ANNALS OF THE CHRYSENE FORMALISM
RESEARCH ARTICLE | AI-AUGMENTED PEER-REVIEWED | VOL. 1, NO. 3 | OCTOBER 2026

The Chrysene-Reachable Material Ledger

Species, Properties, and the Allocation of a Single Pool

Charles D. Schaper, Ph.D.
Chief Editor, Annals of the Chrysene Formalism
San Francisco, California, USA
editor@chrysene.com

Abstract. The cycle paper took its materials as given and derived none of them. Its ledger compiled what was absent by looking at the processes it used, and the fourth column so obtained held the condition on which its own principal result turned: a source of impermeant internal particles, without which a lineage buds a few dozen times and runs down. This paper compiles the same column by looking at the species instead.

Ten species are set against eight properties, each marked as attested by a figure of the filing, stated by the author, or yet to be discovered; the figure inventory is settled here once, so that later papers cite this section and not the filing. Seven transformations are given as partial maps, and what each preserves is computed. Valence once spent, two-sidedness once lost at the azo conversion, and the chrysene skeleton once converted are restored by no composite. Polarity, by contrast, is not determined by a species' provenance at all — templating carries an apolar unit to a polar nucleotide and excision carries it to a zwitterion — which is why it must be tabulated, and why a corpus tracking skeleton and substitution alone could not have seen what follows.

The transformations generate a digraph whose sources are the species produced by nothing and whose sinks are the species consumed by nothing. Retention is not production: the anchor is retained at templating and the initiator at polymerisation because each was present before, and modelling either as an output empties the source set and hides the input requirement entirely. The sources are the three chrysene species together with a heteroatom feedstock — four species the architecture consumes and does not make. The sinks are six, and every one of them partitions into the bilayer except the residue, which is zwitterionic and stays in the lumen.

That single exception carries the paper. *The residue is the architecture's only impermeant sink and therefore its only osmolyte*, and the requirement is of the same order as the membrane's material cost — twice it at a bud fraction of a tenth, a third of it at a fiftieth. The condition the cycle paper could not meet is met by a process the corpus already had: that paper's conservation argument was correct over the processes within its scope, and the residue lay outside it. The three demands on the pool are additive, no unit serving two; the allocation is dominated by the osmolyte, two thirds of the material going to particles that set a volume and a fortieth to the encoding; and the material budget argues for budding independently of the two arguments already on record. The result rests on residues remaining free in the lumen, which one observation would settle and which peptide formation would deny.

Keywords: Chrysene Formalism; material ledger; documentary hypothesis; species inventory; property preservation; reachability digraph; allocation; osmolyte; hypothesis register

1 Introduction

1.1 What the cycle paper assumed

The cycle paper took its materials as given. Its ledger listed four columns and argued nothing, and the fourth column — what is absent from the account — contained the condition on which its own principal result turned: a source of impermeant internal particles, which it could not locate and without which a lineage buds a few dozen times and runs down.

That column was compiled by looking at the processes the cycle paper itself used. The present paper compiles it by looking at the species, and the condition is met by one the cycle paper never considered because it belongs to a different article.

1.2 What this paper addresses

Four questions. What species the architecture involves, and what properties distinguish them. What each transformation preserves, and what no composite restores. Which species must be supplied, and which accumulate. And whether one pool can meet the demands of encoding, membrane and osmolyte at once.

Citation: Schaper, C. D. (2026). The Chrysene-Reachable Material Ledger: Species, Properties, and the Allocation of a Single Pool. *Annals of the Chrysene Formalism*, 1(3):1371–1383. https://chrysene.com/index.php/acf/article/view/65 © 2026 Charles D. Schaper. Distributed under the CC Attribution-NonCommercial-NoDerivatives 4.0. First published by Schaper Systems Press in the *Annals of the Chrysene Formalism*, Vol. 1, No. 3 (2026). ISSN 3144-2021.

The answers are: ten species against eight properties; polarity is the property no transformation determines from its source; the three chrysene species are the whole input requirement and every sink leaves the lumen but one; and the demands are additive, dominated by the osmolyte, and met at a computed rate.

1.3 What is established here, by kind

Recovered. The transformations and their products, from the patents and from the four preceding articles; the pool ratio and the genome length that set the scale of Section 8.

Proved here. That polarity is not functorial (Corollary 6.3); that valence, two-sidedness and the chrysene skeleton are restored by no composite (Theorem 6.4); that the source set is exactly the three chrysene species (Theorem 7.3); that every sink but the residue leaves the lumen (Corollary 7.6); that the three demands are additive (Theorem 8.2); and the feasibility inequality (Theorem 8.5).

Found. That the residue is the architecture's only impermeant sink, and therefore its only osmolyte (Theorem 8.4); that the cycle paper's waste corollary and its unmet condition have a single cause, which is the polarity of the sinks; and that the material budget argues for budding independently of the two arguments already on record (Corollary 8.6).

Computed here. Blocks V1 to V4 of Appendix B.

Supposed. That the residue is retained in the lumen as a free zwitterion, which is H1 and is the paper's exposure; and the documentary bundle, which is H2.

Not claimed. Everything at Section 3, and the whole of column B.

1.4 Organization

Section 2 fixes status, the patent citation rule and the column convention; Section 3 refuses six readings; Section 4 is the documentary bundle and settles the figure inventory once, so that later papers cite that section and not the filing.

Section 5 gives the objects, Section 6 the morphisms between them, Section 7 the reachability structure they generate, and Section 8 the allocation. Sections from 9 are the registers, the precedence entry, the targets and the conclusion.

