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Fission at the Closure Scale: Guest Area, the Curvature Floor, and Line-Tension Drive

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Declared conflict

The initial author-side check was prepared by the same system that drafted the manuscript and wrote its blocks. A subsequent independent referee report was prepared for the Editorial Board after the first-round revisions were incorporated. There is no author-reply section.

Scope of Review

The manuscript examines the membrane of the closure vesicle that Article 72 found at the end of the copy-number argument. It adds the area of the chrysene guests to the closure identity, replaces Article 64's conventional floor by a packing floor, and supplies Article 64's contact energy from Article 68's stacking energies. Its centre is the condition for division by line tension. The initial review found that the central negative result depends on the choice

of criterion and the omission of the Gaussian curvature modulus. Under an energy balance that the paper's own hypothesis admits, and with the Gaussian term the paper omitted, line tension suffices in four of six cases. The result is therefore open, not negative. The rest of the paper stands with corrections. Theorem 9.1 is the paper's most secure new result. Scholium 7.3, that securing copy number shrank the vessel toward the scale at which division becomes hard, survives as a statement about difficulty rather than impossibility.

Compiled disposition

Accept with minor revisions. The first-round required corrections (R1–R6) were incorporated, including the registration of the Gaussian modulus and the restatement of the division criteria. The independent referee confirms the principal results and notes residual hypothesis-renumbering items after the insertion of H5, a clarification in the proof of Proposition 8.1, and minor typographical items. No further computation is required. The central claim is now correctly stated as open, with a stated calculation that would close it.

Required before print

Production and synchronization items only. Synchronize the hypothesis labels H5–H8 after the insertion of the Gaussian modulus as H5, clarify the criterion (A) scaling in the proof of Proposition 8.1, and clear the typographical items listed by the independent referee.

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1 Initial author-side check: the central result depends on the criterion

R1 – The central result depends on the criterion

Theorem 7.1 takes Lipowsky's threshold $\gamma l > 8\kappa$, and Proposition 7.2 finds line tension short in every row. Two things in that premise are not forced. The threshold 8κ is the size at which a flat domain can no longer remain flat. The budded state is already lower in energy when the released line energy exceeds the bending energy of the bud, which gives $\gamma R \geq 2\kappa$, half the paper's requirement. The paper also omits the Gaussian curvature modulus κ_G. Division changes the topology and so changes the energy by $4\pi\kappa_G$; for lipid bilayers κ_G is negative and favours fission. Under the energy balance with the Gaussian term, line tension suffices in four of six cases. Required: add the Gaussian modulus as a registered hypothesis; state the division criterion as a choice and emit the propositions under the barrier-free threshold and under the energy balance, with and without κ_G; restate the abstract and related statements accordingly. The drive is marginal at the closure scale, fails under the barrier-free threshold, and succeeds under the energy balance with the Gaussian term at the stronger stacking.

Further required items from the initial check: R2 (H2 contradicts Proposition 8.2 on leaflet redistribution); R3 (Theorem 7.1's "if and only if" should be qualified by the inherited geometry); R4 (the ruling against Article 62 overstates the dispersion result); R5 (one footprint for every guest; the remnant may be smaller); R6 (Theorem 9.1 presupposes the drive).

2 Independent referee report on the revised manuscript

Independent assessment — Accept with minor revisions

A subsequent independent referee report was prepared for the Editorial Board after the first-round revisions (R1–R6) were incorporated. It recommends Accept with Minor Revisions. The report confirms five major results: guest area and relaxation of the existence condition; replacement of the conventional floor by a packing floor; calibration of contact free energy and domain line tension; scale-dependence of line-tension fission under three criteria; and spontaneous curvature specification together with environmental lipid set points. It notes that the $\sim 1/R$ scaling explains why a drive comfortable at 100 nm becomes marginal precisely because copy-number homeostasis compresses the vessel to 13.82 nm.

M1 — Hypothesis renumbering after insertion of H5

In Revision R1 the Gaussian curvature modulus was inserted as H5, shifting the downstream hypotheses by one index. Several references in the body text and registers still use the pre-shift numbers. Proposition 3.1(v), Proposition 5.1, Proposition 6.1, Theorem 9.1, Section 11.1 entries, Target 11.7 and Appendix C.2 should be updated to the new labels (packing floor becomes H6, contact energy H7, environmental lipid H8). Delete the drafting note at the end of Hypothesis 2.7 once the labels are updated.

M2 — Clarifying the criterion (A) scaling in Proposition 8.1

In the proof of Proposition 8.1 the text replaces the bending energy $8\pi\kappa$ of a bud in H4 by the spontaneous-curvature factor. Because $8\pi\kappa$ in H4 is the right-hand side of the energy-balance criterion (B), whereas criterion (A) is $\gamma l \geq 8\kappa$, state explicitly that the bending modulus κ in criterion (A) is dressed by the spontaneous-curvature factor $(1 - C_0 R/2)^2$.

M3 — Note on the shedding radius under criterion (C)

In Proposition 10.2 the shedding threshold under (C) is stated as $(4\kappa{+}2\kappa_G)/\gamma$. At $\kappa_G = -0.9\kappa$ this gives $l_C = 0.55\, l_B$, which reproduces the reported domain sizes exactly. The explanatory note at the bottom of Appendix D can be simplified or omitted, as the formula and the values are consistent.

Minor and typographical items from the independent report

1. In the table of Proposition 7.2 the entries under (B) and (C) are printed with percent signs instead of asterisks.
2. Corollary 4.2 prints $\rho \leq 1$ instead of $g \leq 1$.
3. Proposition 8.2 has a stray g before $|\delta| < 0.01$.
4. Proposition 9.2 cites “block 28” instead of “block Z8”.
5. The fifth column header in the table of Proposition 9.3 is printed as Γ. instead of r.
6. Several Greek symbols (ϕ, ϵ, κ, δ) and status labels fail to render or collide.
7. The heading of Appendix A appears orphaned because Table 1 floats. Add a one-line pointer.
8. Update the references to Articles 71 and 72 to their published titles and harmonize the issue and page numbers.

The independent report finds that these items do not affect the principal results. Guest area, the packing floor, the three division criteria, and Theorem 9.1 remain intact.

Recommendation

Accept with minor revisions. The first-round required corrections were incorporated. Synchronize the hypothesis labels after the insertion of H5, clarify the criterion (A) scaling in Proposition 8.1, and clear the typographical items noted by the independent referee. No further computation is required. The central claim is correctly stated as open, with a stated calculation that would close it.

References

[Hu12] M. Hu, J. J. Briguglio and M. Deserno. Determining the Gaussian curvature modulus of lipid membranes in simulations. *Biophysical Journal* 102(6):1403–1410, 2012.

[Art72] C. D. Schaper. Cycle integration. *Annals of the Chrysene Formalism* 1(3):1472–1483, 2026. Article 72.

Revision history

Version	Date	Notes
v1.0	2026-10-21	Review record published with Article 73.

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