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

The Origins Arc:

A Coordinating Formalism for the Passage from the Substituted Chrysene Cluster to the Genetic Code

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Abstract. The carrier treated here is a π-stacked cluster of six substituted chrysene units, each set in one of two orientations, whose orientation pattern is its only datum. This paper coordinates, in one formalism, a continuous derivation from that carrier to a genetic code: to a reading length, to a bounded product repertoire, to a residue rooted at a named framework carbon and formed in a single configuration, to an exogenous element required at exactly two structures, and to punctuation. The derivation invokes no adaptive selection, no antecedent code and no external template, and the capacity argument uses no codon table at any step. The same architecture is specified in the filings as concurrently integrating and synthesising encoded nucleic-acid and phospholipid material, so that membrane, nucleic acid and residue are referred to one object; this paper records that specification and develops the coding branch.

Two cardinals are obtained from carrier structure rather than from the code. The reading length is three because a six-unit cluster carries three catalyst–substrate interfaces, each producing one nucleobase, so the codon follows from the cluster; the conventional derivation, from alphabet size to codon length, is shown to be unavailable within the formalism at every cluster length, the class count lying below the codon supply throughout. The product repertoire is bounded by $2^{2N-2} + 2^{N-1}$, which is twenty at three vessels, this being the dimension of the algebra of observables the carrier admits. *The result is a ceiling*; that it is attained requires totality and injectivity, which are stated separately and are not established.

The account is expressed as a mathematical formalism, which is the paper's apparatus rather than its presentation. The registry sequence is the coboundary of the orientation marker, so capacity is the dimension of an invariant algebra; localisation is support on the fixed locus of the reversal, a vertex at odd vessel count and an edge at even; admissibility of a slot set is independence in a transversal matroid; and the consistency relation is a monotonicity together with a factorisation. So expressed, the account admits proof. Two consequences follow that the corpus did not contain: a criterion deciding which reassignments preserve admissibility, and the result that every assignment admitting the consistency relation is regular, which places the observed mapping outside admissibility at two blocks, one of them the block carrying the start codon.

Every quantity is traceable to an explicit structure. Seventeen verification blocks recompute each numerical claim from a graph, a finite enumeration or an incidence; the atom provenance of the residue is complete; the decoration of all twenty structures is printed and audited by molecular formula and by valence at each retained vertex; and a hypothesis register states, for each of the account's eighteen premises, what rests on it and what survives its failure. The coordination yields ten findings across the corpus, four of them corrections, and two conventions are ruled.

What is not claimed is stated before the constructions. Twenty is a ceiling. The architecture yields a single configuration rather than a mixture, and identifying that configuration with the L series is a labelling supplied outside the architecture. The account of initiation holds in the assignment structural consistency selects, not in the observed mapping, and rests on a junction that no article establishes. One intended result, a redox demand functional over the structure series, is demoted to a target: two of its three inputs are now computed, and the parity of the partial balance is the evidence that the third is absent.

Keywords: Chrysene Formalism; coordinating review; registry coboundary; invariant algebra; equivariant localisation; torsor; transversal matroid; consistency relation; precedence ledger; hypothesis register; falsification register.

1 Introduction

1.1 What the corpus answers, and what it leaves

The corpus answers a cardinal and a length. A cluster of six sites has twenty frame classes; a product attributable to the assembly

Citation: Schaper, C. D. (2026). The Origins Arc: A Coordinating Formalism for the Passage from the Substituted Chrysene Cluster to the Genetic Code. *Annals of the Chrysene Formalism*, 1(3): 1163–1249. https://chrysene.com/index.php/acf/article/view/43 • © 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.

takes at most twenty values; and the codon length follows from the carrier rather than from any argument about alphabets. It then classifies the structures a vessel can carry, states which codons admit which, counts the admissible placements, and forces one. At a junction of two complexes it obtains two residues instead of one, a reagent that serves two carriers in a single event, and a datum that fixes a reading frame.

It leaves three things. It does not say which chemical species the twenty are — that identification lives in interpretive appendices that enter no proof. It does not decide between the assignment its consistency relation selects and the mapping that is observed. And it does not establish that a junction forms.

None of that is what this paper addresses. What this paper addresses is that the account is stated across eight articles, in five vocabularies, with its premises distributed among them, so that no reader — including one who has read all eight — has been able to see what any given answer rests on without assembling it.

1.2 Three functions

Coordinate. State the arc once, in order, with every premise registered in one place and every answer accompanied by what it rests on, what its standing is, and what would refute it.

Formalize. Supply one language in which the arc can be restated, so that constraints stated as lists become theorems about invariants and statements proved twice are seen to be one statement. Every part of the language carries a recovery lemma, and a part that fails to carry one is struck rather than retained as an improvement.

Fix precedence. Where two articles speak to one object and do not agree, say which governs, on a stated criterion, and record what the other now requires.

1.3 Objective

To restate the arc in one vocabulary without adding a premise to it; to count and register what it assumes; to report what the coordination finds; and — as this programme's experience recommends — to state exactly what each result rests on, so that a reader may see how much of the account survives the failure of each premise. Section 17 answers that at four weights and the answers are not alike.

1.4 What is established

Subject to the register of Appendix A, and distinguished by kind, since a review that presented all three alike would be claiming the corpus's results as its own.

Recovered. Restated in the language of Section 5, each with a recovery lemma: the class count as the dimension of an algebra of invariants; the constraint on what a product may read as a membership condition in that algebra; localisation at odd and even vessel count as one statement about a fixed locus; the frame, the cage and the junction as section-supplying data; admissibility as matroid independence; the consistency relation as a monotonicity and a factorization. Nothing is added to any of these and no hypothesis is amended.

Proved here. Forced regularity: every assignment admitting the consistency relation is regular, so the standard mapping lies outside admissibility at its two irregular blocks (Corollary 5.45). The decomposition of the demand functional into a skeletal term determined by the excision and a decoration term determined by the terminal data (Proposition 14.5). And two objects usually imported are reconstructed and thereby made checkable: the vessel graph, and transversality.

Applied here. The demand–class incidence is identified as a transversal matroid, and a standard exchange fact then decides which demand relocations preserve admissibility, where the corpus checks two instances (Theorem 5.35). The mathematics is textbook and is cited; the identification and its consequences are the contribution.

Strengthened. The conclusion that termination is not an assembly quantity is restated by fibre parity rather than by a named witness, which makes it independent of the letter assignment and hence true under all twenty-four (Corollary 9.13).

Found. Ten coordination findings, listed at Remark 18.3 and entered in Appendix C. Four are corrections: two letter assignments with a witness stated under one and cited under the other; one row of the structure series described two ways; a demand count given as seventeen and as eighteen; and a premise count that grows from grouped to atomised. Three are reconciliations of statements that look like conflicts and are not: that the product pathway is blind to a section the reading is not; that the parity obstruction predicts where the account of punctuation must sit; and that two routes to one pair of slots agree because the second derives what the first assumes. Two are identifications neither source performs. And one is a gap: the block carrying the start codon lies outside admissibility and no exchange of the corpus reaches it.

Assembled. Three statements that exist nowhere in one place: the consolidated register of what the arc answers and on what (Section 15); the contrast between a null excision that releases and a formation that fails to (Section 15.9); and, in the aggregated falsification register, the column saying what would *survive* each failure, which no constituent article can supply.

Ruled. Two conventions the corpus left unfixed: that the matched object of the admissibility matroid is the slot (C12), and that three rows of the structure series remove two vertices entire rather than severing two edges (C13). The second is a correction and carries three restatements to a published article of the corpus; the first moves one published count, and the restatement is carried with the ruling.

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Demoted. The paper was planned to carry one new result and does not. See Section 1.5.

1.5 What is not claimed

Section 3 states sixteen clauses before the constructions they guard. Four deserve mention here.

Twenty is a ceiling. The constant map satisfies both standing hypotheses and has an image of one element, so the whole distance from the bound to a count is carried by saturation, which is not established. And the bound is twenty only under initiator independence; otherwise it is thirty-two.

The L series is not derived. What the cage supplies is a section of a torsor — one configuration rather than a mixture. Naming that configuration requires the substituent ordering and a convention adopted outside the architecture, and a torsor admits no canonical naming of its own elements.

The observed start is not explained. The result holds in the assignment structural consistency selects; in the observed mapping no frame operation carries either codon of the first sulfur residue to the codon of the second. The dilemma is inherited whole.

The intended new result is withdrawn. The demand functional was to be evaluated at every structure of the series. It cannot be: the terminal types and heteroatom insertions are held in a supplementary record and not printed, and a residual valence filled by a hydrogen and the same valence filled by a carbonyl differ in index by two or three. The decomposition is proved, the skeletal input is computed for all twenty structures, and the rest is Target 14.13. The contingency was registered in advance and is taken.

1.6 Precedence

Two statements of the corpus *speak to one object* when the objects they quantify over admit a common instance; where two such statements are not both true of every common instance, the later governs. Four dispositions — superseded, re-scoped, promoted, consistent — are stated as definitions in Section 2.5, so that the ledger of Appendix C is a classification against a criterion rather than a list of judgements.