2 Status, nomenclature, scope

Convention 2.1 (Status labels)**.** [A] As in the coordinating paper. [A] finite or axiom-free; [D] derived under named hypotheses, registered in Appendix A; [C] imported, with the source named; [E] molecular reading, entering no proof.

Convention 2.2 (Patent citation rule)**.** [A] Adopted verbatim from the chain-polarity paper. The documentary source is cited to a figure or an example and never to "the invention"; a sentence that quotes the filing is labelled [E] and does not enter a proof.

Convention 2.3 (Columns)**.** [A] Every species and every transformation carries a column mark. A is imported and figure-attested; S is stated by the author and not figure-attested; B is to be discovered.
No theorem may rest on a B entry. A theorem resting on an S entry says so where it is stated. The marks are given in Table 1 and are not repeated in the text.

Convention 2.4 (Scope)**.** [A] The object is the material inventory of one enclosure over one cycle. Nothing is asserted about the environment that supplies the pool, about the kinetics of any transformation, or about the mechanism by which a species is delivered to where it is used.

3 Non-implications

Proposition 3.1 (Non-implications)**.** [A] *None of the following is asserted anywhere below.*

(i) No uniqueness among polycycles. *That one species serves several roles is a reading of figures. It is not a theorem that no other skeleton would serve, and no enumeration over a formula class is attempted here.*

(ii) No identification of a membrane-bound tail with an initiator. *The corpus keeps that relation apart and it stays apart; a table of species by role invites the identification and does not make it.*

(iii) No claim that a column B transformation occurs. *The azobenzene conversion is undemonstrated, and Figure 9(c) is not read as attesting it.*

(iv) No production hypothesis. *The pool is a supply and this paper says nothing about where it comes from.*

(v) No claim that the allocation is realised. *Theorem 8.5 gives a requirement on the pool rate and the rate is not supplied.*

(vi) No chemistry is derived. *Every transformation is imported or named; none is obtained here.*

Scholium 3.2 (Why (i) and (ii) are stated together)**.** A ledger is a list of objects with their roles, and two over-readings follow naturally from such a list and are excluded here for the same reason.
The first is that a species which serves several roles must be the only one that could. The second is that two objects serving adjacent roles are the same object. Both convert a tabulation into a claim about necessity, and this paper tabulates.

4 The documentary bundle

This section settles the figure inventory once. Later papers cite this section and not the filing.

Hypothesis 4.1 (H_{mat})**.** [D] The bundle, as a closed list of clauses by figure. Each clause is [E] and enters no proof; the bundle as a whole is named wherever used.

(a) Figure 4 exhibits the three chrysene species together: the 6,12-di-, the 3,6,12-tri- and the 3,6,9,12-tetrasubstituted units.

(b) Figure 5 maps the encoding tables to the stacking alignment of the di- and tetrasubstituted units.

(c) Figure 6 exhibits the progression from the tetrasubstituted unit to nucleotide pairing, including the transition to sugar-ring formation and the tether complexes on both C and A coupled to disubstituted units; Figure 7 gives the bond-level transitions from the substituted unit to the nucleobase with its remnant.

(d) Figure 9(b) exhibits the tether complex constructions of the catalyst to A and to C; Figure 9(c) the same with the chrysene further modified.

(e) Figure 15 exhibits in three dimensions the catalyst remnant and its tether to adenosine.

(f) Figure 16(b) exhibits the bilayer relation with the 6,12-disubstituted unit.

(g) Figures 20 and 21 exhibit configurations of the tether complex within a nucleic acid bound into the lipid structure.

(h) Example 17 concerns the encoding of the membrane by the nucleic-acid–tether complex.

Remark 4.2 (What the bundle does not contain)**.** [A] No codon table. No identification of residues with amino acids. No azobenzene clause: the further modification of Figure 9(c) is the only documentary opening for one and is not read as such here, the conversion remaining column B. And no clause drawn from Figure 16(a).

Remark 4.3 (Figure 16(a) is superseded)**.** [A] Figure 16(a) exhibits an alternative fragmentation to amino acids which the corpus has since replaced. It is excluded from the bundle.
The exclusion is load-bearing and not housekeeping: Theorem 8.4 depends on residue formation, and a result resting on a superseded figure would rest the corpus's newest conclusion on its own retracted chemistry. The residue is imported from the residue account and from nowhere else.

Remark 4.4 (A discrepancy recorded, not resolved)**.** [A] The chain-polarity paper's bundle reads Figure 9(b) as exhibiting catalyst remnants presented as phospholipid-type heads. Clause (d) above reads Figure 9(b) as the tether complex constructions, and clause (f) assigns the bilayer relation to Figure 16(b).
If clause (f) is correct, that paper's bilayer clause names a figure which does not support it. The clause itself is supported — by Figure 16(b) — and only the citation is at issue. This paper uses the inventory above and does not amend a published article; the discrepancy is entered here so that a reader comparing the two bundles finds it recorded rather than concealed.

Remark 4.5 (What the inventory supplies that the corpus lacked)**.** [A] Four clauses are documentary ground the corpus has wanted and not had.
Clause (a) attests the three species together, which is the source set of Theorem 7.3. Clause (b) is the documentary basis for the orientational indexing that the enclosure paper imported as [C] and did not attest. Clause (c) attests the *cytosine* tether, which the corpus has used throughout and for which no figure had been cited — and attests the sugar-ring formation on which the polymerisation of the cycle paper depends. Clause (f) is the membrane figure the enclosure paper wanted.

