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INTEGRATED REFEREE REPORT AND REVISION RECORD

Endogenous and Exogenous Sources of Encoded Chrysene Systems

Functional Selection, Adaptive Realization, and Engineered Emulation

Charles D. Schaper, Ph.D.
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Scope and provenance

This file combines `Article99_Referee_Report.tex` and `Article99_Author_Response.tex`, both carrying the 5 November 2026 publication-integration record. The original scientific assessment is retained, with each of R1–R6 followed by the corresponding author response. Repeated front matter is consolidated.

This is a simulated mathematical referee record. Combining the documents does not constitute a new orthogonal scientific review, an independent human journal review, an editorial acceptance decision, or experimental validation.

Recommendation and recorded disposition

The historical recommendation is **minor revision**, with acceptance after minor revision contingent on the stated clarifications and truthful supplement documentation. The author accepted all six recommendations and reported the corresponding revisions. No substantive recommendation was rejected and no principal theorem was withdrawn. These are the recorded assessment and author disposition, not a new journal decision.

1 Review basis, chronology, and supplement status

Historical manuscript reviewed. Charles D. Schaper, the draft then designated Article 102, Volume 1, Number 5, with provisional pages 4000–4021. The October 2026 review concerns that submitted draft before the subsequent revisions. The work was subsequently integrated as Article 99; the historical pagination is not the publication pagination.

The source records identify `Article102_Revised_Manuscript/main.tex`, rather than the duplicate root-level draft, as the controlling manuscript for that revision. They identify the original records at `provenance/Article102_Referee_Report.tex` and `provenance/Article102_Author_Response.tex`. Those are historical package locators, not additional files required to compile this integrated document. The paper title and scientific review content were retained when article identifiers, companion filenames, journal presentation, and bibliographic metadata were updated for the publication package.

The review distinguishes analytic proof inspection, numerical testing, and machine-checked formal proof. The verification and formal-proof supplements were subsequent deliverables, and their claims are bounded by their actual execution records. The original recommendation states that the central mathematical conclusions are supported under the displayed hypotheses and calls for no theorem reversal or restructuring of the approved introduction.

1.1 Recorded supplement audit of 5 November 2026

The publication-integration records report that the renumbered computational companion was rerun in normal and optimized Python modes, with 213 recorded checks passing in each mode. The suite also records eight negative-control executions in seven categories. Lean 4.24.0 compiled 25 named theorems: nine are axiom-free and sixteen use standard Lean axioms only. The formal companion states its dependency and coverage boundaries.

These checks do not formalize all analytic arguments or validate a molecular realization. The computational and formal dossiers contain the commands, sources, and execution records. These are the audit results recorded on 5 November, not new execution claims made by this consolidation. Renumbering and integration do not expand the scientific scope of the historical recommendations and responses.

1.2 Author's general disposition

The recommendation of minor revision is accepted. The revisions clarify the scope of a dynamic interpretation, make domain and support conventions explicit, and replace future verification plans with actual supplementary results. The approved introduction and the discussion and conclusion text are retained verbatim. No principal theorem is withdrawn, and no endogenous or exogenous capability is inferred from provenance alone.

The referee report is a simulated assessment, not an external journal decision. The computational and formal companions provide their own execution records and coverage boundaries.

2 Summary and contribution

The manuscript compares endogenous assembly and exogenous preparation using a common finite configuration space, functional observations, source laws, and causal operating protocols. Its main organizing principle is the distinction between reaching a configuration and realizing a useful law or response. Relative-entropy disintegration identifies the preparation that changes an output law while preserving the reference distribution within each functional fiber.

The paper then supplies concrete realizations: rejection selection, reversible rate tilting, finite-horizon conditioning, and a responsive two-state kinetic model. Exact and approximate emulation identify the capabilities an engineered system must reproduce. Registry integration, coding interfaces, and a verified stochastic quantum-channel lift connect the comparison to the surrounding corpus without asserting equivalence between different coefficient or physical systems.

The contribution is the coordinated source-comparison framework and its explicit constructions, not the discovery of the relative-entropy chain rule, Metropolis acceptance, or conditioned Markov processes in isolation. The introduction already makes this distinction. The single-core hypothesis is correctly presented as a simplification of the modeled inventory rather than a proof of synthesis or self-assembly.

3 Assessment of the principal arguments

The following assessment records the original review. Requests noted here are paired with the author's reported revisions in Sections 4 and 5.