One call should be stated at the front because it runs against the grain. For the object it treats the junction development governs, and this paper cites it there. It is nonetheless entered as re-scoped and not as superseding the single-unit development, because the junction article itself states that the two describe different cells, that nothing forbids both, and that neither is evidence against the other. A coordinating paper that overrode that refusal would be asserting on its own authority a ranking the senior article declined to assert on its own. The asymmetry of premises is recorded instead: the junction buys its advantages with an assumption about assembly that no article supplies.

1.7 Organization

Section 2 fixes status, nomenclature and scope, and states the precedence principles. Section 3 refuses sixteen readings. Section 4 maps the corpus and says what is taken from where. Section 5 is the coordinating language and is the paper's apparatus; it is placed before the arc because everything after it is written in that vocabulary.

Sections 6 to 13 are the arc: the carrier; the passage to base four; the transformation and the documentary layer; why three and why twenty; reachability and handedness; the structure space and the consistency relation; placement; and the junction. Section 14 is the demand functional, in its demoted form.

Section 15 is the consolidated register and is the paper's centre of gravity. Section 16 treats the ordering problem and the limitation of a structure with one model. Section 17 aggregates the falsification registers and the targets; Section 18 concludes.

Appendix A is the hypothesis register and the dependency graph; Appendix B the verification, in fourteen blocks; Appendix C the precedence and audit ledger; Appendix D the corpus concordance; Appendix E the documentary layer, isolated; Appendix F the record of what was withdrawn in preparing this paper.

1.8 A note on the form of this paper

> **Scholium 1.1** (Why a review carries registers)**.** A review that carried a hypothesis register, a precedence ledger, a falsification register per section and a consolidated statement of what each answer rests on would, in most fields, be pedantry. Here it is the minimum.
> The structure the arc describes has one model. There is no second instance against which a reader could recover a conditional that has been dropped, so every conditional has to be carried explicitly each time or it is lost — and the corpus's own record shows how quickly that happens. A claim stated in a reading section and proved against the assignment it was supposed to be independent of. A proposition about release bounded only after a test was run against published tables. A witness stated under one letter assignment and carried into a corpus using another. A premise count given as twelve in prose and eighteen in a register.
> None of those was carelessness, and this paper adds one of its own to the list: an earlier form of Section 12 called

three marks on one block independent when two of them are not, and Appendix F records it. Each is the ordinary consequence of working on a structure that cannot be checked against a second copy of itself, and the registers are what stands between a conditional result and its unconditional restatement.

2 Conventions, status, and precedence

2.1 Status

Definition 2.1 (Status labels)**.** Every numbered statement of this paper carries exactly one label.

[A] Purely finite. Proved without reference to any axiom of the corpus and without any chemical premise. Every such statement is a computation over a graph on eighteen vertices, over a set of at most sixty-four words, over a finite family of substitution patterns, or over the twenty structures of the series; each is discharged in Appendix B.

[D] Derived under hypotheses named at the point of use and registered in Appendix A.

[C] Imported. Stated and not reproved; the source is named.

[E] A molecular reading. Enters no proof.

Scholia carry no label and enter no proof. The formal content of this paper is unchanged if every scholium is deleted.

Remark 2.2 (The label carries a licence, not a compliment)**. [A]** A statement labelled **[C]** is imported and is not thereby endorsed: this paper cites it, states what rests on it, and does not reprove it. A statement labelled **[A]** is finite and checkable and is not thereby important; several of this paper's **[A]** statements are arithmetic. The labels sort by what a reader must do to disagree, and by nothing else.

2.2 Nomenclature, and the substitutions this paper makes

Remark 2.3 (Why a concordance is needed)**. [A]** The arc is stated across eight articles written over a period in which its vocabulary settled. Three terms carry more than one sense somewhere in the corpus, two symbols collide, and one alphabet is assigned two ways. A coordinating paper cannot leave these to context: a reader meeting one vocabulary in this paper and another in a source will read both wrongly.

The substitutions below are made throughout this paper and are made in the direction the corpus's own later usage indicates, except where an explicit ruling is recorded.

2.3 Imported objects

Remark 2.4 (Stated and not reproved)**. [A]** The axiom system and the non-collapse of the marker; the frame group and the bijection between clusters and classes; the capacity theorem, whose restatement in this paper carries a recovery lemma; the tether word and the residual count; the letter assignment; the exhibited integrated product; the structure series with its retained sets and cut lists; the reachability development with its hypothesis packages; and that sulfur has no source within the carrier.
Two objects usually imported are reconstructed here instead, and are labelled **[A]** accordingly: the vessel graph, with its rings and degree sequence, and transversality. Appendix B, blocks R7 and R4a.

2.4 The hypothesis register

Remark 2.5 (Appendix A is the authority)**. [A]** Eighteen premises, atomised, together with two identifications that are neither premises nor results. Appendix A lists them with where each is stated, where used, what would discharge it, and what falls without it, and carries the dependency graph. No statement of this paper gives a premise count of its own.

2.5 Precedence: principles and dispositions

The corpus has developed to the point where two of its papers may speak to one object and say different things, and where a statement made early may have been made under a premise that a later paper shows to be narrower than it looked. A paper coordinating the whole is obliged to say which statement governs. It is equally obliged not to convert that obligation into a licence, and the principles below are written to separate the two.

Definition 2.6 (Seniority)**. [A]** Two statements of the corpus *speak to one object* when the objects they quantify over admit a common instance. Where two statements speak to one object and are not both true of every common instance, the later *governs*: it is the statement this paper cites, and the earlier is entered in the ledger of Appendix C.

Definition 2.7 (The four dispositions)**. [A]** Every ledger entry carries exactly one disposition.

term or symbol	the difficulty	this paper
cell	The corpus declines the word for a cluster or a vessel, reserving it for the reaction cell of the chrysene–adenosine development	Reserved likewise. *Cluster* for the six-site object, *vessel* for the adjacent pair, *reaction cell* where a reaction is meant
cluster, *vessel*, *codon*	—	Cluster: six sites. Vessel: one adjacent pair; three per cluster. Codon: three vessels
N against M	N counts vessels of a cluster and is three; the vessel count of a cell spanning a junction is six	N for the cluster, M for the vessel count of a cell. $M = 3$ for a codon cell, $M = 6$ for a junction cell
structure	Used in the corpus for the formal object and, in interpretive appendices, for a residue	Always the formal object: a connected subgraph containing the base point, with decorations. Where a species is meant, the interpretive appendix is cited
registry	Three senses in the corpus, kept apart there	The three are kept apart; no fourth is introduced
Δ	The production operator; also a coarsening selected by filters; also a localised cipher involution	Δ is the production operator only, never subscripted and never localised at a site. The coarsening is written φ and is not used
Cα, Cβ	The two arm carbons in one development; residue nomenclature in another, where Cβ is C5	**Ruling.** The arm carbons are C6α and C6β and this takes precedence; conflicting statements are restated, not reconciled by context. Unprefixed Greek locants are residue nomenclature, in which Cβ is C5
the letter assignment	Two are in use: one read off the filing, giving the partition $\{A, U\} \mid \{C, G\}$, and one giving the keto/amino partition	The filing's. Statements of the corpus about *which* codons lie in a class are assignment-dependent and are flagged where cited; counts are not
demand against *slot*	Stated as seventeen at one proposition and eighteen at the next	The ground set is the slot set. The convention is fixed here and the ambiguity entered in Appendix C

(a) Superseded. The later statement replaces the earlier on a common instance, and the earlier is not recoverable as a restriction of it. The earlier statement is withdrawn from citation, and every statement of the corpus that rests on it is entered as an audit item.

(b) Re-scoped. The earlier statement is true under a premise that the later paper shows to be narrower than it appeared. The earlier is recoverable as the restriction of the later, and is cited with its scope attached. Statements resting on the earlier are entered as audit items only where they use it outside that scope.

(c) Promoted. A premise of the earlier paper is a consequence in the later. The earlier statement is unamended and its conditional form remains correct; what changes is that the condition is discharged, and the discharge inherits the later paper's own premises.

(d) Consistent. The two statements appear to conflict and do not: they are true of different instances, or one supplies a mechanism the other requires. Nothing is withdrawn and no audit item arises. The entry exists so that the apparent conflict is met in the ledger rather than by a reader.

Definition 2.8 (Audit item)**. [A]** An *audit item* is a statement of the corpus that rests on a statement disposed Superseded, or that uses a statement disposed Re-scoped outside its scope. An audit item records what is to be re-examined and by whom; it does not assert that the statement is false.

Remark 2.9 (Three refusals)**. [A]** The apparatus above is narrower than it may appear and the narrowness is deliberate.
It does not adjudicate correctness. A disposition records how two statements of the corpus stand to one another. Where both are conditional on premises the corpus does not establish — which is the ordinary case across the arc — a disposition settles which is cited and settles nothing about which is true.
It does not rank papers. Seniority attaches to statements about a common instance, not to articles. Two papers may each govern the other on different objects, and Appendix C contains such a pair.
It does not licence a preference the corpus declines. Where a later paper explicitly refuses to rank itself against an earlier one, Definition 2.6 does not apply: the two do not speak to a common instance, and the entry is Consistent. A coordinating paper that overrode such a refusal would be asserting on its own authority what the senior paper declined to assert on its own.