5 Species

Definition 5.1 (Species and properties)**.** [D] A species is an object carrying eight properties: skeleton type; substitution set; valence, meaning the number of arms available for further bonding; two-sidedness, meaning whether the object has distinguishable faces; chirality; chromophore class, recorded as absorption and triplet accessibility; am-

Table 1: The inventory: thirteen species. Transcribed from block V1; "col" is the column of Convention 2.3.

id	species	val	2-sided	chiral	polarity	col
D	6,12-disubstituted	2	yes	no	apolar	A
T	3,6,9,12-tetrasub.	4	yes	no	apolar	A
I	3,6,12-trisub. init.	3	yes	no	apolar	A
Xh	heteroatom feedstock	0	–	no	polar	A
Su	sugar-bearing intermed.	2	yes	**yes**	polar	A
Nt	tethered nucleotide	2	yes	yes	polar	A
Z	substituted azobenzene	2	no	no	apolar	B
Z3	azo trimer connector	2	no	no	apolar	B
LA	route-A lipid	0	no	no	amphiphile	A
LC	route-C macrocycle	0	no	no	amphiphile	A
R	residue	0	no	yes	zwitterion	A
W	fragments and remnant	0	no	no	apolar	A
St	strand	0	–	yes	polyanion	A

phiphilicity; and polarity.

Remark 5.2 (Why polarity is carried)**.** [A] Because the cycle paper's osmotic argument turns on it and no earlier paper of this corpus records it. A species that stays in the lumen enters the particle count; one that partitions to the bilayer does not, and the difference decides whether a lineage runs down.
The property was invisible while the corpus tracked skeleton and substitution alone, and Theorem 8.4 is what it makes visible.

Remark 5.3 (The chiral source, and why it was missing)**.** [A] The sugar-bearing intermediate is the only chiral species the architecture produces before the residue, and it is chiral because the residue account transfers the configuration from the sugar through the tether.
A first inventory omitted it, listing ten species and no chiral precursor, and the property table then recorded the residue's chirality as arising at the excision — a creation of handedness from achiral material, which does not occur. The correction is recorded at Remark D.2.
The chirality of the residue is transferred and not created, along the path Su → Nt → R, and the inventory now contains every species on that path.

Remark 5.4 (The heteroatom feedstock)**.** [A] The chrysene skeleton carries carbon and hydrogen. Four transformations require more: the sugar ring takes oxygen, the nucleotide takes phosphorus, the azo conversion takes two nitrogens, and the residue takes nitrogen and oxygen.
The enclosure paper admits nitrogen from outside as a named premise and places oxygen and hydrogen rather than counting them. That convention is correct for a carbon ledger and wrong for a species inventory, in which anything consumed and not produced is a source. The feedstock is entered here as one species, without distinguishing its members, because no result below depends on which heteroatom is wanted where.

Remark 5.5 (Species promoted to column A)**.** [A] The initiator and the nucleotide were carried as author-stated and not figure-attested while the cycle paper was drafted. Clauses (a) and (c) of H_{mat} attest both, and they are entered here as column A.
The azobenzene and its trimer remain column B. Clause (d) attests a further modification of the chrysene and is not read as attesting that modification (Remark 4.2).

6 Transformations

Definition 6.1 (The transformations)**.** [D] Seven partial maps on the inventory: templating, scission by route A and by route C, azo conversion, trimerisation, excision, and polymerisation. Inputs and outputs are given at block V2.

Theorem 6.2 (Property preservation)**.** [D] *For each transformation, the properties of the product determined by those of the source. Skeleton type is determined in every case. Valence is determined and non-increasing. Two-sidedness is preserved by templating and destroyed by the azo conversion. Chirality is* transferred*: it enters at the sugar-bearing intermediate and passes to the tethered nucleotide and thence to the residue. No transformation creates it, and none could. Polarity is not determined by the source's: templating carries an apolar unit to a polar nucleotide, and excision carries it to a zwitterion.*

Corollary 6.3 (Polarity is not a function of polarity)**.** [A] *Polarity is not determined by the source's polarity alone: templating carries an apolar unit to a polar nucleotide and excision carries it to a zwitterion. It is of course determined by the source together with the transformation, as the table shows; the claim is only that it cannot be propagated along a chain without consulting each step.*
That is why Table 1 carries polarity as a column rather than deriving it, and it is why a paper enumerating its own processes — as the cycle paper did — may traverse the whole architecture without the property ever coming into view.

Theorem 6.4 (What no composite restores)**.** [D] *Three properties are absent from the codomain of every transformation that could supply them, and are therefore not recovered by any composite: valence once spent, there being no transformation that adds an arm; two-sidedness once lost at the azo conversion, no transformation producing a two-sided object from a one-sided one; and the chrysene skeleton once converted, the azo conversion being the only edge leaving it and no edge returning.*
This is the materials analogue of the one-way theorem of the signalling paper, and it is proved the same way: by exhibiting the property as absent from every codomain rather than by an argument about mechanism.

7 The reachability digraph

Definition 7.1 (The digraph)**.** [D] Let Γ have the species as vertices and the transformations as edges, an edge running from each input to each output. Retention is not an edge.

Remark 7.2 (Retention is not production)**.** [A] The distinction is not pedantic, and an earlier form of this section did not observe it.
The anchor is retained at templating and the initiator at polymerisation: each is present after the transformation because it was present before, not because the transformation made it. Modelling either as an output places the species in the image of an edge, removes it from the source set, and makes it appear self-supplying.
The whole of Theorem 7.3 — and with it the architecture's entire input requirement — is lost by that single modelling choice.

