

ORTHOGONAL REVIEW RECORD

The Conditional Refinement, Part II: The Chrysene–Adenosine Reaction Cell, Margin Geometry, and Sufficiency

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Review focus: Title versus contents; margin geometry; binding of Corollary 8.9

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Declaration of provenance

This report is not independent of the manuscript. The reviewer participated in drafting the paper and in the four passes recorded at its Appendix B. It is a structured re-reading by a party to the work. The first finding below concerns the paper’s title and was not reached in any of those passes, which is the reason the report is worth having on the record. There is no author-reply section.

Scope of Review

Part I leaves two negative results: the thresholds governing the three-valued refinement are not a function of the codon block, and no single environmental parameter orders the published

record. This paper places the account in the reaction cell by taking the predecessor theory of cage-constrained reachability and making its hard constraint functionals depend on the medium. Reachability becomes a maximum over path supports of a minimum over step margins. The reachable set is constant on the chambers cut out by the margin zero sets. Part I's threshold hypothesis is derived under stated premises, and the first of them is then refuted by the record.

Compiled disposition

Major revision. The mathematics is correct so far as the reviewer can check it, and the presentation is disciplined. The paper does not prove the thing its title names. The one quantitative conclusion it does reach may be vacuous for a reason the manuscript does not address. Two required changes (R1, R2) and two recommended (R3, R4). The cheapest fix for R1 costs the paper nothing it possesses.

Required before print

Required. Retitle to *Margin Geometry and Necessary Conditions for Sufficiency*, and restate Section 1.2's objective to match. Or prove an existence theorem by exhibiting a cage, even a schematic one with stipulated margins, and two environments realising the resolutions of tables 1 and 2. Correct Scholium 6.18's reference to "the sufficiency theorem," and amend the series plan to say which part, if either, delivers it. For Corollary 8.9, either estimate or bound N in the reference realization, or state explicitly that the bound is not known to be binding.

Contents

1	Required revisions	3
2	Recommended revisions	4
3	Matters not requiring action	4

1 Required revisions

R1 — The title promises sufficiency and the paper proves only necessary conditions

The title ends “and Sufficiency.” Section 1.2 states the objective in those terms. The series plan makes a conditional sufficiency theorem the goal of both papers. Section 6.3 does the following, and only the following.

- Definition 6.13 defines what it is for a cage to type-suffice and to residue-suffice.
- Proposition 6.14 restates each as an equivalent condition.
- Proposition 6.16 gives a necessary condition: if a cage type-suffices then two environments lie in distinct chambers at each of three halves.
- Corollary 6.17 gives a weaker necessary condition: such a cage has at least one environed constraint.

No statement of the paper asserts that any cage type-suffices. There is no existence claim, no witness, and no theorem of the form “there exists a codon-indexed environed cage and two environments such that...” The reviewer searched for one and finds none. Scholium 6.18 describes Corollary 6.17 as “weaker than the sufficiency theorem,” which presupposes a sufficiency theorem the manuscript does not contain.

This is the report’s principal finding. The paper is a theory of what a sufficing cage would have to satisfy, which is a legitimate and useful object, but it is not sufficiency and must not be titled as though it were. Required: one of the following.

- (a) Retitle, to *Margin Geometry and Necessary Conditions for Sufficiency*, and restate Section 1.2’s objective to match. This is the reviewer’s recommendation. It costs nothing the paper actually has.
- (b) Prove an existence theorem, by exhibiting a cage, even a schematic one with stipulated margins, and two environments realising the resolutions of tables 1 and 2. Under H_{aff} this ought to be constructible, and Corollary 6.17 already says what it must do.

Whichever is chosen, Scholium 6.18’s reference to “the sufficiency theorem” must be corrected, and the series plan’s statement of the goal amended to say which part, if either, delivers it.

R2 — Corollary 8.9’s bound may be satisfied trivially, and its units are not discussed

The paper’s one quantitative conclusion is that fifteen distinct rank vectors force $\sum_{k \leq d} \binom{N}{k} \geq 15$, whence $N \geq 14$ at $d = 1$ and $N \geq 5$ at $d = 2$. By Definition 8.5, N counts the distinct nonconstant margin functions $\mu_{\sigma}(w, \cdot)$ over $\sigma \in \Xi$ and w ranging over the codons of the halves considered. For the sixteen purine halves, thirty-two codons.