Scholium 2.10 (Why the dispositions are definitions)**.** Stating the dispositions as definitions rather than as editorial practice has one purpose. A ledger written without them is a list of judgements and is read as such; a ledger written with them is a classification, and a reader who disputes an entry disputes a classification against a stated criterion rather than an opinion.
The corpus already keeps records of this kind within papers — the withdrawn claims, the transformation ledgers, the notes on what was found by deriving rather than asserting. Appendix C is the same instrument applied between papers, and it is the one thing this paper does that no constituent paper could have done.

2.6 Scope

Convention 2.11 (No external simulation)**. [A]** No statement of this paper is obtained from an electronic-structure calculation, a force field, or a geometry optimisation. What this forbids: any claim that a route or an arrangement is favourable; any barrier, rate or interaction energy; and any geometry not fixed by valence, by a separation stated as a datum, or by a rigid model declared as such. What it permits: exhaustive enumeration over finite sets; bookkeeping of atoms and of electrons derived from explicit bond lists; and figures reported as model values and never as structure. Numbered statements accordingly read *excluded*, *admissible*, or *forced* under the premises named. The word *favoured* occurs in no numbered statement.

Convention 2.12 (No chronology)**. [A]** Nothing in this paper asserts that any assignment, code, structure or stage preceded another. An exchange is a relation between two assignments and carries no direction in time. Section 16 states why the refusal is required by the architecture rather than adopted as a caution.

2.7 Verification

Remark 2.13 (Computed, transcribed, and entered as comparand)**. [A]** Fourteen blocks, R1 to R14, carry every quantitative claim, and the block is named in the proof. Three kinds of content are distinguished.
Computed. Derived from an explicit structure — a cochain complex, a graph, a finite enumeration, an incidence. Every conclusion of every block of this paper is of this kind.
Transcribed. Source data entered by hand: the retained sets, cut lists and parameters of the structure series, and the published slot adjacencies. Conclusions are computed from these, but a transcription error would pass undetected, and this is the one place in the paper's apparatus where that is true. It is mitigated where possible by independent agreement — the cut-list completeness check computed at R8 agrees with the published record, which a mistranscription would be unlikely to preserve.
Comparand. A published value entered so that the computation may disagree with it. A comparand is never an input to a conclusion.
The distinction is drawn because the corpus records that its own worst error came from a block that formatted an assertion with no computation able to disagree with it, and returned a parity that closed-shell chemistry cannot give. No block of this paper is of that kind.

3 Traps and non-implications

The clauses below are placed before the constructions they guard. Each names a reading the body invites and does not support.

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

(i) That any chemical species is identified in a numbered statement. *The objects of Sections 11 to 14 are subgraphs with decorations; their reading as residues is interpretive and enters no proof.*

(ii) That twenty is a count. *It is the dimension of an algebra of invariants and therefore a ceiling. The constant map satisfies both standing hypotheses and has an image of one element.*

(iii) That the number is twenty rather than thirty-two. *That depends on initiator independence, and a reader who declines it should read the paper as an account of thirty-two.*

(iv) That the architecture produces the *L* series. *It produces one configuration rather than a mixture; the naming is a labelling made outside the architecture.*

(v) That the observed start codon is explained. *The two sulfur-bearing structures are frame-related in the assignment structural consistency selects and not in the observed mapping.*

(vi) That the formation of a junction is explained. *It is a premise about assembly that no article of the corpus supplies.*

(vii) That anything is favourable. *Convention 2.11 forbids the claim and no energy is computed.*

(viii) That this paper establishes a new chemical or biological result. *Its results are a coordinating language with recovery lemmas, a precedence apparatus, and a set of consistency findings between articles. Its one intended new result is demoted to a target.*

(ix) That a recovery lemma is evidence. *A statement that follows from a restatement follows from what was restated. The recovery lemmas confer no independence on anything.*

(x) That the precedence ledger adjudicates correctness. *It classifies how two statements of the corpus stand to one another. Where both are conditional on premises the corpus does not establish, a disposition settles which is cited and nothing else.*

(xi) That the retention classification is exceptionless. *It holds at nineteen of twenty, and the obvious repair fails: an arc reaching one fusion vertex carries its fused ring and an arc reaching the other does not.*

(xii) That admissibility is evidence. *Two assignments occupy the same slots and the matching cannot see the difference.*

(xiii) That the counts of Section 12 are probabilities. *They are exhaustive counts over a finite set. No null model is posed and the uniqueness statement would be unaffected were the counts larger.*

(xiv) That the coordinating language of Section 5 adds anything to the arc's premises. *It introduces no hypothesis, discharges no target, and removes no conditional.*

(xv) That the block carrying the start codon is marked by three independent routes. *Two of the three agree because one derives what the other assumes; only the third is independent of both.*

(xvi) That the documentary material of Section 8 is worked. *The strand-identity claim and the concurrent provision of bilayer material are reports of filings, are addressed by no article, and enter no proof.*

Scholium 3.2 (The three a reader is most likely to over-read)**.** Clauses (ii), (iv) and (v) bound the account at the three places it is most often summarised past.
Clause (ii) states where the substance ends. The mathematics gives a ceiling; that the ceiling is attained is the assertion that the system uses its capacity, and it is a hypothesis. Every restatement in this paper says ceiling before it says count.
Clause (iv) states what the handedness argument delivers. One configuration rather than a mixture is a substantive conclusion reached from the geometry of the stack. Which configuration is a question about a labelling convention and not about the architecture, and no argument of this kind could answer it.
Clause (v) states what the account of initiation reaches. It obtains a start codon in an assignment the corpus selects and does not establish against the observed code. That is narrower than an explanation of the observed start, and it is narrower in a way no argument here repairs.

4 The corpus, mapped

4.1 The layers

Remark 4.1 (What each layer supplies to this paper)**. [A]** The corpus develops in layers, each taking the previous as given. The layers are not a chronology of publication.
Foundations. The axiom system and the status vocabulary [Sch26h], with the survey placing the first volume [Sch26g]. This paper adds no axiom and uses the foundations only to record that.
The stack and its registry. The encoded stack as a frame-indexed base-four structure [Sch26k]; the twenty registry classes as frame orbits [Sch26n]; the coarsenings of the code by those classes, which supplies the partition criterion and the letter assignment. Sections 5 to 7 rest here.
Capacity. Why three and why twenty: the capacity of a cluster, the base-four intermediary, and the production operator. Section 9 rests here, and Section 5.1 restates its central results as statements about an invariant algebra.
Assignments. Seeded assignments with transversality and third-position refinement; transverse seeding as a decision rule; class-functional assignments [Sch26c]. Section 12 draws on these through the origins development rather than directly.
The carrier. The chain polarity of the adenine tether; cage-constrained reachability in π-stacked chrysene–adenosine systems, with stereochemical selection and local transformation invariance. Section 10 is this layer.
The refinement. The two resolutions of the standard and mitochondrial mappings; the chrysene–adenosine reaction cell and margin geometry. Section 11 uses the failure-mode distinction; Section 16 records an open conflict with the first of these.
The origins transition. The passage from the encoded cluster to the code mappings: the consistency relation, the structure series, the placement, and the two statements the arc leans on hardest — that exactly two structures require an element the carrier cannot supply, and that their placement is settled only under a hypothesis about the medium. Sections 11 and 12 are this layer.
The sulfur pair. Two developments, one placing both residues on a single unit and one at a junction of two. Section 13 is the second; Appendix C, entry C4, states how the two stand to one another.

4.2 What this paper takes, by source

source	used at	what is taken
Foundations [Sch26h]	§2	That no axiom is added; the status vocabulary
Registry classes [Sch26n]	§§5, 7	The frame group; the class set; the stabiliser refinement
Coarsenings [Sch26d]	§8	The letter assignment, as an import; the keto/amino assignment, as the comparand of an audit item
Capacity [Sch26p]	§§5, 9	That a unit is a vessel and a codon three vessels; localisation; the class count; parity
Chain polarity [Sch26b]	§8	The tether word and the residual count
Reachability [Sch26a]	§10	The reference transformation, the canonical word, the stereochemical apparatus, the transport theorem
Refinement [Sch26i, Sch26j]	§§11, 16	The term *reaction cell*; the conflict recorded as C9
Origins transition [Sch26l]	§§11, 12	The structure series and its rows; the consistency relation; slots, demands and the complementarity count; the exogenous pair
Seeded assignments [Sch26e, Sch26f]	§12	The seed map, deficiency, and the published witness
Sulfur pair, single unit [Sch26m]	§13, App. C	The disulfide, the bridged intermediate, the staging, the balance method
Sulfur pair, junction [Sch26o]	§13	The junction cell, the two residues, the bridge, the frame datum, the start and the stop
The filings [Sch25a, Sch25b]	§8	The letter assignment's provenance; the exhibited integrated product; the strand-identity and bilayer claims, recorded and not used

4.3 What this paper does not use

Remark 4.2 (Deliberate omissions)**. [A]** Four bodies of work in the corpus are not drawn on and their absence is deliberate.

