughput is not the only mode of Life.

Dormancy is not failed life-realisation and not Life-in-Potential. It is Life where the same Attribution Locus preserves intrinsic resumability despite reduced or suspended active throughput.

The relevant discriminator is not current visible activity.

It is whether the candidate itself preserves intrinsic resumability.

Where external conditions supply water, temperature, oxygen, substrate, light, pressure, or other permissive inputs, and the candidate's own organisation resumes life-realisation, intrinsic resumability belongs to the same Attribution Locus.

Where another organised system must reconstruct the candidate, replace its failed organisation, or impose a new developmental sequence after the candidate's identity-bearing continuity has failed, the relation is not intrinsic resumption.

Dormancy therefore belongs inside Life because the same Attribution Locus remains identity-bearing and intrinsically resumable, even if active throughput is suspended or reduced.[3]

5.4. Potential informational throughput

Life-in-Potential requires a different continuity relation.

A candidate may not be a presently maintained living locus. It may lack active DTS completion. It may not preserve intrinsic resumability. It may not maintain itself as a living regime under its current conditions.

Yet it may still preserve identity-relevant distinctions capable of entering an admissible completion pathway and becoming counterfactually operative in later life-realisation.

This relation is potential informational throughput.

Potential informational throughput is the preservation of identity-relevant distinctions in a non-life-realised candidate such that those distinctions can enter an admissible life-realising completion pathway and become counterfactually operative in the later regime.

Life-in-Potential is warranted only where five conditions are met: the candidate is not presently life-realised as a living locus; it retains identity-bearing organisation; it has an admissible extrinsic life-realising completion pathway; its retained distinctions become counterfactually operative in that later regime; and the relation preserves throughput identity rather than relying on reconstruction after identity-bearing continuity has failed.

This is the grounding condition for Life-in-Potential.

The candidate is not presently alive at the framed scale. It does not maintain its own life-realising DTS under current conditions. It may not preserve its own active metabolism, repair, or boundary regulation. But it preserves distinctions that can be taken up, copied, expressed, propagated, completed, or otherwise made operative in a later life-realising regime in a way attributable to the candidate organisation.

Potential informational throughput is deliberately stricter than "contains information."

Many things contain, preserve, or can be interpreted as information. A sequence may be read. A fossil may preserve structure. A written record may describe an organism. A dead genome may be copied. A molecule may be useful. A chemical fragment may trigger a reaction. A laboratory may reconstruct a living system from stored instructions.

These facts do not automatically establish Life-in-Potential.

Potential throughput requires more than record-presence. The candidate must preserve identity-bearing distinctions in an organisation whose admissible completion path makes those distinctions counterfactually operative in later life-realisation.

Potential throughput is less than active life.

It is more than useful matter.

5.5. Throughput identity

Throughput identity is the continuity of identity-bearing distinctions that make later completion attributable to the candidate rather than only to an external reconstructing system.

This concept prevents Life-in-Potential from inflating into every biological record, molecule, causal trigger, useful material, lineage trace, or reconstructable instruction set.

A stored sequence alone may not preserve throughput identity if it functions only as an interpreted template for an external system. A genome inside an intact virion-like organisation may preserve stronger throughput identity if the surrounding structure, packaging, entry relation, and completion path make the candidate's organisation counterfactually necessary. An isolated nucleus may preserve throughput identity where chromatin organisation, epigenetic state, and nuclear structure participate in later developmental completion. A prion-like candidate remains difficult because conformational propagation may establish copying without life-realising completion attributable to the candidate.[4]

Throughput identity is not mere lineage.

It is not mere sequence preservation.

It is not mere causal triggering.

It is not mere reconstructability.

It is not mere usefulness to a living system.

It is the continuity relation by which potential distinctions remain attributable to the candidate into later life-realising completion.

5.6. Terminal active Life

Terminal active Life is Life.

A terminal organism or terminal phase may spend reserves, narrow future options, subordinate long-term somatic maintenance, or move toward irreversible closure while still actively maintaining a life-realising regime over the relevant horizon.

Terminal does not mean dead.