Theorem 7.3 (Sources)**.** [A] *The species produced by no transformation are four: the 6,12-disubstituted unit, the 3,6,9,12-tetrasubstituted precursor, the 3,6,12-trisubstituted initiator, and the heteroatom feedstock.*
The architecture consumes all four and makes none of them. *Clause (a) of H_{mat} attests the three chrysene species together; the feedstock is attested by no figure and is imported from the enclosure paper's premise.*

Proof. Finite; Appendix B, block V2, computed over the eight edges. □

Remark 7.4 (Three was wrong, and the way it was wrong)**.** [A] A first form of this theorem gave the source set as the three chrysene species alone and called that the architecture's entire input requirement.
Four of the eight transformations consume a heteroatom the skeleton does not carry — the sugar ring takes oxygen, the nucleotide phosphorus, the azo conversion two nitrogens, the residue nitrogen and oxygen — and none produces one. The error is recorded at Remark D.3.
It arose from importing the enclosure paper's convention without its scope. That paper places oxygen, nitrogen and hydrogen rather than counting them, which is correct for a ledger in carbon and wrong for an inventory of species, where anything consumed and unproduced is a source. *An input requirement of three carbon skeletons understated what the architecture needs, and understated it in a direction that flatters the account.*

Theorem 7.5 (Sinks)**.** [A] *The species consumed by no transformation are the two lipids, the azo trimer, the excised fragments, the residue, and the strand.*

Corollary 7.6 (Every sink but one leaves the lumen)**.** [A] *Of the six sinks, four are apolar and two are amphiphilic; all six partition into the bilayer except the residue, which is zwitterionic and impermeant, and the strand, which is a single particle however long it is.*
That single exception is why the cycle paper's waste corollary holds and why its condition C1′ can be met at all. *The two facts have one cause and were separated only because no paper had recorded polarity.*

8 The allocation

Proposition 8.1 (Three demands on one pool)**.** [D] *The 6,12-disubstituted unit is drawn upon by three processes at once: retained as the anchor that carries the encoding; scissioned to the lipid that makes the membrane; and excised to the residue that makes the osmolyte.*

Theorem 8.2 (Exclusion at the arm)**.** [A] *No unit serves two of the three demands.*
Anchor and residue are exclusive because the excision consumes the tethered complex, and a complex so consumed carries no encoding.
Residue and lipid are exclusive for a reason that must be argued rather than assumed, since the excision removes an arm and not a skeleton. The scission routes are defined by cut sets on a dimer whose substituted positions carry the bridge and the ether; route A in particular eliminates that ether to fix the retained unsaturation. A remnant that has lost one substituted position is not that substrate and route A has nothing to eliminate on it. The remnant is therefore

entered among the fragments and is not returned to the pool. The three demands are additive and admit no economy from dual use.

Remark 8.3 (What the exclusion is worth)**.** [A] The clause about the remnant is not incidental. Were an arm-excised unit a scission substrate, residue and lipid would overlap and the requirement of Theorem 8.5 would fall by up to the smaller of the two terms — at $\alpha = 0.10$ by 13,200 of 42,200 units, a third of the total.
The argument above turns on the scission routes being defined over substituted positions, which is the enclosure paper's construction and not an assumption made here. A reader who doubts it should read the theorem as giving an upper bound on the requirement rather than its value.

Theorem 8.4 (The residue supplies the osmolyte)**.** [D] *The cycle paper requires impermeant internal particles at a fractional rate $\alpha/(1-\alpha)$ per period, and found that every process it examined leaves the count unchanged or lowers it. The residue is zwitterionic, impermeant, and produced by a transformation the corpus already has.*
At $N \simeq 2.5\times10^5$ the requirement is 28,000 *residues per cycle at $\alpha = 0.10$ and* 5,100 *at $\alpha = 0.02$: twice the membrane's material cost in the first case and a third of it in the second.*
Of the same order as the membrane, not a different one.
Condition C1′ of the cycle paper is therefore met by a process already in the corpus, and that paper's lineage is bounded only because it did not look at its neighbour.

Proof. Finite; Appendix B, block V3, computed at five values of α. □

Theorem 8.5 (Feasibility)**.** [D] *Write R for the rate at which the pool supplies disubstituted units. By Theorem 8.2 the three demands are additive, so a steady cycle requires*

$$R \;\geq\; 5L \;+\; \frac{\alpha}{1-\alpha}N \;+\; \nu L$$

per period, with L the genome length and ν the pool ratio. At $L = 200$ and $\nu = 66$ this is 42,200 *units per cycle at $\alpha = 0.10$ and* 19,300 *at $\alpha = 0.02$. The allocation is then $(f_{\mathrm{anc}}, f_{\mathrm{res}}, f_{\mathrm{lip}}) = (0.024, 0.664, 0.313)$ and $(0.052, 0.266, 0.682)$ respectively.*
Over a lineage of the length the cycle paper computes — about forty buds at $\alpha = 0.10$ — the lifetime demand on one founder is of order 1.7×10^6 units. Whether any environment delivers that is not addressed here and is Target 12.2.

Proof. Finite; Appendix B, block V4, computed. □

Corollary 8.6 (A third and independent argument for budding)**.** [D] *The osmolyte demand is the only term of Theorem 8.5 that falls with α, and nothing rises. Small α is therefore cheaper in material and dearer in nothing.*
The cycle paper adopted budding on osmotic grounds and again on branching grounds; the material budget is a third argument, unrelated to either, for the same conclusion.

Remark 8.7 (The allocation is dominated by the osmolyte)**.** [A] At $\alpha = 0.10$ two thirds of the pool goes to residues and a fortieth to the encoding. That proportion should be stated plainly because it is unexpected: an architecture whose subject is an encoding spends almost none of its material on one, and most of it on keeping the enclosure at a size that can divide.
The reading is not that the encoding is cheap but that osmotic work is dear. A polymer of two hundred units is one particle; the particles that set the volume must be made one at a time.

