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ORTHOGONAL REVIEW RECORD

The First Polypeptide: Condensation, Sequestration, and the Discharge of the Remnant

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Declared conflict

This report was prepared by the same system that drafted the manuscript. All quantitative points below are verifiable by running `acf-68-blocks.py` or by substituting into the formulas given in the body. There is no author-reply section.

Scope of Review

The paper supplies the mechanism that Article 67 left open. The remnant `W` is discharged by a polypeptide formed at the hexameric loom site, which partitions to the bilayer and sequesters `W` by aromatic stacking. The rate condition $f_c \geq \beta$ is derived from the Article 67 invariance. The dual function (equal increments on N and W_b) is proved and the ϱ-invariance is shown to survive the loop. The shared target `tgt:cond_rate` is defined and passed. The paper is substantially expanded from the first draft and the additional results are sound. The valence

theorem (Theorem 4.1) is the cleanest new result: four lines, scoped correctly to Article 65's statement, with a precise falsification entry. The stacking energy bounds and the transfer free energy calculation are the first numerical entries the corpus has made for a physical interaction (as opposed to a bond energy or a geometry), and they are handled conservatively.

Compiled disposition

Minor revision. Two errors must be corrected before acceptance. Both are in proof passages rather than in the theorems themselves. The core results are correct. Four further points are recommended for clarity.

Required before print

Required before acceptance. Correct the algebraic expression in Proposition 8.3's proof: replace $4.76/(\alpha/(1-\alpha))$ with $0.524(1-\alpha)/\alpha$. Replace the falsification entry for Theorem 6.1 so that it names a modification under which $\Delta N \neq \Delta W_b$, not a circular failure of the invariance proposition. The reporter would re-review these two items only.

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1 Error 1: algebraic expression in Proposition 8.3

Required — algebraic form of the ratio is incorrect

This item is required before acceptance. The proof of Proposition 8.3 (feasibility of k) states that the ratio $k_{\max}/k_{\min} = 2L_{\text{lip}}\varrho_{\max}/(\beta N_0) = 2 \cdot 13200 \cdot 5/((\alpha/(1-\alpha)) \cdot 252000)$, which equals $4.76/(\alpha/(1-\alpha))$. The numerical evaluation is correct at $\alpha = 0.10$ ($\beta = 0.111$, ratio ≈ 4.71), but the algebraic expression $4.76/(\alpha/(1-\alpha))$ is wrong as written. The constant 4.76 is the value of the ratio at the specific point $\alpha = 0.10$, not a universal constant. The general formula is

$$\frac{k_{\max}}{k_{\min}} = \frac{2L_{\text{lip}}\varrho_{\max}}{\beta N_0} = \frac{0.5238\,(1-\alpha)}{\alpha},$$

which evaluates to 4.71 at $\alpha = 0.10$ and to 25 at $\alpha = 0.02$. The condition exceeds 1 for all $\alpha < 0.83$ is correct. The algebraic form of the ratio is not. As written, $4.76/(\alpha/(1-\alpha))$ reads as though 4.76 is the numerator of the general formula, which it is not.

Required: replace which equals $4.76/(\alpha/(1-\alpha))$ with which equals $0.524(1-\alpha)/\alpha$.

2 Error 2: circular falsification entry for Theorem 6.1

Required — falsification entry is circular

This item is required before acceptance. The falsification entry for Theorem 6.1 (the rate condition) reads: a derivation showing the Article 67 invariance does not hold through the condensation loop. Proposition (invariant survives) proves it does. Falsifying Theorem (rate) would require Proposition (invariant survives) to fail. This is circular. Theorem 6.1 is derived from the Article 67 ϱ-invariance, which is itself proved in Article 67 and carried into Article 68 by Proposition 7.2. The falsification of Theorem 6.1 should name what would invalidate the invariance argument that underpins it, not what would invalidate the proposition that confirms the invariance in the loop context.

The correct falsification of Theorem 6.1 is a modification to the map under which the N-increment and the W_b-increment are not equal. This is the assumption that Article 67 proved and that Theorem 6.1 imports. If the condensation removed more from N than it sequestered from W_b (e.g. a sequestration efficiency ε that is counted differently in the two budgets), the rate condition $f_c \geq \beta$ still holds but at the rescaled threshold $f_c \geq \beta/\varepsilon$, which is already in Corollary 6.2. The genuine falsification of Theorem 6.1 therefore sits in Corollary 6.2's $\varepsilon = 0$ case, not in a hypothetical failure of the invariance proof. Required: replace the falsification entry for Theorem 6.1 with a modification to the augmented map under which $\Delta N \neq \Delta W_b$ per cycle, breaking the equal-increment structure of Theorem 7.1 (dual function). If the condensation removes n_R from the lumen but sequesters $n_W \neq n_R$ remnants, the rate condition becomes $f_c \geq \beta \cdot (n_R/n_W)$, and the threshold changes but the form of the argument does not. The genuine falsification of the equal-increment claim is a mechanism by which poly-R sequesters residues from the lumen rather than remnants from the bilayer, which would break the coupling.