3.1 Common reachability and causal emulation

The full-support and placement-surjectivity argument is valid. Its extension to lateral lattices correctly requires bridge access rather than inferring that access from the shared stock. The sequential-positivity lemma correctly concerns joint support, not positive marginals alone.

The operational order of quantifiers, $\forall u\, \exists v\, \forall e$, prevents an emulator from being selected using inaccessible environmental information. The full-history total-variation estimate is valid for the specified conditional kernels, including their extensions on zero-probability histories. Its reward and cost consequences use the correct budget slack. No maximizing policy or uniform-in-time approximation is assumed.

The environment set should nevertheless be explicitly declared nonempty, as requested in R2 below and accepted in the recorded response. Finiteness of that set is not necessary.

3.2 Functional selection and supply

The finite KL decomposition, equality condition, and unique selected joint law are correct. Zero target masses do not create an ambiguity in the joint optimizer. The excess cost of microscopic specification is the negative logarithm of the conditional reference mass, and strictness is correctly restricted to nontrivial positive-probability fibers.

The maximum-Shannon-entropy interpretation is appropriately limited to a uniform reference. The successive-quotient result follows by a second disintegration. The rejection construction has the

correct maximal acceptance constant, normalization, geometric waiting law, and repeated-draw cost under the stated independent-trial premise.

The hexamer census is consistent: eight singleton reversal classes and twelve two-element classes partition the thirty-two agreement words. Uniform microstates do not induce uniform classes. The class-uniform optimizer assigns $1/20$ to singleton words and $1/40$ to the members of two-element classes. Its acceptance realization has probability $5/8$ per trial and mean trial count $8/5$. The minimax coverage theorem distinguishes an unknown demand selected before the realized draw from an adversary that sees the realized draw.

3.3 Reversible and conditioned dynamics

The rate-tilting construction preserves the allowed move graph for positive weights and satisfies detailed balance with the selected law. The Dirichlet-form and variance comparisons yield the stated spectral-gap bound. The L^2 contraction and Cauchy–Schwarz argument give the correct total-variation constant. The paper correctly separates a sufficient operating-time bound from a sharp relaxation claim.

For zero target masses, the restricted support and the connected-component initialization condition are correct. The Doob construction includes the necessary initial-law reweighting. Arbitrary zero-backward-weight rows are unreachable under the transformed law and therefore do not invalidate the construction. The terminal-event and soft-terminal-law optimizers are correct, subject to the explicit support convention discussed in R4.

The strong-lumpability proposition is correct. Its interpretation should be narrowed: strong lumpability is sufficient, not necessary, for a fixed target and horizon to admit functional conditioning factors. R1 and its recorded response clarify this scope without changing the proposition or conclusions.

3.4 Adaptive, lattice, and channel arguments

The two-state kinetic witness and its least-favorable-initial-state dwell-time threshold are correct. The strict result compares a responsive realization with uninformed preparation. An engineered copy of the sensor and generator restores equality; this is a necessary boundary of the argument, not a deficiency.

The spanning-forest proof of registry integration is coefficient-consistent. The $3 \times 3 \times 6$ box has 54 vertices, 45 vertical edges in nine components, and 117 full nearest-neighbor edges. The respective integrable binary dimensions are 45 and 53, and the connected graph has cycle dimension 64. The additional eight coordinates are cross-column references, not extra vertical contacts.

The reliability module uses a common encoder, noise kernel, and decoder. Its total-variation bound has constant one. The Kraus construction is trace-preserving and completely positive for the intended common $\mathcal{X}$-to-$\mathcal{X}$ kernel. It does not establish coherent preparation or quantum advantage.

4 Required minor revisions and integrated responses

R1 Strong lumpability is not a necessary target-specific condition

Original referee assessment and request.

Location. Final paragraph following `prop:quotient-doob` in the dynamics section.

The proposition establishes a target-independent sufficient condition for fiber-constant backward weights and quotient Markov kernels. The following prose can be read as making every failure of strong lumpability require additional microscopic sensing. That is stronger than the result.