Hypothesis 8.8 (Free residues)**.** [D] Residues are retained in the lumen as free zwitterions. Registered as H1 in Appendix A.

Remark 8.9 (The tension this premise stands in)**.** [A] Hypothesis 8.8 is assumed and not argued, and it stands against a reading the corpus has entertained elsewhere.
A hundred free residues are a hundred particles; one decapeptide made from ten of them is one. If residues condense, the count falls by the degree of polymerisation and the osmolyte is lost in that proportion. The architecture has been proposed as a scaffold for exactly such condensation — the juxtaposition that catalyses one polymer would catalyse another — so the two readings are not merely alternatives but are in direct tension, and this paper takes the one that suits its result.
That is stated here rather than in an appendix because Theorem 8.4 is the paper and this premise is the whole of what it rests on. Target 12.1 asks which reading obtains, and one observation settles it.

9 Consolidated register

Which species must be supplied?
Four: the three chrysene species and a heteroatom feedstock. The architecture consumes each and makes none.
Rests on: Finite (Thm. 7.3), block V2.
Standing: [A] Computed. The three chrysene species are attested at clause (a); the feedstock is not attested by any figure and is imported as a premise.

Which species accumulate?
Two lipids, the azo trimer, the excised fragments, the residue, and the strand.
Rests on: Finite (Thm. 7.5).
Standing: [A] Computed over the seven edges.

Do the sinks enter the osmotic balance?
Only the residue. Every other sink is apolar or amphiphilic and partitions into the bilayer; the strand is one particle however long.
Rests on: Cor. 7.6.
Standing: [A] The waste corollary of the cycle paper and its condition C1′ have one cause.

Is polarity determined by provenance?
No. Templating carries an apolar unit to a polar nucleotide and excision carries it to a zwitterion.
Rests on: Thm. 6.2, Cor. 6.3.
Standing: [A] It is why the property must be tabulated and why the cycle paper could not have found Thm. 8.4 from its own materials.

What does no composite of transformations restore?
Valence once spent; two-sidedness once lost at the azo conversion; the chrysene skeleton once converted.
Rests on: Thm. 6.4.
Standing: [D] Proved by absence from every codomain, as in the signalling paper.

Can one unit serve two demands?
No. Excision spends the arm the anchor requires, and scission consumes the whole unit. The three demands are additive.
Rests on: Thm. 8.2.
Standing: [A] No economy from dual use.

Is there a source for the osmolyte the cycle paper wanted?
Yes: the residue, at 28,000 units per cycle at $\alpha = 0.10$ and 5,100 at $\alpha = 0.02$ — the same order as the membrane's cost.
Rests on: Thm. 8.4, block V3.
Standing: [D] *Condition C1′ discharged*, subject to Target 12.1.

What does a steady cycle cost in material?
42,200 units per cycle at $\alpha = 0.10$ and 19,300 at $\alpha = 0.02$, for a 200 bp genome.
Rests on: Thm. 8.5, block V4.
Standing: [D] Computed; the pool rate R is not supplied here.

How is the material divided?
Two thirds to the osmolyte and a fortieth to the encoding at $\alpha = 0.10$.
Rests on: Rem. 8.7.
Standing: [A] Unexpected and stated as such: osmotic work is dear, not the encoding cheap.

Does the material budget bear on the division mode?
Yes, and in the same direction as two unrelated arguments: the osmolyte term is the only one that falls with α.
Rests on: Cor. 8.6.
Standing: [D] A third and independent argument for budding.

Is the azobenzene conversion attested?
No. Clause (d) attests a further modification of the chrysene and is not read as attesting that one.
Rests on: Rem. 4.2.
Standing: [A] Column B. No theorem here rests on it.

Remark 9.1 (The kinds, counted)**.** [A] Of the eleven entries above, seven are finite computations over the inventory and stand whatever becomes of any premise. Three are derived under named premises and one is a refusal. Two of the seven — the source set and the property preservation — were recomputed after the corrections of Remarks D.2 and D.3, and the count is taken after that recomputation and not before.
The proportion is higher than in the neighbouring papers, and the reason is that a ledger's content is enumeration. What is not enumeration is Theorem 8.4, and it carries the paper.

Scholium 9.2 (Where the trapdoor is)**.** The corpus asks of each paper whether a failure could leave the account intact and its conclusion false. Here it could, and the place is named.
Every structural statement of Sections 5 to 7 is enumeration over the inventory and is indifferent to where the residue goes. If residues do not remain in the lumen as free zwitterions — if they polymerise, partition, or leave — Theorem 8.4 fails, Theorem 8.5 loses its largest term, and the cycle paper's lineage is bounded after all. The inventory, the digraph, the sources and the sinks all stand unchanged.
The exposure is narrow, it is chemical rather than formal, and it is one observation.

10 Falsification register

Theorem 7.3
A transformation producing any of the four sources, which would remove it from the set and reduce the input requirement; or a fifth species consumed and unproduced, which the heteroatom correction of Rem. D.3 shows is the likelier direction of error.

Theorem 7.5, Corollary 7.6
A transformation consuming a listed sink; or a polar sink not listed, which would enter the osmotic balance and arrest the cycle.

Theorem 6.2, Corollary 6.3
A transformation whose product polarity is determined by its source's, which would make the property functorial and removable from the table.

Theorem 6.4
A composite restoring valence, two-sidedness, or the chrysene skeleton.

Theorem 8.2
A route by which one unit both retains its arm as an anchor and yields a residue; or a demonstration that an arm-excised remnant is a scission substrate after all, which would make residue and lipid overlap and reduce the requirement of Thm. 8.5 by up to a third (Rem. 8.3).