A lifecycle phase may be organised toward reproduction, dispersal, transformation, exhaustion, programmed closure, or irreversible completion. If distinction-conditioned organisation remains operative in maintaining or completing the target regime, the locus remains alive during that phase.

The point is not whether indefinite continuation remains possible.

The point is whether future branch-realisation for the locus is still being actively realised, completed, or transmitted through its own identity-bearing organisation.

Death occurs only when that future branch-realisation has closed.

5.7. Death as branch closure

Death is the closure of all future counterfactual branch-realisation for the target locus as that locus.

Death is a continuity status, not a ladder class.

This definition is narrower than material decay and broader than cessation of one visible activity. A living system may stop moving, feeding, reproducing, growing, or visibly responding without being dead if its identity-bearing organisation remains resumable or active over the relevant horizon. Conversely, a body may retain form, molecules, sequence, and recognisable structure after the target locus has died.

Death closes the target identity.

It does not annihilate matter. It does not erase all records. It does not decide the status of every constituent. It does not prevent descendants, remnants, or incorporated materials from having other relations.

A dead cell may contain viral candidates whose throughput remains potential. A dead organism may contain cells that remain temporarily alive. A dead tissue may contain molecules later incorporated into another organism. A dead genome may be readable without preserving same-locus branch-realisation.

Death therefore requires attribution.

The dead locus is closed. The remaining constituents are not automatically classified by the closure of the former whole.[5]

5.8. Reconstruction and incorporation

Reconstruction and incorporation are cross-locus descriptors. They do not name primary classes and they do not preserve same-locus continuity by default.

Reconstruction occurs where a later living locus is produced using records, material, templates, or instructions after the prior identity-bearing continuity has failed. Reconstruction may reproduce resemblance, sequence, function, or lineage relation. It does not by itself preserve same-locus continuity. In the continuity question, reconstruction marks failure of the prior branch to continue as that locus. In the topology or material-relation question, reconstruction material describes how records, remnants, or templates are used in a later regime.

Incorporation occurs where material from one candidate becomes part of another regime without preserving the prior identity. The incorporated material may be chemically important, structurally important, informationally useful, or metabolically necessary. But its status belongs to the new regime unless identity-bearing continuity from the prior locus is preserved. In the continuity question, incorporation marks that the prior locus has not survived as itself. In the topology or material-relation question, incorporated material describes how remaining matter relates to the receiving regime.

A dead cell's atoms may enter another organism. That is incorporation. A preserved sequence may guide synthesis of a later organism. That may be reconstruction. Neither is intrinsic resumption unless the identity-bearing continuity relation has survived.

This distinction prevents the ladder from inflating.

Not all useful matter is Life-in-Potential. Not all reconstruction is survival. Not all lineage relation is present life-status.

5.9. Continuity-status summary

Formal continuity status is limited to active, dormant, terminal active, potential, or closed. Active means realised maintenance. Dormant means intrinsic resumability. Terminal active means active completion under narrowing future branch-space. Potential means extrinsic completion with throughput identity. Closed means closure of future counterfactual branch-realisation for the target locus as that locus.

Reconstruction and incorporation are not continuity statuses in the same formal sense. They are cross-locus descriptors used where identity-bearing continuity has failed or where material has entered another regime without survival of the prior locus.

Residual deferral is not a continuity status. Where a discriminator condition remains incomplete or uncertain, the affected field should be withheld, the missing condition should be stated, and the update condition that would strengthen or change the classification should be given.

These distinctions are not primary classes. They specify how identity-bearing informational throughput remains open, suspended, completed, closed, externally remade, incorporated into another regime, or deferred to residual pending further evidence.

6. The formal ladder

6.1. Why the ladder has three primary classes

The attribution ladder classifies present regime status.

It does not classify every continuity mode, topology, phase, relation, modifier, history, uncertainty, or remnant condition as a separate primary class.

The formal ladder is:

Complex Chemistry.

Life-in-Potential.

Life.

Primary class may only be Complex Chemistry, Life-in-Potential, or Life.

Death is not a fourth class. Death is the ordinary-language name for closed continuity of a formerly living target locus whose future branch-realisation has closed. In formal attribution, closure is recorded as a closed target-locus relation, not as a primary class.