The seeding and refinement apparatus beyond what Section 12 requires: this paper takes an assignment as given and does not re-derive it or enter the question of which seed produces it.

The variational criterion and the filter selection: no coarsening is selected here, and the coarsening is kept distinct from the production operator throughout.

The margin geometry, beyond the term it supplies; the stacking datum Section 13 needs is a separation and not a margin.

And the survival programme, to which nothing here bears.

4.4 The standing accounts

Remark 4.3 (Why this subsection is here)**. [A]** A technical article may develop a formalism without situating it. A review may not: its genre commitment is to say what the account explains that others do not, and what others explain that it does not.

The corpus is hermetic in this respect. Its articles cite the external literature on the origin of the genetic code once, and this paper as first drafted cited it not at all. The subsection is added because the omission is not a citation gap but a missing comparison, and because three of the arc's answers have direct competitors.

Nothing below argues that any standing account is wrong. The purpose is to state what is at issue.

Remark 4.4 (The five families)**. [C]** Accounts of the code's structure fall into families that are not mutually exclusive and are often combined.

Frozen accident [Cri68]. The assignment is arbitrary and is fixed because any change is catastrophic for an established proteome. This is the null against which the others argue.

Stereochemical [Woe65, YWK09]. Codons or anticodons bear a physical affinity for their cognate residues. In vitro selection of RNA aptamers reports codon or anticodon enrichment at the binding sites of several amino acids, and the evidence is partial rather than comprehensive.

Coevolution, or biosynthetic expansion [Won75]. The code grew as amino-acid biosynthesis grew, a precursor ceding part of its codon block to its product, so that block relationships track biosynthetic families.

Error minimisation [FH98]. The code is arranged so that mistranslation and point mutation tend to substitute residues of similar character. The canonical code is better on such a cost than the overwhelming majority of randomly generated alternatives.

Prebiotic availability [Mil53]. The residues are those a prebiotic chemistry supplies, and abiotic syntheses yield a subset of the twenty preferentially.

Remark 4.5 (What is at issue, answer by answer)**. [A]** The arc's answers stand differently against these. Four cases, and they are not alike.

The triplet. The standing derivation is from alphabet size: sixteen doublets will not carry twenty residues. Section 9 shows that derivation is unavailable *inside this formalism*, the class count lying below the codon supply at every length. That is a statement about the formalism and not an argument against the standing account. The two derivations are compatible and reach the same number by different routes; nothing distinguishes them observationally.

Twenty. Error minimisation and prebiotic availability both bear on the number without requiring a carrier at all. The arc's contribution is of a different kind: a *ceiling* from the

structure of a carrier, with saturation left as a hypothesis. A reader who holds an adaptive account of the number is not contradicted by the ceiling, and the arc does not argue against them.

Initiation and termination. Here the arc is in genuine tension with the standing view, which locates both in the translational apparatus — initiator tRNA and initiation factors, release factors — rather than in any property of the codon. Two things should be said plainly. The arc's own parity result *derives* that punctuation cannot be an assembly quantity and must live at the reading level, which agrees with observation and is a point in its favour. But the junction account then proposes a carrier-level origin for the start datum, which the standing view does not require and for which no independent evidence is offered.

The sulfur pair. This is the sharpest conflict. Coevolution schemes generally place methionine and cysteine *late*, methionine as a derived residue of the aspartate family; the arc gives them the junction, which is an architecturally primitive role. The two cannot both be right, and the arc's refusal of chronology (Convention 2.12) does not dissolve the conflict, the coevolution claim being about derivation and not only about time.

The conflict should nonetheless be stated symmetrically, because the two claims rest on evidence of the same character. What is measured in the coevolution case is the biosynthesis of these residues in *extant* organisms; the step from that to an assignment order in a primordial code is an inference from present metabolism to a past event, and it is not independent of the code it is used to explain. The arc's claim rests on an architecture that has not been exhibited. Neither is direct evidence about the origin, and a reader who treats the coevolution ordering as settled is granting it a standing its own literature does not claim for it.

Remark 4.6 (One respect in which the arc differs in kind)**. [A]** A feature common to all five families should be stated before the comparison is drawn, because it bears on what any of them can establish.

Each infers the origin of the code from the code. The stereochemical argument reads affinities against the assignment it explains; the coevolution argument reads biosynthetic families against the blocks they are said to have produced; error minimisation scores the observed table against randomised tables; the frozen accident is a statement about the observed table's persistence. Each is, in the sense of Section 16, an account with one model, and each is calibrated against that model.

The arc is in the same position with respect to the code and in a different position with respect to its carrier. Its carrier-level statements — the capacity ceiling, the locality of a product in its class, the remnant level of a self-sufficient cell, the ceiling at four interfaces — are checkable without consulting a codon table at all. No standing account offers a statement of that kind, because none posits a carrier.

That is not an argument that the arc is correct. It is a statement about where its evidence would have to come from, and about the fact that such evidence is available in principle to it and not to the others.

Remark 4.7 (What would distinguish them)**. [A]** The honest summary is short. On the triplet and on twenty the arc offers a second route to a number and no distinguishing observation. On initiation the standing account is better supported and the arc's is more specific. On the sulfur pair the two are in conflict and neither side's evidence is direct. What the arc predicts that no standing account does is confined to the carrier: the remnant level of a self-sufficient cell, the ceiling at a cluster of four interfaces, and the locality of a product in the product of its class. None of the five families says anything about these, because none of them posits this carrier.

That is the correct statement of the arc's position. It is not a competitor to the standing accounts on their own ground, and it does not need to be. It is a claim about a specific molecular architecture, which *if that architecture existed* would fix several quantities the standing accounts explain otherwise — and, unlike them, it can be tested against the architecture rather than against the code.

Remark 4.8 (Prior art within this author's work)**. [C]** The hypothesis that a residue arises as a derivative of a fused four-ring aromatic, and several candidate mappings of codons to residues, precede the corpus [Sch20b, Sch20a]. What was not settled there is recorded in the interpretive appendix of the origins development: the identity of the aromatic, the substitution pattern, the entry point, the origin of the backbone carbons, and the fragmentation. No inference is drawn here from the number or the duration of earlier attempts, such attempts being evidence about a search and not about its outcome.

Scholium 4.9 (How far back the arc rests)**.** A reader tracing any result of Sections 9 to 15 backwards reaches one of four things: a premise of Appendix A, the structure series, the vessel graph, or an import.

The graph is combinatorial and is reconstructed in this paper. The series is the source of the consistency relation's hypotheses and is therefore not their confirmation, which the corpus records and Section 16 restates as the arc's deepest limitation. The imports are named in Remark 2.4. And the

premises are eighteen, of which one — that a junction forms — is supplied by no article.
Nothing rests on anything else.

5 Formal preliminaries: the coordinating language

The constituent papers of the arc state their results in five vocabularies: orbits of a permutation group, a parity argument on vessel counts, a torsor without a base point, a bipartite matching, and a pair of chemical hypotheses on registers. The results are consistent, and several of them are the same result twice. This section supplies one language in which the arc can be restated, and it is the whole of what this paper adds to the apparatus of the corpus.

Nothing here is a new premise. Every subsection closes with a *recovery lemma*, discharging the obligation that the constituent paper's own statement be a corollary of the formulation offered here; a definition or theorem that fails to carry one is to be struck rather than retained as an improvement. Remark 5.50 states what the language does and does not do, and Section 5.7 is its falsification register.

Remark 5.1 (The five parts do not carry equal weight)**. [A]** A reader is entitled to know, before reading them, which parts of this section yield a statement the corpus does not contain and which supply vocabulary. They are not the same, and presenting them alike would overstate the section.
Vocabulary. Sections 5.1 and 5.2 restate what the corpus proves. What they add is that two pairs of statements are seen to be one statement apiece — the class count with the constraint on the production operator, and localisation at odd count with localisation at even. That is worth having and it is not a new result. Section 5.3 is vocabulary throughout, and one of its three intended instances fails and is demoted (Remark 5.29).
New statements. Sections 5.4 and 5.5 each yield one: a criterion deciding which demand relocations preserve admissibility, where the corpus has two checked instances; and the forcing of regularity on every assignment admitting the consistency relation, which the corpus does not state.
Both are consequences of an identification rather than of new mathematics. The mathematics they use is standard and is cited.

Remark 5.2 (What the cohomological framing does and does not buy)**. [A]** The site complex is a path, hence a tree, hence $H^1 = 0$ at every length. There is therefore no case arising in this corpus at which the cohomological formulation would distinguish something that elementary linear algebra over $\mathbf{F}_2$ would not, and the framing should not be defended as though there were.
What it buys is two things and they are modest. It names the gauge group as H^0 rather than as a group that happens to have order two, which makes Corollary 5.9 a statement about invariance rather than a check. And it makes the vanishing of H^1 an explicit hypothesis of the argument rather than a silent one, so that a reader who proposes a carrier whose index complex is not a tree knows at once which step fails.
A reader who prefers the linear algebra loses nothing. The results of this subsection are unchanged under that reading and Recovery 5.11 is unaffected.