Theorem 8.4
Residues not retained in the lumen as free zwitterions — polymerised, partitioned, or exported. *This is the entry that matters*, and Scholium 9.2 says what survives it.

Theorem 8.5
A recomputation at block V4 disagreeing; or a pool rate below the stated total, which would make the region empty and the steady cycle unavailable.

Clause (d) of H_{mat}
A reading of Figure 9(c) that attests the azobenzene conversion, which would move it from column B to column A and license the mechanisms of the cycle paper that currently have no documentary support.

11 Precedence

Ruling 11.1 (Against the cycle paper)**.** [A] *Consistent, extending, with one condition discharged. That paper's C1′ names a process it could not locate; Theorem 8.4 locates it. The discharge is subject to Target 12.1 and is not unconditional.*

Ruling 11.2 (Against the enclosure paper)**.** [A] *Consistent; one premise may now be attested. That paper imports the orientational indexing as* [C] *without documentary support. Clause (b) of H_{mat} maps the encoding tables to the stacking alignment, which is documentary ground for it. Whether the clause suffices to discharge the import is a question for that paper and is not decided here.*

Ruling 11.3 (Against the residue account)**.** [A] *Consistent; a use supplied. That account establishes the residue and draws no consequence outside its own subject. Here the residue is the only impermeant sink and therefore the architecture's only osmolyte, which is a role it was not given and does not alter any result obtained there.*

Remark 11.4 (A discrepancy against the chain-polarity paper)**.** [A] Recorded at Remark 4.4 and not resolved here. That paper's bilayer clause cites Figure 9(b); clause (f) of H_{mat} assigns the bilayer relation to Figure 16(b) and clause (d) reads Figure 9(b) otherwise. The clause is supported either way and only the citation is at issue.

Remark 11.5 (What the earlier papers may now cite)**.** [A] Three entries.
That the three chrysene species are attested together at clause (a), so the input requirement of an architecture using any of them is a documentary fact and not an assembly of separate readings.
That the cytosine tether is attested at clause (c). The corpus has used it throughout — its length is the datum the signalling paper's readout resolves — and no figure had been cited for it.
And that Figure 16(a) is superseded, so any paper citing it for the residue should cite the residue account instead.

12 Targets, and conclusion

12.1 Targets

Target 12.1 (The fate of the residue)**.** Determine whether residues are retained in the lumen as free zwitterions. It decides Theorem 8.4, and through it whether the cycle of the neighbouring paper is bounded at a few dozen generations or steady. It is one observation and it is the first target of both papers.

Target 12.2 (The pool rate)**.** Supply R, the rate at which the environment delivers disubstituted units. By Theorem 8.5 the steady cycle exists iff R exceeds a computed total, and every other term of that total is now known.

Target 12.3 (Figure 9(c))**.** Determine whether the further modification exhibited there is, or is not, the azobenzene conversion. It decides whether column B has one entry or none, and with it whether the clock of the cycle paper has documentary support.

Target 12.4 (The 9(b) discrepancy)**.** Settle which figure supports the bilayer clause, and issue a correction to the chain-polarity paper if clause (f) is right.

12.2 Conclusion

Proposition 12.5 (What is established)**.** [A] *Subject to Appendix A:*

(i) An inventory of ten species against eight properties, with each entry marked as attested, author-stated or undemonstrated (Table 1).

(ii) What each of eight transformations preserves; that chirality is transferred from the sugar-bearing intermediate and created nowhere; and that polarity cannot be propagated along a chain without consulting each step (Theorem 6.2, Corollary 6.3, Remark 5.3).

(iii) That valence, two-sidedness and the chrysene skeleton are restored by no composite (Theorem 6.4).

(iv) That the input requirement is four species — the three chrysene skeletons and a heteroatom feedstock — and that retention is not production (Theorem 7.3, Remarks 7.2, 7.4).

(v) That every sink leaves the lumen except the residue, which is why the cycle paper's waste corollary and its unmet condition have one cause (Corollary 7.6).

(vi) That the three demands on the pool are additive (Theorem 8.2).

(vii) That the residue supplies the osmolyte, at the same order as the membrane's material cost (Theorem 8.4).

(viii) The material cost of a steady cycle, and the allocation that meets it (Theorem 8.5).

(ix) That the material budget argues for budding, independently of the two arguments already on record (Corollary 8.6).

Remark 12.6 (What is not established)**.** [A] No chemistry is derived. The transformations are imported or named, the azobenzene conversion is undemonstrated, and the pool rate is unsupplied. Theorem 8.4 is conditional on a localisation nobody has checked, and Scholium 9.2 says exactly how much depends on it.

Scholium 12.7 (What would overturn the paper)**.** Two findings.
Residues not retained in the lumen would remove the paper's one result that is not enumeration, leaving an inventory, a digraph and a set of demands that cannot be met. It is the likelier of the two and is one observation away.
A fifth species consumed and unproduced would extend Theorem 7.3 again. That is the less consequential of the two and the more probable: the theorem has already been wrong once in that direction (Remark D.3), and a ledger's characteristic error is to omit an input rather than to invent one.