Dormancy is not a fourth class. It is Life under continuity-preserving suspension, with intrinsic resumability and suspended or reduced active throughput. In formal output, the primary class is Life and the continuity status is dormant.

Terminal active life is not a fourth class. It is Life in a terminal horizon where the regime remains actively realised or completed. In formal output, the primary class is Life and the continuity status is terminal active.

Reconstruction and incorporation are not fourth classes. They are cross-locus descriptors used after identity-bearing continuity has failed or after material has entered another regime without survival of the prior locus.

Residual deferral is not a ladder value. It records that field assignment is not warranted because a discriminator condition remains incomplete. The missing condition belongs in residual together with the update condition.

The ladder gives primary class. Continuity gives branch status. Closure records target-locus death. Topology gives relation among attributed loci. Residual deferral manages unresolved discriminator conditions.

6.2. Complex Chemistry

Complex Chemistry is the status of organised matter below life-realisation and below identity-bearing potential throughput.

A candidate belongs to Complex Chemistry where it may be structured, reactive, catalytic, bounded, persistent, dynamic, informationally describable, chemically useful, biologically derived, or historically related to life, but does not establish active life-realisation, intrinsic resumability, or identity-bearing potential throughput.

Complex Chemistry is not a dismissal. It may be highly organised. It may be necessary for life. It may participate in later living regimes. It may preserve traces, records, chemical capacities, or reconstructable materials. It may be the substrate from which life arises.

But it is not Life, and it is not Life-in-Potential, unless identity-bearing throughput is established.

The distinction matters because the framework must avoid both over-attribution and under-attribution. Not every complex biological remnant is potential life. Not every non-active candidate is mere chemistry. Complex Chemistry names the case where the tested candidate lacks active life-realisation, intrinsic resumability, and identity-bearing potential throughput. After a separate closure output for a formerly living target locus, non-identity-bearing remnants may be reframed as Complex Chemistry where they preserve no life-realising maintenance, intrinsic resumability, or potential throughput.

6.3. Life-in-Potential

Life-in-Potential is the status of a non-life-realised candidate that preserves identity-bearing potential informational throughput into admissible extrinsic life-realising completion.

It is not weak Life, dormant Life, biological material, stored sequence, causal triggering, lineage, usefulness, or reconstructability.

Life-in-Potential requires five conditions: the candidate is not presently life-realised as a living locus; it retains identity-bearing organisation; it has an admissible extrinsic life-realising completion pathway; its retained distinctions become counterfactually operative in that later regime; and the relation preserves throughput identity rather than relying on reconstruction after identity-bearing continuity has failed.

The candidate does not presently maintain itself as a living DTS at the framed scale. It does not intrinsically resume active life-realisation through intrinsic resumability alone. It requires extrinsic completion. But it is not empty matter. Its identity-bearing throughput remains open.

This is why Life-in-Potential occupies the middle formal class of the ladder: it is not Complex Chemistry, because identity-bearing potential throughput is preserved; it is not Life, because life-realising DTS completion is extrinsic rather than presently realised or intrinsically resumable.

Life-in-Potential must not be shortened to “potential life.” It is a formal attribution class grounded in identity-bearing potential throughput into admissible extrinsic life-realising completion.

This is why Life-in-Potential belongs between Complex Chemistry and Life in the formal ladder. That position is not a gradient of weak life-status. It marks a distinct attribution relation: more than Complex Chemistry because identity-bearing potential throughput remains open, less than Life because active or intrinsically resumable DTS maintenance is not presently attributable to the candidate locus.

6.4. Life

Life is the status of a correctly attributed Attribution Locus whose driven constraint-bearing regime is actively realised or intrinsically resumable through its own identity-bearing organisation.

Active Life is realised informational throughput. Distinction-conditioned organisation presently maintains, redirects, repairs, regulates, reproduces, develops, inhibits, moves, transforms, or completes the regime.

Dormant Life is intrinsically resumable informational throughput. Active realisation may be reduced or suspended, but the same Attribution Locus preserves intrinsic resumability by which life-realisation can resume.