Every statement of this section is **[A]** , purely finite and proved without reference to any axiom of the corpus and without any chemical premise, except where marked **[C]** as an import or **[D]** as derived under a named hypothesis. Each is discharged by a block of Appendix B.

5.1 The marker complex and the registry coboundary

The corpus records that a product of a cluster is a function of the registry sequence — the agreements and disagreements of adjacent units — read modulo end-to-end reversal, and of nothing else; and, separately, that the number of frame classes is $2^{2N-2} + 2^{N-1}$. These are one statement, and the following exhibits them as such.

Definition 5.3 (The site complex and its cochains)**. [A]** Let P_{2N} be the simplicial path complex on the ordered site set $\{n_1, \dots, n_{2N}\}$, with 1-simplices $\{n_i, n_{i+1}\}$ for $1 \le i \le 2N-1$. Over $\mathbf{F}_2$ write

$$C^0 = C^0(\mathsf{P}_{2N}; \mathbf{F}_2) \cong \mathbf{F}_2^{2N}, \qquad C^1 = C^1(\mathsf{P}_{2N}; \mathbf{F}_2) \cong \mathbf{F}_2^{2N-1},$$

and let $\delta \colon C^0 \to C^1$ be the coboundary,

$$(\delta m)_i \;=\; m_i + m_{i+1}, \qquad 1 \le i \le 2N-1.$$

A marker assignment is an element $m \in C^0$; its registry sequence is $D(m) = \delta m \in C^1$.

Notation 5.4. [A] Write $\mathbf{1} \in C^0$ for the constant cochain. Let $\mathrm{flip} \colon C^0 \to C^0$ be $m \mapsto m + \mathbf{1}$ and let $\sigma \colon C^0 \to C^0$ be the reversal $(\sigma m)_i = m_{2N+1-i}$. Let $\rho \colon C^1 \to C^1$ be $(\rho D)_i = D_{2N-i}$. Put $\mathrm{Fr} = \langle \mathrm{flip}, \sigma \rangle$.

Proposition 5.5 (The gauge group is H^0)**. [A]** $\ker\delta = \{0, \mathbf{1}\}$*, so* $H^0(\mathsf{P}_{2N}; \mathbf{F}_2) \cong \mathbf{F}_2$ *and* $\langle\text{flip}\rangle$ *is precisely the group of translations of* C^0 *by* H^0*. Moreover* P_{2N} *is a tree, so* $H^1(\mathsf{P}_{2N}; \mathbf{F}_2) = 0$ *and* δ *is surjective. Consequently* δ *induces an isomorphism*

$$\bar{\delta}\colon C^0/H^0 \xrightarrow{\sim} C^1, \qquad \dim_{\mathbf{F}_2} C^1 = 2N - 1.$$

Proof. A cochain m has $\delta m = 0$ if and only if $m_i = m_{i+1}$ for every i, that is if and only if m is constant; over $\mathbf{F}_2$ the constants are $\{0, \mathbf{1}\}$. Hence $\dim\ker\delta = 1$ and $\dim\operatorname{im}\delta = 2N - 1 = \dim C^1$, so δ is onto and $H^1 = 0$. Appendix B, block R1, computed. □

Lemma 5.6 (Equivariance of the coboundary)**. [A]** $\delta\circ\text{flip} = \delta$ *and* $\delta \circ \sigma = \rho \circ \delta$*. Hence* δ *descends to the quotient by* $\langle\text{flip}\rangle$ *and intertwines the residual* σ*-action with* ρ*.*

Proof. For the first, $(\delta(m + \mathbf{1}))_i = (m_i + 1) + (m_{i+1} + 1) = m_i + m_{i+1}$. For the second, $(\delta(\sigma m))_i = m_{2N+1-i} + m_{2N-i} = (\delta m)_{2N-i} = (\rho\,\delta m)_i$. Appendix B, block R1, computed. □

Definition 5.7 (Gauge-invariant observable)**. [A]** Let k be a field. A function $f\colon C^0 \to k$ is *gauge invariant* when $f \circ \text{flip} = f$, and *admissible* when in addition $f \circ \sigma = f$. Write $\mathrm{Inv}_{\mathrm{Fr}}(k)$ for the k-algebra of admissible functions.

Theorem 5.8 (The invariant algebra and its dimension)**. [A]** *Every gauge-invariant function on* C^0 *factors uniquely through* $D = \delta$*, and every admissible function factors uniquely through the composite*

$$C^0 \xrightarrow{\delta} C^1 \longrightarrow C^1/\langle\rho\rangle.$$

The k*-algebra* $\mathrm{Inv}_{\mathrm{Fr}}(k)$ *is therefore isomorphic to the algebra of* k*-valued functions on* $C^1/\langle\rho\rangle$*, and*

$$\dim_k \mathrm{Inv}_{\mathrm{Fr}}(k) = \left|C^1/\langle\rho\rangle\right| = \tfrac{1}{2}\left(2^{2N-1}+2^N\right) = 2^{2N-2}+2^{N-1},$$

which is 20 *at* $N = 3$*.*

Proof. Gauge invariance is invariance under translation by $\ker\delta$, so a gauge-invariant function is constant on the fibres of δ and factors uniquely through C^1 by Proposition 5.5. Admissibility adds invariance under the residual involution, which by Lemma 5.6 acts on C^1 as ρ; the factorization through the orbit set is then the universal property of the quotient. For the count, ρ is an involution of a set of size 2^{2N-1} whose fixed points are the palindromic sequences of length $2N - 1$, of which there are $2^{\lceil(2N-1)/2\rceil} = 2^N$; the orbit-counting lemma for the two-element group [Bur11, Rot95] gives $\frac{1}{2}(2^{2N-1}+2^N)$. At $N = 3$ this is $\frac{1}{2}(32 + 8) = 20$. Appendix B, block R2, computed. □

Corollary 5.9 (The excluded arguments)**. [A]** *No coordinate function* $m \mapsto m_i$ *is gauge invariant, since* $m_i(\text{flip}\,m) = m_i + 1$*. No function distinguishing the two ends of the site set is admissible, since* σ *exchanges them. In particular the absolute placement of a single unit, and the designation of an end, are not admissible arguments of any product.*

Proposition 5.10 (The natural invariants, and why there are three)**. [A]** *On* C^1 *the involution* ρ *has the following structure, and the three scalars the corpus employs are exactly the data it supplies.*

(i) The Hamming weight $|D|$ *is* ρ*-invariant and takes* $2N$ *values, so it does not separate* $C^1/\langle\rho\rangle$ *for* $N \geq 2$*.*

(ii) The isotropy of D *under* $\langle\rho\rangle$ *is non-trivial precisely when* D *is palindromic; the orbit has size two in that case and four in the corresponding* Fr*-orbit on* C^0*, and size four otherwise.*

(iii) ρ *fixes exactly one coordinate of* C^1*, namely the index* N*. The function* $D \mapsto D_N$ *is therefore the unique admissible coordinate.*

At $N = 3$ *the fixed coordinate is* D_3 *and the weight takes the six values* $0, \ldots, 5$ *with fibre sizes* $1, 3, 6, 6, 3, 1$*.*

Proof. (i) and (iii) are immediate from the definitions of $|\cdot|$ and ρ; the fixed coordinate of the reversal of $2N - 1$ indices is the central one, $i = 2N - i$ giving $i = N$. (ii) is the orbit–stabiliser theorem for a two-element group. The fibre sizes at $N = 3$ are binomial coefficients $\binom{5}{j}$ folded by ρ; Appendix B, block R2, computed. □

Recovery Lemma 5.11 (Article 48, and the class count of Article 57)**. [A]**

(a) The class count $|X| = 2^{2N-2} + 2^{N-1}$*, twenty at* $N = 3$*, is Theorem 5.8.*

(b) The statement that the production operator is a function of five binary agreements read modulo end-to-end reversal, and of nothing else, is the factorization clause of Theorem 5.8 at $N = 3$*, together with Definition 5.7.*

(c) The exclusion of absolute orientation, and of any variable distinguishing one end of the cluster from the other, is Corollary 5.9.

(d) The three derived scalars — the weight, the class size,

and the central entry — together with the failure of the weight to separate, are Proposition 5.10.

(e) The Burnside computation $\frac{1}{4}(64 + 0 + 8 + 8) = 20$ *recorded in Article 57 is the same count taken on* C^0 *rather than on* C^1*; the two agree by Proposition 5.5.*

No statement of the constituent papers is amended, and no hypothesis of theirs is weakened or strengthened.

Remark 5.12 (What the formulation makes visible)**. [A]** Three things that were separate become one.

The capacity ceiling is the dimension of an algebra of invariants and not an orbit count that happens to land on twenty; the two coincide because the marker complex is a tree, and the argument would read differently on a complex with $H^1 \neq 0$.

The constraint on what a pathway may read ceases to be a list of permitted and forbidden variables and becomes a single membership condition: an argument of a product is admissible if and only if it lies in $\mathrm{Inv}_{\mathrm{Fr}}(k)$.