For example, let $\mathcal{X} = \{a, b, c\}$, with $\pi(a) = \pi(b) = 0$, $\pi(c) = 1$, horizon two, and terminal target $\{1\}$. Take

$$P_0 = \begin{pmatrix} 3/4 & 0 & 1/4 \\ 1/4 & 0 & 3/4 \\ 1/2 & 0 & 1/2 \end{pmatrix}, \qquad P_1 = \begin{pmatrix} 1/2 & 0 & 1/2 \\ 1/2 & 0 & 1/2 \\ 1/2 & 0 & 1/2 \end{pmatrix}.$$

P_0 is not strongly lumpable, but the backward weights at times zero and one are both $(1/2, 1/2, 1/2)$. The first-step conditioning factors are all one, while the final-step factors depend only on destination output. Failure of strong lumpability therefore does not by itself imply a need for microscopic distinctions in these factors.

Requested repair. Explicitly state sufficiency rather than necessity, and tie any additional information requirement to implementation of the actual transformed transition factors using the allowed observations or local physical couplings. Do not alter the proposition. The counterexample is useful in the verification supplement; it need not lengthen the manuscript.

Author response and recorded revision.

Accepted. The proposition on quotient conditioning remains unchanged. The following paragraph now says explicitly that strong lumpability is sufficient, not necessary, for fiber-constant backward weights for a particular target and horizon.

The implementation requirement is now tied to the actual transformed transition factors and the observations or local couplings available to the mechanism. Additional sensing is described as potentially necessary when those factors cannot be implemented from functional observations, not as a consequence of every failure of strong lumpability.

The computational companion contains the referee's three-state, two-step counterexample. It checks both the failure of strong lumpability and constancy of the target-specific backward weights. This prevents the corrected interpretation from being replaced by an unintended necessity claim in subsequent numerical work.

R2 Nonempty environment domain

Original referee assessment and request.

Location. `def:op_protocol` and `def:op_value`.

Requested repair. State $\mathcal{E} \neq \varnothing$ explicitly. The real-valued worst-environment supremum and infimum require this intended domain convention. Do not impose finiteness unnecessarily.

Author response and recorded revision.

Accepted. The source-protocol definition now specifies a nonempty environment set. The set is not required to be finite. The uniform bounds and the finite comparison record remain the premises used by the robust performance estimates.

R3 Certification and supplement scope

Original referee assessment and request.

Location. The future-verification appendix and the forthcoming VERIFICATION CODE and FORMAL PROOF documents.

Requested repair. Replace future-tense certification plans with the actual status of the delivered supplements. Distinguish exact finite arithmetic, numerical checks, analytic proofs, and Lean kernel-checked statements. Identify versions, commands, hypotheses, and theorem coverage. Compiling a LaTeX listing is not compiling its Lean source. A partial, fully checked formal development must not be represented as formalization of every entropy, spectral, kinetic, or molecular claim.

Author response and recorded revision.

Accepted. The manuscript's final appendix now describes the executed Python suite and the compiled Lean module. It distinguishes:

1. exact integer, rational, and finite-field calculations;
2. floating-point tests of finite instances;
3. universal analytic proofs in the manuscript;
4. the specific structural and rational results checked by Lean.

The two standalone LaTeX companions embed their complete code listings. Their raw executable sources and actual execution logs are also provided. The distinction between compiling a LaTeX document and executing or compiling its embedded program is explicit.

The Lean companion checks a finite structural and exact rational core. It does not claim to formalize all real-logarithmic KL optimality, spectral-gap, continuous-time, total-variation, graph-integration, or physical-realization results. Those exclusions are stated on its opening page and mapped to the manuscript in its coverage discussion.

5 Recommended clarifications and integrated responses

R4 Restrict the soft-terminal-law proof to positive support

Original referee assessment and request.

Location. Proof of `prop:terminal-law-transform`.

The result is correct, but its use of the positive-reference chain rule is clearer if competitors not absolutely continuous with respect to the baseline path law are first excluded as having infinite divergence. Restrict the remaining proof to the positive-support path space and terminal-output support, where the earlier theorem applies literally. This adds no hypothesis and changes no conclusion.

Author response and recorded revision.

Accepted as a useful proof clarification. The proof now first excludes competitors with infinite divergence because they are not absolutely continuous with respect to the baseline path law. It then restricts to the baseline path support and terminal-output support, where the positive-reference functional-selection theorem applies directly. No new hypothesis is imposed.

R5 Declare the resolution of a finite comparison record

Original referee assessment and request.

Location. `def:op_protocol`.

One sentence should say that the finite record has a declared observation resolution. Exact continuous waiting times or a complete continuous-time jump trajectory do not automatically belong to this finite alphabet. Sampling or discretization belongs to the observation map. No measurable-space generalization is needed for the stated finite results.