Nothing in the paper bounds Ξ , and the reaction cell of the predecessor has many steps. With thirty-two codons and a step set of even modest size, N runs to hundreds. A lower bound of fourteen is then no constraint at all, and the “cost” at Scholium 8.10, fourteen constraints in one dimension

against five in two, compares two numbers both of which the architecture supplies many times over. The manuscript does not say how large N is expected to be, and without that the reader cannot tell whether Corollary 8.9 constrains anything. Required: either an estimate or bound for N in the reference realization, or an explicit statement that the bound is not known to be binding. The second is honest and cheap. The first is Target 10.8 and would make the corollary a result.

2 Recommended revisions

R3 — The chamber theorem is elementary, and the paper should say so

Theorem 5.4 is the paper’s central positive result and carries [A]. Its proof is four lines: on a connected set missing the margin zero sets each margin has constant sign, so the liftable set, the admissible paths and the reachable targets are constant. This is correct and it is also nearly immediate from the definitions.

The manuscript nowhere says so, and Scholium 5.9’s framing, “the precise form of the assertion that a continuously varying environment produces a discontinuously varying product,” invites a reader to take the theorem for more than a sign argument. Recommend a sentence conceding the elementarity. It costs nothing. The interest of the result is in identifying this as the load-bearing fact, not in the difficulty of proving it, and saying so is more persuasive than leaving a referee to notice.

R4 — H_{one} is assumed, untested, and implausible as stated

Hypothesis 8.7 asserts that one cage with one constraint family realises the resolutions of every published table. Remark 8.8 correctly says that without it the paper’s bounds are vacuous, and Target 10.7 correctly says it is tested nowhere. What neither says is that it is a strong hypothesis on its face. The twenty-seven tables come from organisms separated by the whole of eukaryotic and bacterial divergence, and asking one cage with one constraint family to cover them is not a mild idealisation.

Recommend that Section 8.2 state the objection rather than leave it to a Target. The paper’s treatment of H_{one} is otherwise exemplary. It is named, its vacuity without it is printed, and it heads the load-bearing list. One sentence would complete it.

3 Matters not requiring action

- The proofs the reviewer checked are correct, including the compactness argument at Proposition 4.5, the sign argument at Lemma 5.2, the threshold construction at Theorem 5.24 and the ξ -order argument at Theorem 8.15. Remark 8.13’s counterexample, that nesting can lower the rank, is right and is the reason H_{sep}^ξ cannot be dropped.
- The removal of the range parameter (Scholium 4.17) is a real simplification: a path margin depends only on the support, so no length bound is needed anywhere.
- The retirement of H_{det} in favour of a selection rule plus a general-position proviso is well judged,

and Scholium 6.12 is right to record it as a trade rather than a removal.

- The disclosure at Remark 8.8, that the series claim bounds nothing, is unusual and correct.
- The defect ledger records a check that certified a false statement by searching a hand-set range (Appendix B.6, item 10). Recording it is the right decision, and the accompanying rule, that a check asserting a maximum must search until it fails, should be adopted across the volume.

Assessment

The paper does what Part I's negative results ask: it moves the account into an object where the codon enters through geometry rather than through block algebra, and it derives from that a genuinely nonlinear relation between medium and product. The mathematics is sound and the presentation is honest to an unusual degree about what it does not establish. The gap between the title and the contents is nevertheless not a matter of emphasis. A reader who takes the paper for a sufficiency result, and the title, the objective and one scholium all invite that, will have been misled about its principal claim. That must be fixed before publication, and the cheapest fix costs the paper nothing it possesses.

References

- [Sch26] C. D. Schaper. The conditional refinement, part I. *Annals of the Chrysene Formalism* 1(2):1015–1047, 2026. Predecessor whose two negative results this paper places in the reaction cell.

Revision history

Version	Date	Notes
v1.0	2026-10-11	Review record published with Article 56.

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