And the conditional that the corpus states between twenty and thirty-two acquires a formulation. Thirty-two is $|C^1|$, the count before the reversal quotient is taken; twenty is $|C^1/\langle\rho\rangle|$. An initiator supplying a base point to the frame data is exactly a datum removing the quotient, and the difference between the two numbers is the presence or absence of that base point — which Section 5.3 treats in general.

5.2 Equivariant localisation on the vessel complex

The corpus fixes the site of a reaction within a cell by a rule requiring an odd vessel count, and records separately that a cell of even count has no central vessel but a central pair, so that the rule does not apply to it. The following exhibits both as instances of one principle, and the change is one of derivation and not of premises: Remark 5.20 states what is and is not affected.

Notation 5.13. [A] Throughout this subsection M denotes the vessel count of a cell, which is not in general the N of Section 5.1. For a codon cell $M = N = 3$; for the junction cell of Article 59, $M = 6$.

Definition 5.14 (The vessel complex and its involution)**. [A]** Let Q_M be the simplicial path complex on the ordered vessel set $\{v_1, \dots, v_M\}$, with 1-simplices $\{v_i, v_{i+1}\}$. Let $\tau\colon \mathsf{Q}_M \to \mathsf{Q}_M$ be the simplicial involution induced by $i \mapsto M + 1 - i$.

Proposition 5.15 (The fixed locus, and the simplex that carries it)**. [A]** *The fixed point set* $|\mathsf{Q}_M|^\tau$ *of the induced action on the geometric realization is a single point. That point is the barycentre of a unique simplex* θ_M *of* Q_M*, and*

$$\theta_M = \begin{cases} \{v_{(M+1)/2}\}, & M \text{ odd}, \\ \{v_{M/2},\, v_{M/2+1}\}, & M \text{ even}. \end{cases}$$

Equivalently, θ_M *is the unique vertex of the barycentric subdivision* $\mathrm{sd}\mathsf{Q}_M$ *fixed by* τ*. Thus* θ_M *is a vertex when* M *is odd and an edge when* M *is even, and in either case* $|\theta_M| = \lceil M/2 \rceil - \lfloor M/2 \rfloor + 1$*, that is* 1 *for* M *odd and* 2 *for* M *even.*

Proof. The realization $|\mathsf{Q}_M|$ is an interval and τ is the reflection exchanging its endpoints, whose fixed set is the midpoint. The midpoint lies in the interior of exactly one simplex, and is its barycentre: the vertex $v_{(M+1)/2}$ when M is odd, since $i = M + 1 - i$ has the integer solution $i = (M + 1)/2$ precisely then, and the edge $\{v_{M/2}, v_{M/2+1}\}$ when M is even, that edge being carried to itself with its two vertices exchanged. Passing to $\mathrm{sd}\mathsf{Q}_M$, whose vertices are the barycentres of simplices of Q_M, the fixed point is a vertex in both cases. Appendix B, block R3, computed. □

Definition 5.16 (Localisation at the fixed locus)**. [D]** A pathway on a cell of M vessels is *equivariantly localised* when the vessels it transforms are exactly the vertices of θ_M, the remaining vessels acting on the outcome without themselves transforming.

Theorem 5.17 (Parity of the product count)**. [D]** *An equivariantly localised pathway transforms* $|\theta_M|$ *vessels and yields one product at each. Hence it yields one product when* M *is odd, transforming the central vessel, and two products when* M *is even, transforming the two vessels flanking the central interface. No other designation of a vessel or pair of vessels is admissible, a designation not contained in* θ_M *being moved by* τ *and therefore excluded by Corollary 5.9.*

Proof. Immediate from Definition 5.16 and Proposition 5.15, with the exclusion clause supplied by Corollary 5.9 applied to the vessel index in place of the site index. Appendix B, block R3, computed. □

Corollary 5.18 (The two cells of the arc)**. [D]** *At* $M = 3$ *the fixed locus is the vertex* v_2*: a localised pathway transforms the middle vessel of a codon cell and yields one product. At* $M = 6$ *the fixed locus is the edge* $\{v_3, v_4\}$*: a localised*

pathway transforms the two facing units of a junction cell and yields two products, one on each.

Recovery Lemma 5.19 (Articles 48 and 59)**. [A]**

(a) That reversal fixes a vessel if and only if M is odd, and then fixes the central one uniquely, is the odd case of Proposition 5.15.

(b) That at $M = 3$ a localised pathway transforms the second of three vessels, the first and third forming a flanking environment exchanged by reversal, is the first clause of Corollary 5.18.

(c) That a cell of six vessels has no central vessel, its centre being an interface and its central pair the two facing units, is the even case of Proposition 5.15 at $M = 6$.

(d) That such a cell yields two residues rather than one is the even case of Theorem 5.17.

Remark 5.20 (Scope: a derivation is changed, premises are not)**. [A]** Three points, because this is the subsection most likely to be over-read.

Nothing above establishes that a cell of six vessels exists. The junction is a premise of Article 59 about how carriers assemble; it is not derived there and it is not derived here, and every consequence of the even case is conditional on it exactly as before.

Nothing above asserts that a localised pathway is what occurs. Definition 5.16 carries the label **[D]** for that reason: localisation is a chemical premise in the corpus and remains one. What is proved is the consequence of localisation once granted.

And the corpus's refusal to call the even case an exception is preserved and, in this formulation, becomes unnecessary to state: there is no rule being excepted, because the odd and even cases are two instances of Theorem 5.17 and not a rule together with a departure from it.

Scholium 5.21 (An item for the precedence ledger)**.** Article 48 concludes from the parity of the fixed locus that a localised pathway requires odd M, and hence that a four-interface architecture admits none. Under Theorem 5.17 the even case is not the absence of a localised pathway but the presence of a pathway localised at an edge, with two products. The two statements are compatible — Article 48 localises at a *vessel* and finds none at even M, which is correct — but the earlier phrasing invites the reading that even M admits nothing, and Article 59 was written against that reading.

The disposition is *re-scoped*, not *superseded*: the earlier statement is true of vessel-localisation and is silent on edge-localisation. The item is entered in Appendix C, and the consequence for the four-interface target of Article 48 — which predicts a ceiling of seventy-two and observes that no vessel-localised pathway exists there — is flagged for audit, an edge-localised pathway at $M = 4$ being admissible under Proposition 5.15 and not considered there.

5.3 Torsors and section-supplying data

Three of the corpus's constructions have the same shape: a set on which a group acts simply transitively, carrying no distinguished element, and an external datum that supplies one. The pattern is worth naming, both because it recurs and because it fixes exactly what such a datum can and cannot deliver.

Definition 5.22 (Torsor; section-supplying datum)**. [A]** Let G be a finite group. A G-torsor is a non-empty set T with a simply transitive G-action [Ser79]. A G-torsor admits no canonical element: the automorphisms of T as a G-set act transitively on T. A *section-supplying datum* for T is a structure external to T together with a map to T; its value is the *section*.

Remark 5.23 (The two things a section does not do)**. [A]** A section selects an element of T. It does not name that element, a name being a bijection $T \to L$ to some label set, which is further data; and it does not privilege itself, a second datum supplying a different section being no less a section. Both clauses are used below, the first at Proposition 5.26 and the second at Remark 5.12.

Proposition 5.24 (The frame torsor)**. [C]** *The set Φ of frame-setters is a torsor under $\mathbf{Z}/2 \times \mathbf{Z}/2$, and the initiator supplies a section of it, being a distinguished end of the stack that fixes the direction sign and the projection reference. The hypothesis that the amino-acid pathway does not involve the initiator is the hypothesis that the pathway is blind to that section.*

Corollary 5.25 (Twenty and thirty-two, restated)**. [D]** *Under blindness to the section, admissible functions are those of Definition 5.7 and the ceiling is $|C^1/\langle\rho\rangle| = 20$ at $N = 3$. With the section in view the residual group is $\langle\mathrm{flip}\rangle$ alone and the ceiling is $|C^1| = 32$. The difference between the two numbers is the presence or absence of the section, and nothing else.*

Proposition 5.26 (The chirality torsor)**. [D]** *At the installation of the α-nitrogen the two local approach branches at c_α, distinguished by the sign of the attack scalar, form a torsor under* $\mathbf{Z}/2$*. An oriented cage condition excluding one branch is a section-supplying datum, and its section is the selected configuration $\chi^\star$.*
The identification of $\chi^\star$ with the intended L-series assignment is not a section but a name: it is the composite of the substituent-priority ordering of the completed product with the biochemical L/D convention, and by Remark 5.23 a torsor supplies no such composite of itself.

Scholium 5.27 (What the cage argument can and cannot deliver)**.** Proposition 5.26 is the precise form of a result the arc is otherwise liable to overstate, and the precision is worth stating positively rather than as a hedge.
What the cage delivers is homochirality in the strict sense: a mechanism by which one of two branches is excluded, so that the product of the architecture is of one configuration rather than of a mixture. That is a section, and it is a substantive conclusion.
What the cage does not deliver, and what no argument of its kind could deliver, is that the selected configuration is the one called *L*. Calling it *L* requires the full substituent ordering and a convention adopted outside the architecture. Article 54 twice declines a universal identification of χ_L with *R* or with *S* for exactly this reason, and takes $\chi^\star = \chi_L$ as a supposition where it is used.
The formulation offered here does not repair that and is not intended to. It relocates it: the gap is not a missing step in a chemical argument but the standard fact that a torsor has no canonical base point, and a reader who wants the architecture to produce the letter *L* is asking a question about a labelling convention and not about the architecture.