Author response and recorded revision.

Accepted. The protocol definition now states that the finite record uses a declared observation resolution. Exact continuous waiting times and complete continuous-time jump histories require a different measurable-space model; sampling and discretization in the present framework belong to the observation map. The finite-horizon engineering theorem is unchanged.

R6 Type the stochastic kernel in the channel lift

Original referee assessment and request.

Location. `prop:channel-lift`.

Write $x, z \in \mathcal{X}$ in the kernel definition, or explicitly provide a separate output space. The existing common-space interpretation and proof are already correct; this is a notation clarification.

Author response and recorded revision.

Accepted. The channel-lift proposition now writes $x, z \in \mathcal{X}$ explicitly. The Hilbert space and Kraus proof remain unchanged.

6 Scope boundaries retained

6.1 Referee's boundaries on the recommendation

The following demands would not repair a gap in the present finite theorems and should not be imposed as conditions of acceptance:

1. Replacing conditional endogenous advantages with superiority over every conceivable exogenous technology. This would contradict the explicitly admitted emulation class.
2. Equating the KL specification objective with total chemical work. A thermodynamic resource model is additional work, not an unstated consequence of the finite information identities.
3. Requiring experimental synthesis, sensing, or reversible rate realization as a proof of the displayed conditional mathematical statements. Such evidence would be needed for a claim of demonstrated molecular implementation, which this manuscript does not make.
4. Replacing the finite framework by an infinite lattice or asserting equivalence of all algebraic structures in the surrounding corpus. Explicit typed coordination is the appropriate present scope.

These are boundaries of the referee recommendation, not requests that should be artificially added and then discharged. The author may retain the approved introduction and conclusions while making R1–R6.

6.2 Author's retained scope

No substantive referee recommendation needed to be rejected. The report also identified possible demands that would expand or contradict the paper's scope. These are not adopted:

- Absolute endogenous superiority is not substituted for conditional separation, because an admissible engineered emulator can attain the same law and objective.
- Information divergence is not reinterpreted as total manufacturing work without a thermodynamic model.
- Experimental molecular feasibility is not claimed on the basis of finite mathematical constructions.
- Infinite-lattice and full cross-domain equivalence claims are not added to a finite, map-based comparison.

This preserves the paper's main conclusions and research direction while making their precise conditions easier to verify.

7 Historical supplement validation and editorial checks

The statements in this section record the original October revision process and are retained from the author response. The 5 November renumbering and audit results are recorded separately in Section 1. These statements do not claim that the supplements were re-executed during this consolidation. The Python and Lean companions are independently executable artifacts, not only displayed source code. Their version records, source hashes, commands, and full outputs accompany the files. Their printed listings are checked against the raw source.

A supplement consistency check identified a complemented encoding in the initial Python registry helper. It was aligned with the manuscript's binary sum convention before release. The registry census and class probabilities were unchanged; the released Python, Lean, and manuscript now use the same convention.

The original and revised source trees are retained separately. A byte-level comparison verifies that the approved introduction and the discussion/conclusion file are unchanged. The revised manuscript and all standalone supplementary LaTeX documents are compiled and their rendered pages inspected before delivery. These editorial checks do not replace the stated mathematical and machine-proof coverage limits.

8 Final integrated assessment and recorded disposition

8.1 Historical referee assessment

The manuscript has a coherent mathematical contribution: it identifies which distinctions between sources concern support, functional specification, dynamics, observation, or resources, and gives constructive ways for engineering to reproduce selected capabilities. The analytic proofs examined support the qualified conclusions. Acceptance after minor revision is the simulated recommendation, contingent on the scope clarifications and truthful supplement documentation above.

8.2 Disposition after the recorded author response

All required minor revisions (R1–R3) and recommended clarifications (R4–R6) were accepted in the author response. The reported changes narrow the interpretation of strong lumpability, declare the environment domain and observation resolution, make the path-support and stochastic-kernel conventions explicit, and state the actual scope of the computational and formal companions. The author reports no principal theorem withdrawal, no rejected substantive recommendation, and no expansion from mathematical constructions to demonstrated molecular implementation.

The integrated record therefore preserves both parts of the review cycle: the simulated recommendation of acceptance after minor revision and the author's account of how those conditions were addressed. It does not substitute an editorial decision or an additional scientific review for either source.