Terminal active Life is realised informational throughput inside a terminal horizon. The candidate may be spending reserves, narrowing futures, or completing a final phase, but branch-realisation remains open until closure.

Life therefore includes active, dormant, and terminal modes where organisational identity remains attributable to the target locus.

The class is defined by realised or intrinsically resumable regime maintenance, not by ordinary activity level.

6.5. Closed target-locus relation

A closed target-locus relation records that a formerly living target locus has no future counterfactual branch-realisation as that locus.

Death is the ordinary-language name for this closed continuity. Formal attribution should not place death in the primary-class field. It should record closure of the target locus and then reframe remaining constituents.

Closure may occur through destruction, irreversible loss of organisation, failure of intrinsic resumability, collapse of integration, depletion beyond recovery, or terminal completion that leaves no further identity-bearing branch open.

Closure applies to the target locus. It does not classify every constituent.

After closure, remaining matter, subloci, records, fragments, sequences, symbionts, parasites, potential candidates, and incorporated materials must be reframed. Some may be Complex Chemistry. Some may be Life-in-Potential. Some may remain Life at a lower scale for a horizon. Some may enter another regime through incorporation. Some may require reconstruction analysis. Some may require residual deferral rather than class assignment.

Closure closes all remaining branches.

It does not close the attribution architecture.

6.6. Ladder, closure, and residual deferral

The ladder can be read as an informational throughput classification.

Complex Chemistry names absence of life-realising maintenance, intrinsic resumability, and identity-bearing potential throughput.

Life-in-Potential names identity-bearing potential throughput requiring extrinsic life-realising completion.

Life names realised or intrinsically resumable informational throughput maintaining a driven constraint-bearing regime.

Closure, outside the primary ladder, names closed throughput of a formerly living target locus, after which constituents require renewed attribution.

Reconstruction and incorporation, also outside the primary ladder, describe cross-locus relations after identity-bearing continuity has failed or material has entered another regime without survival of the prior locus.

Residual deferral, outside the primary ladder, records the missing discriminator condition and the update condition where a field cannot be assigned without overreach.

This reading prevents the ladder from becoming a biological taxonomy or an uncertainty bin.

It is not a list of familiar kinds. It is a classification of regime status under reference conditions.

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7. Relations among informational regimes

7.1. Relationship terms follow attribution

Relationship terms classify relations among loci after attribution has identified the relevant informational regimes.

Parasite, host, symbiont, organelle, organ, tissue, scaffold, machine support, developmental environment, higher-order locus, remnant, reconstruction material, and incorporated material are not primary life classes. They describe how candidate regimes relate once maintained boundary, DTS completion, continuity, and throughput status have been located.

This ordering matters.

If relationship terms come first, they can smuggle in conclusions. A parasite may be assumed alive because it has a biological role. An organelle may be assumed non-living because it is named as a component. A symbiont may be assumed merged because it benefits the host. A machine-supported organism may be assumed artificial rather than alive. A viral particle may be assumed dead chemistry or active life before throughput status has been assessed.

Attribution must precede relationship.

The relation among loci cannot identify the loci it relates.

7.2. Resource dependence

Resource dependence occurs where a candidate requires matter, energy, substrates, or permissive conditions supplied by its environment while its own organisation performs the life-realising maintenance relation.

Resource dependence is normal for life. It does not weaken life-status.

A bacterium requires nutrients. A plant requires light, water, and minerals. An animal requires oxygen and food. A seed requires permissive conditions to germinate. A cryopreserved organism may require thawing conditions. A machine-supported organism may require artificial assistance. None of these dependencies alone settles attribution against Life.

The question is whether the candidate's own identity-bearing organisation maintains or resumes the regime once conditions are supplied.

Where it does, resource dependence is not constitutive displacement.

7.3. Constitutive dependence

Constitutive dependence occurs where another organised locus performs operations required to complete the candidate's life-relevant regime.

This relation is more difficult than resource dependence because completion is not merely supplied as background condition. It is enacted through another organisation.

A candidate may preserve potential throughput into a host-completed regime. A developmental candidate may require gestational or artificial completion. A symbiotic system may require partner operations for full regime maintenance. A supported organism may depend on technological functions that replace failed physiological operations.