Definition 5.28 (Phase-fixing datum)**. [D]** Let *h* be a hexamer and let $\mathcal{P}(h)$ denote the set of readings of *h* that the sequence alone does not distinguish. A datum is *phase-fixing* for *h* when it determines a single element of $\mathcal{P}(h)$.

Remark 5.29 (The reading phase is not yet presented as a torsor)**. [A]** The corpus establishes that on an alternating hexamer changing the frame and changing the phase by one position have the same effect, so that the sequence determines the reading only up to one position, and that a junction supplies exactly one datum. It is tempting to present $\mathcal{P}(h)$ as a torsor under a group of order two, by analogy with the two cases above, and this draft declines to do so.
The obstruction is arithmetical. Face inversion is an involution and a phase shift generates a group of order three, so the composite operation that acts trivially on an alternating hexamer has order six; a set on which a group of order six acts simply transitively has six elements, which is not what "one position" names. Either $\mathcal{P}(h)$ is not a torsor under the group generated by that operation, or the group is not the one the phrase suggests, and the present draft does not know which.
The consequence is confined. Nothing in the arc depends on the group-theoretic statement: what the corpus uses is that the sequence leaves a determination open and that the junction closes it, both of which are finite checks already discharged there, and Definition 5.28 is sufficient to carry them.

Target 5.30. [A] Determine the group acting on $\mathcal{P}(h)$ for *h* alternating, and decide whether $\mathcal{P}(h)$ is a torsor under it. If it is, the junction datum joins Propositions 5.24 and 5.26 as a third instance and Section 5.3 acquires a theorem; if it is not, the disanalogy is worth recording, the reading phase being the one place in the arc where an external datum is supplied by a discontinuity in the carrier rather than by a persistent feature of it.

Recovery Lemma 5.31 (Articles 48, 54 and 59)**. [A]** *The torsor structure on Φ, and the initiator as its section, are imported unamended at Proposition 5.24; the conditional between twenty and thirty-two is Corollary 5.25. The branch selection at c_α under strong cage exclusion, and the separation of that selection from the L/D assignment, are Proposition 5.26, which asserts neither more nor less than Article 54 asserts. The phase statements of Article 59 are carried by Definition 5.28 and are not strengthened.*

5.4 Admissibility as matroid independence

The corpus establishes that the demand graph depends on the slot set alone, and distinguishes two kinds of exchange: one that permutes structures between occupied slots, which is deficiency-neutral by construction, and one that relocates a demand, which must be checked. It checks two instances. The following supplies the general criterion.

Definition 5.32 (The incidence and its matroid)**. [D]** Let $\mathcal{S}$ be the set of slots, $\mathcal{K}$ the set of registry classes, and $\Gamma \subseteq \mathcal{S} \times \mathcal{K}$ the incidence in which $(s, k) \in \Gamma$ when the class *k* meets the slot *s*. For a demand *d* write $s(d)$ for its slot and $\Gamma(d) = \{k : (s(d), k) \in \Gamma\}$ for its neighbourhood. Let $\mathsf{M} = \mathsf{M}[\Gamma]$ be the transversal matroid on ground set $\mathcal{S}$

induced by Γ: a set $A \subseteq \mathcal{S}$ is independent when A admits a system of distinct representatives in $\mathcal{K}$.

Theorem 5.33 (Admissibility is independence)**. [A]** *Let $\mathcal{D}$ be a set of demands occupying the slot set $A = s(\mathcal{D})$. Then*

(i) the incidence Γ, hence M, is determined by A and is independent of which structure occupies which slot;

(ii) the deficiency of $\mathcal{D}$ is $|A| - \operatorname{rank}_{\mathsf{M}}(A)$, and the assignment is admissible if and only if A is independent in M;

(iii) $|A| - \operatorname{rank}_{\mathsf{M}}(A) = \max_{B \subseteq A}\big(|B| - |\Gamma(B)|\big)$.

Proof. (i) is Definition 5.32: the neighbourhood of a demand is computed from its slot, and the occupying structure is not an argument of Γ. (ii) is the definition of the rank function of a transversal matroid, a maximum matching of A into $\mathcal{K}$ having size $\operatorname{rank}_{\mathsf{M}}(A)$. (iii) is the defect form of Hall's theorem. Appendix B, block R4, computed. □

Corollary 5.34 (The two kinds of exchange)**. [A]** *An exchange permuting structures between two slots of A leaves A unchanged, hence leaves M, the rank and the deficiency unchanged; it is deficiency-neutral by construction. An exchange relocating a demand from s to $s' \notin A$ replaces A by $A' = (A \setminus \{s\}) \cup \{s'\}$ and need not preserve independence.*

Proposition 5.35 (Exchange criterion, in matroid form)**. [A]** *Let A be independent in M, let $s \in A$ and $s' \in \mathcal{S} \setminus A$. Then $A' = (A \setminus \{s\}) \cup \{s'\}$ is independent if and only if*

$$s' \notin \operatorname{cl}_{\mathsf{M}}\big(A \setminus \{s\}\big),$$

equivalently if and only if some — hence every — maximum matching of $A \setminus \{s\}$ into $\mathcal{K}$ admits an augmenting path beginning at s'. In particular the test is decided by one alternating-path search on the incidence restricted to $A \setminus \{s\}$ together with s'.

Proof. $A \setminus \{s\}$ is independent, being a subset of an independent set. Both clauses are standard. For any matroid and any independent I and element $x \notin I$, the set $I \cup \{x\}$ is independent if and only if $x \notin \operatorname{cl}(I)$; and in a transversal matroid $I \cup \{x\}$ is independent if and only if a maximum matching of I can be augmented from x, the existence of an augmenting path from a fixed vertex being independent of the choice of maximum matching [Oxl11]. Appendix B, blocks R5 and R4b, computed. □

Remark 5.36 (What is new here, and what is cited)**. [A]** The matroid facts used above are textbook and are cited as such [Oxl11]. Nothing in Proposition 5.35 is new mathematics.

What is new is the identification of Definition 5.32: that the demand–class incidence of the corpus *is* a transversal matroid. Once that is seen, a case distinction checked at two instances becomes a decision procedure linear in the size of the incidence, and Theorem 5.33(i) becomes a triviality about a ground set. The contribution is the identification and the consequences drawn from it, and this paper classifies it as an application rather than as a theorem of its own.

Corollary 5.37 (The admissible relocations form an exchange graph)**. [A]** *Let $\mathcal{A}$ be the set of independent slot sets of a fixed cardinality. The relation "differs by one admissible relocation" makes $\mathcal{A}$ the basis-exchange graph of M restricted to that rank, which is connected by the matroid exchange axiom. Every admissible slot set of that cardinality is therefore reachable from any other by admissible relocations.*

Recovery Lemma 5.38 (Article 57)**. [A]**

(a) That the demand graph depends on the slot set alone, and that which structure sits at a slot does not enter, is Theorem 5.33(i).

(b) That an exchange between two slots both carrying demands is deficiency-neutral by construction, and that one moving a demand must be checked, is Corollary 5.34.

(c) That the assignment induced by the consistency relation is admissible with eighteen demands matched and deficiency zero, and that the published witness occupying the same slots has the same deficiency, is Theorem 5.33(i) and (ii) together.

(d) That the withdrawn third exchange yields deficiency one, with eight demands reaching seven classes, is an instance of Theorem 5.35 in the negative and of clause (iii) of Theorem 5.33; Appendix B, block R5, recomputes it against the criterion.

Remark 5.39 (The incidence is computed, not imported)**. [A]** Definition 5.32 takes the incidence Γ as given. It need not be: the registry classes are reconstructible as codon sets from the letter assignment alone, and Γ follows by intersecting each class with each slot. Appendix B, block R4a, carries the reconstruction and reports agreement with

the published class sets of Article 57 at the two classes that record prints. Transversality — that a block and a class meet in at most one codon — is thereby a computed fact of this paper rather than an import, the maximum intersection over all class–block pairs being one.
The eighteen-slot list of the seeded assignment is printed at Table 4, so the incidence is exhibited in full and the rank computation of Theorem 5.33(ii) is carried out on the assignment rather than on a subset of it; Appendix B, block R4b, computed. Block R15 checks the list against every adjacency the corpus prints.
The eighteen-slot list of the seeded assignment is printed at Table 4, so the incidence is exhibited in full and the rank computation of Theorem 5.33(ii) is carried out on the assignment rather than on a subset of it; Appendix B, block R4b, computed. Block R15 checks the list against every adjacency the corpus prints.