A Hypothesis register

	premise	**what rests on it**	**what survives its failure**
H1	The residue is retained in the lumen as a free zwitterion (Hyp. 8.8); in direct tension with the condensation reading (Rem. 8.9).	Thm. 8.4, the largest term of Thm. 8.5, and the discharge of the cycle paper's condition C1′.	Everything else. The inventory, the property table, the digraph, the sources, the sinks and the additivity are enumeration and are indifferent to it (Sch. 9.2). One observation settles it.
H2	The documentary bundle H_{mat}: the figure readings of Hyp. 4.1.	The column marks of Table 1, and through them which theorems are permitted to stand.	The formal content. A misread figure moves a species between columns and changes what may be asserted, not what is true of the inventory as tabulated.
H3	The scale parameters: genome length L, pool ratio ν, particle count N, imported from the enclosure and cycle papers.	Every number in Thms. 8.4 and 8.5.	Both theorems, each being stated as a formula in L, ν, N and α rather than at their values.

Remark A.1 (Three premises, and only one that bites)**.** [A] H1 carries one theorem and nothing else carries it; H2 carries the column marks, which govern what may be asserted rather than what is the case; H3 carries numbers and no statements. A reader allocating scepticism should spend nearly all of it on H1.

B Verification

Each block recomputes its claim from an explicit structure and emits its own numbers. Nothing quantitative in the body is asserted.

V1 [COMPUTED] **The species inventory**

Thirteen species against eight properties, with the column mark of Convention 2.3.

```
id  species                                 val 2-sided chiral polarity   col
-------------------------------------------------------------------------------
D   6,12-disubstituted                        2    yes    no   apolar      A
T   3,6,9,12-tetrasubstituted                 4    yes    no   apolar      A
I   3,6,12-trisubstituted initiator           3    yes    no   apolar      A
Xh  heteroatom feedstock, N and P             0     --    no   polar       A
Su  sugar-bearing nucleoside intermediate     2    yes   YES   polar       A
Nt  tethered nucleotide with anchor           2    yes   yes   polar       A
Z   substituted azobenzene                    2     no    no   apolar      B
Z3  azo trimer connector                      2     no    no   apolar      B
LA  route-A dialkyl phosphate                 0     no    no   amphiphile  A
LC  route-C macrocycle                        0     no    no   amphiphile  A
R   residue                                   0     no   yes   ZWITTERION  A
W   fragments, including the spent remnant    0     no    no   apolar      A
St  strand                                    0     --   yes   polyanion   A
-------------------------------------------------------------------------------

Su is the CHIRAL SOURCE: chirality enters there and is transferred along
Su -> Nt -> R.  A first inventory omitted it and recorded the residue's
chirality as created, which cannot occur from achiral material.

R is the only ZWITTERION and the only sink that stays in the lumen.
```

V2 [COMPUTED] **The reachability digraph**

Eight transformations; sources and sinks, with polarity.

```
edge    transformation        inputs      outputs  note
-------------------------------------------------------------------
tau1    sugar-ring formation  T + Xh      Su       Fig. 6
tau2    tether complex        Su + D      Nt       Figs. 6, 9b
sigA    scission, route A     D + D       LA + W
```

```
sigC    scission, route C     D + D       LC
zeta    azo conversion        D + Xh      Z + W    column B; + 2 N
zeta3   trimerisation         Z + Z + Z   Z3       column B
eps     excision              Nt + Xh     R + W    chirality via Nt
pi      polymerisation        Nt + I      St       I incorporated
-----------------------------------------------------------------------

SOURCES  D (apolar), T (apolar), I (apolar), Xh (polar)
SINKS    Z3 (apolar), LA (amph.), LC (amph.), R (ZWITTERION),
         W (apolar), St (polyanion, one particle)

FOUR SOURCES, NOT THREE.  Four of the eight edges consume a heteroatom the
chrysene skeleton does not carry and none produces one.  An input
requirement of three carbon skeletons understated what is needed.

THE SINK POLARITIES ARE UNCHANGED by either correction: every sink leaves
the lumen except R, and the strand is one particle however long.  The
central result is untouched.

SPENT REMNANT.  The excision returns a chrysene that has lost a substituted
position.  The scission routes are cut sets on a dimer whose substituted
positions carry the bridge and the ether, and route A eliminates that ether;
a remnant lacking one is not that substrate.  The remnant is entered in W.
```

V3 [COMPUTED] **The osmolyte requirement**

Residues per cycle needed to restore what a bud removes, against the material cost of the membrane and the genome.

```
the mother must recover a fraction alpha/(1-alpha) of N per cycle
N = 2.52e5 ;  genome L = 200 bp ;  pool ratio nu = 66

 alpha   residues/cycle    x membrane cost   x genome cost
 ------------------------------------------------------------
  0.50       252000             19.1            252.0
  0.20        63000              4.8             63.0
  0.10        28000              2.1             28.0
  0.05        13263              1.0             13.3
  0.02         5143              0.4              5.1
 ------------------------------------------------------------
 membrane = nu.L = 13200 units ; genome + connectors = 5.L = 1000 units

At alpha = 0.10 the osmolyte costs twice the membrane; at alpha = 0.02, a
third of it.  The SAME ORDER as the membrane, not a different one.
```

V4 [COMPUTED] **The feasibility requirement and the allocation**

Total pool rate required per cycle, and the fraction each demand takes.

```
R  >=  5L  +  (alpha/(1-alpha)) N  +  nu.L        per cycle

 alpha = 0.10                    alpha = 0.02
 -----------------------------   -----------------------------
 anchor    1000   f = 0.024      anchor    1000   f = 0.052
 residue  28000   f = 0.664      residue   5143   f = 0.266
 lipid    13200   f = 0.313      lipid    13200   f = 0.682
 -----------------------------   -----------------------------
 total    42200                  total    19343

The osmolyte is the only term that falls with alpha and nothing rises, so
small alpha is cheaper in material and dearer in nothing.

At alpha = 0.10 two thirds of the pool goes to the osmolyte and a fortieth
to the encoding.
```

C Molecular commentary, isolated

Remark C.1 (Status of this appendix)**.** [A] Nothing here enters a numbered statement and no result is weakened by its removal.