Constitutive dependence does not automatically deny life-status. It requires attribution of DTS completion.

If the candidate's own regime remains the Attribution Locus, support may be scaffolded. If the candidate lacks active life-realisation but preserves identity-bearing throughput into completion, the status may be Life-in-Potential. If no component alone carries the regime but the coupled relation does, higher-order or coupled attribution may be required. If identity-bearing continuity has failed, reconstruction or incorporation may be the correct relation.

7.4. Parasitism

Parasitism requires distinct loci and asymmetric maintenance cost.

A parasitic relation is present where one candidate's life-realisation or potential throughput depends on another locus in a way that imposes maintenance burden, damage, resource diversion, trajectory alteration, or branch-risk on the host, while the parasite preserves its own identity-bearing continuity or throughput.

Parasitism is not mere coupling.

It presupposes that the parasite and host remain attribution-distinct in the relevant sense. If all identity-bearing continuity has merged into a higher-order regime, parasitism may no longer be the primary relation. If the candidate cannot preserve throughput or maintenance distinct from the host, parasite-status may fail or require residual deferral.

For life attribution, parasitism matters because it prevents physical containment or dependence from erasing the parasite locus.

A candidate may require host completion and still preserve distinct throughput.

7.5. Symbiosis and mutualism

Symbiosis names sustained coupling among loci. Mutualism names a symbiotic relation in which participating loci receive maintenance-relevant benefit.

Mutual benefit does not erase locus distinction.

Two regimes may support each other while retaining separate maintained boundaries, distinct continuity paths, and separate branch-realisation. Conversely, long-term integration may stabilise a higher-order locus in which the coupled relation becomes a maintained regime beyond the parts.

The distinction is not decided by benefit.

It is decided by maintained boundary, DTS completion, continuity, and whether the coupled system itself carries identity-bearing informational throughput.[6]

7.6. Integration and merger

Integration occurs where one regime becomes functionally, developmentally, or organisationally incorporated into another.

Integration may be shallow, deep, reversible, irreversible, partial, or complete. It may preserve lower-order locus status, reduce it to functional sublocus status, or participate in the emergence of a higher-order locus.

Merger is stronger. It occurs only where formerly distinct continuity relations no longer remain attribution-separate at the reference scale and the integrated arrangement supports a unified maintained regime.

Historical lineage alone does not prove merger. Functional dependence alone does not prove merger. Internal location alone does not prove merger.

Merger requires continuity and maintenance to have shifted.

7.7. Higher-order loci

A higher-order locus exists where coupled components stabilise a maintained informational regime beyond the parts alone.

Higher-order attribution is not granted merely because many living parts interact. A forest, microbiome, colony, organism, tissue, or symbiotic assemblage may contain intense coupling without necessarily forming a single Attribution Locus at the claimed scale.

A higher-order locus requires a regime-level identity relation. The coupled system must preserve a boundary or maintained interface, regulation, continuity, DTS-completion pattern, and life-relevant informational throughput in a way that is not reducible to merely listing the participating components.

The coupled relation must therefore carry its own attribution burden. It must show regime-level maintenance, regime-level continuity, and candidate-level counterfactual dependence beyond the fact that its parts coexist or interact.

Multicellular organisms are familiar cases where higher-order locus attribution is often strong. Other coupled systems may be weaker, partial, or residual-bearing.

The higher-order claim must be earned.[7]

7.8. Fragmentation

Fragmentation occurs where a formerly integrated locus loses higher-order unity while some lower-order regimes, potential candidates, or non-living remnants remain.

This is common in death, injury, dismemberment, tissue survival, cell culture, organ preservation, and decomposition.

Fragmentation prevents one classification from being imposed on all remnants. A higher-order organism may die while some cells remain alive. A tissue may remain viable without preserving organismal identity. A viral load may remain Life-in-Potential after host-cell lysis. Non-identity-bearing molecules may return to Complex Chemistry. Material may be incorporated into other organisms.

Fragmentation is therefore not one status and not a primary class.

It is the loss of one attribution unity followed by renewed framing of constituents.

7.9. Artificial and hybrid systems

Substrate is not decisive.