3 Further points (recommended)

3.1 — "Immediately" in Proposition 5.1 is a kinetic claim

Proposition 5.1 states that poly-R partitions to the bilayer immediately on formation. The thermodynamic argument (transfer free energy $\approx -19\,\mathrm{kJ\,mol^{-1}}$ per chain) supports partition. It does not establish a timescale. If the partition timescale exceeds one forcing period, the condensed residues would sit in the lumen as osmolyte for one or more cycles before crossing to the bilayer, changing the per-cycle budget. The word immediately should either be replaced with thermodynamically driven to partition and registered as a kinetic assumption (H3), or the argument should note that the PCET mechanism which forms the polymer at the bilayer-facing hexameric site deposits the product at the bilayer, so no diffusive crossing is required. Suggestion: add a convention or hypothesis. The condensation product poly-R is formed at the hexameric site and deposited at the bilayer face. No diffusive timescale is assumed for partition. This removes the kinetic claim while retaining the result.

The side-chain fragment size is not specified. The transfer free energy calculation uses $\log P \approx 3.4$ (naphthalene) as a lower bound and 6.1 (chrysene) as an upper bound, with the body leading with the lower-bound figure ($-19\,\mathrm{kJ\,mol^{-1}}$). Proposition 5.1 describes the side chain as chrysene-derived, which could mean a full chrysene arm ($\log P \approx 6.1$) or a fragment of it. The appropriate estimate depends on which arm is severed at the transannular centre, a question that Article 62 addresses geometrically but does not resolve numerically for the partition calculation. This does not change the conclusion (both estimates give strongly spontaneous partition), but the leading figure should match the species being modelled. Suggestion: clarify which $\log P$ estimate is the appropriate one for the severed arm, and note that the range -19 to $-35\,\mathrm{kJ\,mol^{-1}}$ brackets the answer rather than bounding it from below.

Proposition 7.2 should note the frozen state at the fixed line. Proposition 7.2 (the ϱ-invariance through the loop) states the Möbius form with contraction factor $(1 + \beta - f_c)^{-1}$ and notes that $\varrho^* = 1$. It does not note that at the fixed line, where $f_c = \beta$, the contraction factor becomes 1: ϱ is frozen rather than contracting. This is not an error. The fixed point $\varrho^* = 1$ is well-defined and the invariance holds. But the frozen state is the operating condition at steady state (where $f_c = \beta$), and it matters for interpreting what the ϱ-invariance means on the fixed line versus approaching it. Suggestion: add a sentence to Proposition 7.2 or the following remark. At the fixed line $f_c = \beta$ and $\beta - f_c = 0$, the contraction factor is 1 and ϱ is frozen at its current value. The invariance is most active during the approach to the fixed line and exact (trivially) on it.

Remark 7.3 anticipates the Article 69 identity. Forward-reference is appropriate. Remark 7.3 (division signal) states: at $f_c = \beta$, $f \to Q(\alpha)^{-3/2}$ and division fires after exactly one cycle. This is the content of Article 69, Theorem (period), derived from the algebraic identity $v_{\mathrm{thr}} \cdot Q(\alpha)^{3/2} = 1$. The remark is correct but credits Article 69 only implicitly. A reader encountering the remark without Article 69 in hand may not recognise it as a non-trivial result. Suggestion: add a parenthetical. (This is the exact-period identity of Article 69, Theorem (period), derived from Article 64's definitions and first visible here.)

What should not be changed

Theorem 4.1 (functional valence) is the paper's cleanest local result. The proof is four lines, the scoping to Article 65's Theorem (norestore) is precise, and the valence-hierarchy remark (Remark 4.2) correctly places it as a finer refinement than the per-axis precedent of Article 66. The stacking energy bounds (Proposition 5.2). The range 3.8–8.4 $\mathrm{kJ\,mol^{-1}}$, the K_{eq} interval 5–29, and the sequestration fraction 82–97% are all consistent with the blocks and with standard PAH thermochemistry. The lower bound (naphthalene) and upper bound (pyrene/chrysene) bracket the expected value conservatively. The paper appropriately disclaims an exact calculation and names Target (pistack). Scholium 6.1 (rate condition cannot be circumvented by rate alone) correctly distinguishes fractions from rates and applies the Article 67 invariance at the right level of generality. Scholium 7.2 (two rings, two functions) is the correct architectural observation. One unit, one symmetry, two spacings, two functions. The diameter ratio $1.80 = 9.17\,\text{Å}/5.1\,\text{Å}$ is confirmed by the block values. The closing scholium (what the polymer is for). The first polymer clears the path is the honest characterisation of a structural homopolymer that does not fold, does not catalyse, and does not carry information. It should stay.

Summary of required and recommended actions

1. **Required.** Correct the algebraic expression in Proposition 8.3's proof: replace $4.76/(\alpha/(1-\alpha))$ with $0.524(1-\alpha)/\alpha$.
2. **Required.** Replace the falsification entry for Theorem 6.1 as described above.
3. *Recommended.* Qualify immediately in Proposition 5.1 with a kinetic convention or site-deposition argument.
4. *Recommended.* Clarify the appropriate $\log P$ estimate for the severed side-chain arm.
5. *Recommended.* Note the frozen ϱ at the fixed line in Proposition 7.2.
6. *At discretion.* Add a forward reference to Article 69's exact-period identity in Remark 7.3.

The reporter would re-review items 1 and 2 only.

References

[Art67] C. D. Schaper. The persistent lineage. *Annals of the Chrysene Formalism* 1(3):1405–1413, 2026. Article 67. DOI: `https://doi.org/10.68366/h6d6b415`.

Revision history

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v1.0	2026-10-17	Review record published with Article 68.

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