Remark C.2 (The zwitterion)**.** [E] An α-amino acid is zwitterionic near neutrality and its permeability through a lipid bilayer is low, which is what Corollary 7.6 uses. The permeability is not zero, and over the tens of generations the cycle paper's lineage runs it need not be. Nothing

here estimates the leak, and a slow one would convert the discharge of C1′ from complete to partial.

Remark C.3 (Peptide formation)**.** [E] The tension between free residues and condensed ones is stated in the body at Remark 8.9, where it belongs, the result turning on it. What is added here is only that the condensation, if it occurs, would be catalysed by the same juxtaposition that catalyses the polymerisation of the strand — so the two are not independent processes competing for residues but one propensity acting on two substrates.

Remark C.4 (Scission consumes two units)**.** [E] Route A and route C both act on a dimer, so the lipid demand is counted in units and not in dimers throughout. The pool ratio ν is imported in the same convention.

D What was withdrawn in preparing this paper

Remark D.1 (Two figure attributions)**.** [A] An earlier form of the cycle paper's ledger assigned the interleaved slots to Figure 9(b) and the initiator to Figure 15(a). Both are withdrawn and the correct readings are at Hypothesis 4.1.
The withdrawal is recorded here rather than there because the inventory is this paper's subject, and because the same two figures are at issue in the discrepancy of Remark 4.4.

Remark D.2 (Chirality recorded as created)**.** [A] A first inventory listed ten species with no chiral precursor, and the property table then recorded the residue's chirality as arising at the excision.
Handedness does not arise from achiral material. The residue account obtains the configuration by transfer from the sugar, and the inventory omitted the species that carries it. The sugar-bearing intermediate is now entered and the chirality entry reads as transfer.
The error is recorded because the table was internally consistent and wrong: nothing in it flagged that a chiral product had no chiral ancestor, and only a comparison against the cited account exposed it.

Remark D.3 (The source set given as three)**.** [A] A first form of Theorem 7.3 gave the source set as the three chrysene species and called that the entire input requirement. Four of the eight transformations consume a heteroatom and none produces one.
The error came of importing the enclosure paper's convention without its scope: that paper places oxygen, nitrogen and hydrogen rather than counting them, which is right for a ledger in carbon and wrong for an inventory of species. It is recorded because the mistake ran in the direction that flatters the account, understating what the architecture must be given.

Remark D.4 (Retention as production)**.** [A] A first form of the digraph placed the anchor and the initiator in the image of the templating and polymerisation edges, on the ground that each is present after the transformation. The source set was then $\{T\}$ and the input requirement of Theorem 7.3 did not appear.
The error is recorded because it was invisible in the output — a digraph with one source is not obviously wrong — and because it would have removed the paper's second result while leaving its first untouched.

E Sources, by use

Remark E.1 (Status of this appendix)**.** [A] A concordance. It enters no proof.

source	used at	what is taken
patents	Hyp. 4.1, Table 1	The eight documentary clauses, by figure. Every column-A mark descends from one of them.
chain-polarity paper [Sch26a]	Conv. 2.2, Rem. 4.4	The patent citation rule and the form of a documentary bundle. Its Figure 9(b) reading is recorded as a discrepancy and is not used.

source	used at	what is taken
residue account [Sch26b]	Table 1, Thm. 8.4	The residue and its formation at the transannular centre. Figure 16(a) of the filing is superseded by that account and is not imported.
enclosure paper [Sch26d]	Thms. 8.5, 8.4	The scission routes and their products; the pool ratio ν.
signalling paper [Sch26c]	Thm. 6.4	The form of the one-way argument, which is reproduced here for species rather than arrangements. No result is drawn from it.
cycle paper [Sch26e]	Sec. 8	Condition C1′ and its rate; the genome length and particle count that set the scale.

References

[Sch26a] Charles D. Schaper. Chain Polarity of the Adenine Tether: Residual Frame Group, Documentary Realization of Sixty-Four, and the Patent Correspondence. *Annals of the Chrysene Formalism*, 1(2):914–925, 2026. Article 52. DOI: https://doi.org/10.68366/e22mm429.

[Sch26b] Charles D. Schaper. Configuration at the Transannular Centre: Uniformity of the Selected Branch over the Structure Series, and the Descriptor Pattern of the Twenty. *Annals of the Chrysene Formalism*, 1(3):1250–1278, 2026. Article 61. DOI: https://doi.org/10.68366/qf0vze43.

[Sch26c] Charles D. Schaper. Structural Adequacy for Signalling: The Chrysene–Nucleic Acid Complex as a Hybrid Channel, Scaffold Succession, and the Continuity of Directed Pathways. *Annals of the Chrysene Formalism*, 1(3):1321–1347, 2026. Article 63. DOI: https://doi.org/10.68366/0e3gsg12.

[Sch26d] Charles D. Schaper. The Enclosure via the Encoded Chrysene Cluster: Integrated Synthesis of Nucleic Acids and Phospholipids, and the Orientational Encoding of the Membrane. *Annals of the Chrysene Formalism*, 1(3):1279–1320, 2026. Article 62. DOI: https://doi.org/10.68366/24m3wx88.

[Sch26e] Charles D. Schaper. The Photoentrained Cycle: Existence and Stability of a Periodic Orbit in a Forced Hybrid Protocell. *Annals of the Chrysene Formalism*, 1(3):1348–1370, 2026. Article 64. DOI: https://doi.org/10.68366/h9rzkd75.