A living regime may be supported by artificial devices. A biological candidate may depend on technical intervention. A synthetic system may be engineered to support driven constraint-maintenance. A hybrid system may distribute maintenance across biological and artificial components.

The attribution question remains the same.

Which informational regime is realised? Which locus carries it? Where is DTS completion? What identity-bearing throughput remains open? Does the artificial component function as resource, scaffold, constitutive completer, functional sublocus, part of a higher-order locus, or external reconstructing system?

Artificial support is a topology or completion relation, not a class verdict.

Artificiality does not settle life-status.

Regime relation does.

7.10. Relation topology as secondary classification

Class, continuity, closure, relation, and residual deferral answer different questions.

Class asks whether the candidate is Complex Chemistry, Life-in-Potential, or Life.

Continuity asks whether identity-bearing branch-realisation is active, dormant, terminal active, potential, or closed.

Closure asks whether a formerly living target locus has no future counterfactual branch-realisation as that locus. Closure is recorded as target-locus death, not as a primary class.

Relation asks how already-attributed regimes are connected: resource-dependent, constitutively dependent, parasitic, mutualistic, scaffolded, nested, merged, higher-order, fragmented, reconstruction-material, incorporated-material, or otherwise coupled.

Residual deferral asks which discriminator condition remains incomplete and what would update the attribution.

These questions must not be collapsed.

Topology describes relations among already-attributed regimes. It must not decide primary class.

A candidate can be Life and parasitic. It can be Life-in-Potential and host-completed. It can be Complex Chemistry and incorporated as material. It can be a formerly living target locus with closed continuity while containing living subloci. It can be terminal active Life without being dead. It can be dormant Life without being Life-in-Potential. Where boundary, completion, or continuity conditions are not strong enough, the case should carry residual deferral rather than treating unresolvedness as a class, continuity status, or topology.

The attribution architecture preserves these distinctions.

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8. Canonical compression and handoff

8.1. What the paper has established

Paper 1 defines life. This paper defines life attribution.

The inherited life discriminator identifies the physical relation that earns life-status: driven thermodynamic constraint-maintenance supported by IPL-mediated Non-Trivial Computation. The present paper has asked the next question: where, when, and for which locus does that relation belong?

The answer is not supplied by familiar matter-state barriers. A membrane, body, organ, capsid, genome, lineage, metabolic trace, or biological noun may identify a candidate frame. It does not by itself identify the living locus.

Life attribution identifies an informational regime under reference conditions. It asks which identity-bearing distinctions are realised, intrinsically resumable, extrinsically completable, or closed; where those relations are not warranted, it records whether the tested relation is positively excluded under the stated reference conditions or deferred to residual.”

This allows the framework to treat difficult cases without ad hoc exception. A living organism actively maintaining itself is Life. A dormant organism preserving intrinsic resumability is Life with dormant continuity. A terminal organism completing a life-realising phase is Life with terminal active continuity. A virion-like candidate preserving identity-bearing throughput into host-completed life-realisation may be Life-in-Potential. A formerly living target locus whose future branch-realisation has closed has closed continuity; its constituents require renewed framing. A reconstructed organism is a new locus unless identity-bearing continuity has been preserved. A molecule incorporated into another organism belongs to that other organism's regime. Where discriminator conditions remain incomplete, residual deferral records the missing condition and update condition rather than becoming class, continuity status, or topology.

The transition from chemistry to life may be materially gradual, but attribution is operationally narrow. Only a small number of relations can carry the classification: driven organisation, operative distinction, regime maintenance, Attribution Locus, DTS completion, identity-bearing informational throughput, continuity, and residual where the discriminator cannot yet be completed.

8.2. The classification grammar

Life attribution does not classify matter by familiar state barriers.

It identifies an informational regime under reference conditions.

Primary class, continuity status, closure-output route, Attribution Locus, DTS-completion relation, topology, reconstruction, incorporation, and residual deferral answer different questions and must not be collapsed.

Primary class answers whether the candidate is Complex Chemistry, Life-in-Potential, or Life.

Continuity status answers whether identity-bearing branch-realisation is active, dormant, terminal active, potential, or closed.

Closure output records death as closed continuity of a formerly living target locus. Death is not a fourth primary class, and closure of the target locus does not classify every constituent inside the former system.

Attribution Locus answers whose informational regime is being classified.

DTS-completion relation answers where the living, resumable, or potential completion relation is actually performed: intrinsic, resource-dependent, scaffolded, constitutively dependent, host-completed, coupled, or insufficiently established. Where later life-like or life-realising production depends on external reconstruction after identity-bearing continuity has failed, reconstruction is recorded as a cross-locus descriptor rather than same-locus DTS completion.

Topology answers how already-attributed loci relate to one another. It follows attribution; it does not decide primary class.

Reconstruction and incorporation are cross-locus descriptors, not survival and not primary classes.

Residual deferral records which discriminator condition remains incomplete and what would update the attribution. It is uncertainty management, not a ladder value, continuity status, topology modifier, or hidden verdict.

The ladder is Complex Chemistry, Life-in-Potential, Life.

The attribution architecture determines which relation is present.

8.3. Handoff to procedure

Paper 3 operationalises the attribution sequence but does not redefine the relations.

It should therefore preserve the field discipline established here: primary class only where the ladder is warranted; continuity status before primary class; closure output for formerly living target loci whose future branch-realisation has closed; constituent reframing after closure; topology only after attribution; residual for incomplete discriminator conditions; and cross-locus descriptors for reconstruction and incorporation.

The procedure should not turn this architecture into a trait checklist. Its task is to keep the order of attribution intact: frame the candidate, test life-realisation, localise the Attribution Locus, localise DTS completion, determine identity and continuity, assign primary class where warranted, assign topology where warranted, and state residual and update conditions wherever closure would overstate support.

Endnotes

[1] Krakauer et al. (2020) likewise seek to identify biological individuals without assuming the candidate unit in advance, using temporally persistent information; Pradeu (2016) distinguishes physiological from evolutionary individuality and cautions against treating organism and biological individual as interchangeable. These are examined comparators only: neither supplies the present life discriminator, Attribution Locus, DTS-completion relation, or continuity ladder.

[2] Montévil and Mossio (2015) characterise biological organisation through closure of constraints and explicitly propose closure as an operational means of marking boundaries between interacting biological systems. Rafiei and Asadi Anar (2026) independently treat protocellular membranes as informational boundaries parameterised by boundary strength, memory, and identity persistence. Neither boundary account is inherited here: closure or membrane organisation alone does not establish Attribution Locus or life-status.

[3] Lennon and Jones (2011) review microbial dormancy as a reversible state of low metabolic activity from which organisms can resuscitate after environmental change. This supplies empirical support for suspended or reduced activity without death; intrinsic resumability is the present paper's attribution criterion, not a term inherited from that literature.

[4] Forterre (2011) distinguishes inert virions from the intracellular virocell phase and locates viral life in the infected-cell phase. This is a close comparator to free-phase/host-completed attribution, but Life-in-Potential is not the virocell concept: it requires a non-life-realised candidate to preserve identity-bearing potential throughput into an admissible extrinsic life-realising completion pathway.

[5] Bernat, Culver, and Gert (1981) define death as permanent cessation of functioning of the organism as a whole and propose whole-brain loss as the criterion; Shewmon (2001) challenges the premise that the brain uniquely confers somatic integrative unity. Together they provide comparator pressure on localisation of organismal death. The present branch-closure criterion is broader and does not inherit a whole-brain criterion.

[6] Suárez and Stencel (2020) argue that holobiont individuality is part-dependent and may be evaluated host-relative or microbe-relative. Moran and Sloan (2015) provide critical pressure against treating intimate host-microbiome association as sufficient for a unified evolutionary individual. Both are comparators for the need to separate relationship topology from automatic unity; the present attribution criteria remain independent.

[7] Doulcier, Takacs, and Bourrat (2024) model evolutionary transitions in individuality as life-cycle closure: the emergence of a higher-level embedding life cycle. Queller and Strassmann (2009) analyse organismality through high cooperation and low conflict. These are comparators for higher-order identity, not dependencies. Doulcier et al.'s life-cycle closure is not the present paper's death/branch-closure.

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