Remark 5.40 (What is added, and what it costs)**. [A]** The corpus tests two slot sets, one admissible and one not, and states the distinction between the two kinds of exchange as a case distinction. Theorem 5.35 replaces the case distinction by a criterion and the two tests by a decision procedure linear in the size of the incidence, which over eighteen slots is immediate.
The cost is that the criterion is only as good as the incidence, and the incidence is read from the consistency relation, whose hypotheses are abstracted from the structure series rather than derived. A criterion applied to an incidence of uncertain provenance decides admissibility and not correctness, and Corollary 5.37 in particular should not be read as saying that every admissible slot set is a candidate assignment: it says that the constraint of admissibility does not by itself isolate one.

5.5 The consistency predicate, factored

The two hypotheses carrying the consistency relation are stated in the corpus as clauses about registers. The following states them as a monotonicity and a factorization, which sharpens the falsifiers and makes the block a derived unit rather than a chosen one.

Definition 5.41 (The register poset and the width relation)**. [D]** Let $\mathcal{R} = \{\mathrm{AU}, \mathrm{AC}, \mathrm{AA}, \mathrm{AG}\}$ be the register set, each register carrying its number of completed contacts, its width in $\{\text{narrow}, \text{wide}\}$, and the locus of its defect. Let P be the partial order on $\mathcal{R}$ generated by

$$\mathrm{AG} \prec \mathrm{AA} \prec \mathrm{AC},$$

with AU incomparable to all three. Let $\mathrm{w}\colon \mathcal{R}\times\mathcal{R} \to \{\text{match}, \text{mismatch}\}$ record whether two registers agree in width.

Hypothesis 5.42 (Accommodation, as monotonicity)**. [D]** With the second and third positions held fixed, the arc extent $\mathrm{e} = p + q$ of the structure consistent with a codon is non-decreasing as a function $P \to (\mathbf{Z}_{\geq 0}, \leq)$ of the register at the first position.

Hypothesis 5.43 (Gating, as factorization)**. [D]** Let $c = n_1n_2n_3$ be a codon with registers r_1, r_2, r_3, and define

$$\kappa(c) \;=\; \big(r_2,\; r_1,\; \mathrm{w}(r_3, r_2)\big) \;\in\; \mathcal{R}\times\mathcal{R}\times\{\text{match}, \text{mismatch}\}.$$

Then the consistency predicate factors through κ: there is $\widehat{\mathrm{Con}}$ with $\mathrm{Con}(c, x) = \widehat{\mathrm{Con}}(\kappa(c), x)$ for every codon c and structure x. The three clauses of the corpus are the three coordinates: r_2 gates whether any structure is consistent, r_1 determines p and q, and r_3 enters only through $\mathrm{w}(r_3, r_2)$.

Proposition 5.44 (The factorization is proper)**. [A]** $|\operatorname{im}\kappa| \leq 32 < 64$. *The map κ is constant on the two pyrimidine-third codons of a block and constant on the two purine-third codons, the width of a base being a pyrimidine/purine distinction, and a block is by definition a fibre of $c \mapsto (n_1, n_2)$.*

Proof. The bound is the cardinality of the target of κ. Constancy on the two halves of a block is immediate, r_1 and r_2 being constant on a block and $\mathrm{w}(r_3, r_2)$ depending on r_3 only through the pyrimidine/purine character of n_3. Appendix B, block R6, computed. □

Corollary 5.45 (Regularity is forced)**. [D]** *Assume Hypothesis 5.43. Then every assignment consistent with* Con *carries at most two structures on each block, the two pyrimidine-third codons agreeing and the two purine-third codons agreeing. That is, every* Con*-admissible assignment is regular.*

Proof. By Proposition 5.44 the argument $\kappa(c)$ takes at most two values on a block, one on each half, and by Hypothesis 5.43 consistency depends on c only through $\kappa(c)$. □

Corollary 5.46 (Where the standard mapping leaves the relation)**. [D]** *The standard mapping is not regular, failing at exactly two blocks. By Corollary 5.45 it is therefore not* Con*-admissible at those two blocks, under Hypothesis 5.43.*

Proposition 5.47 (The two pairs of blocks do not coincide)**. [A]** *Corollary 5.46 locates a failure of* Con*-admissibility at the two blocks at which the standard mapping is irregular, namely* AU *and* UG*. The two exchanges separating the assignment that structural consistency selects from the published witness act at the blocks* UG *and* UA*, and* AA *and* CA*. The two sets of blocks meet in* UG *and in nothing else. In particular the block* AU *is irregular in the standard mapping and is touched by neither exchange.*

Proof. The irregular blocks are computed from the published table by the criterion of Definition 5.41 and the block partition; the exchange blocks are those of the two codon-pair exchanges of Article 57, entered as comparands. Appendix B, block R6, computed. □

Scholium 5.48 (An identification withdrawn, and what remains)**.** An earlier form of this section asked whether the blocks at which the standard mapping leaves Con-admissibility are the blocks at which the two exchanges act, and undertook to report the comparison whichever way it fell. It falls negative, and Proposition 5.47 states the negative rather than absorbing it: the two phenomena are distinct and overlap at one block.

What remains is not the identification but its residue, and the residue is the more interesting of the two. The irregularity of the block AU is the disagreement of its purine-third pair, which is the start codon against the residue filling the rest of the block. So under Corollary 5.45 the start-codon block lies outside Con-admissibility, and no exchange recorded in the corpus addresses it.

Two cautions, and they are not small. This is a statement about a failure and not about what repairs it: nothing here supplies an assignment at AU, and nothing here bears on the junction. And it is conditional on Hypothesis 5.43, whose provenance is abstraction from the structure series rather than independent chemistry. What may fairly be said is that the block carrying the start codon is marked as anomalous by two criteria that do not share a premise, and Section 15 is where that observation is placed.

Recovery Lemma 5.49 (Article 57)**. [A]** *The accommodation hypothesis is Hypothesis 5.42, restated as monotonicity of arc extent along P with the incomparable register left incomparable. The gating hypothesis in its three clauses is Hypothesis 5.43. The observation that the third position carries no information of its own and acts only as a width relation against the second, and that this is what makes the block the natural unit, is Proposition 5.44. No clause is weakened or strengthened; what is added is Corollary 5.45, which is not stated in the corpus and which makes regularity a consequence of the relation rather than a property observed of assignments produced by a construction whose range it is.*

5.6 What the language is for

Remark 5.50 (Three things it does, and three it does not)**. [A]** It does the following. It converts three constraints of the corpus — on what a product may read, on where a reaction may sit, and on what a codon may determine — into membership conditions in an invariant algebra, a fixed locus, and the image of a factorization. It exhibits two pairs of statements as one statement apiece: the class count with the constraint on the production operator, and vessel-localisation at odd count with central-pair localisation at even. And it replaces one case distinction by a criterion.

It does not do the following. It introduces no premise: every hypothesis of the arc is stated in the constituent papers and is carried here unamended, and Appendix A registers them. It discharges no target and removes no conditional: the ceiling is still a ceiling, the junction is still assumed, the selected assignment is still selected, and the identification of the selected configuration with the L-series is still a labelling. And it is not evidence: a result that follows from a restatement follows from what was restated, and Remark 5.12, Remark 5.20 and Remark 5.40 each say so at the point where the temptation is strongest.

The paper's one new result is the redox functional of Section 13, which is stated there as new and carries its own verification and falsification entries. Nothing in the present section is offered as new.

5.7 Falsification register for this section

6 Stage 0: the carrier

The object of this section carries no nucleobase, no codon and no residue. It is stated first, and separately, so that what Section 8 adds can be seen to be added, and so that a reader who declines the transformation of that section still has an object here.

Everything below is imported. What this paper contributes is the restatement in the language of Section 5, which is given at Recovery 6.11 and which is used from Section 9 onward.

6.1 The cluster

Definition 6.1 (Cluster)**. [C]** A cluster is a stack of six sites alternating in species, read at a fixed offset, with a placement datum at each site; its marker assignment is an element of $\{0,1\}^6$, written F and B where the placement is named rather than numbered. Two clusters are identified

statement	what would refute it
Proposition 5.5, Lemma 5.6, Theorem 5.8	A recomputation disagreeing with blocks R1 or R2; or an admissible function not factoring through $C^1/\langle\rho\rangle$.
Proposition 5.10	A ρ-invariant coordinate of C^1 other than the index N; or weight fibres disagreeing with R2.
Proposition 5.15, Theorem 5.17	A recomputation disagreeing with R3; or a fixed point of τ on $\lvert \mathsf{Q}_M \rvert$ other than the midpoint.
Recovery 5.19	A statement of Article 48 or Article 59 concerning localisation that is not an instance of Theorem 5.17.
Proposition 5.26	A derivation of the L/D assignment from the cage condition alone, without the substituent ordering and the convention — which would refute the proposition by establishing more than it allows.
Theorem 5.33, Theorem 5.35	An admissible relocation with $s' \in \mathrm{cl}_{\mathsf{M}}(A \setminus \{s\})$; or a recomputation disagreeing with R4 or R5; or an incidence depending on the structure occupying a slot.
Proposition 5.44, Corollary 5.45	A Con-admissible assignment that is not regular; or a block on which κ takes more than two values.

when no operation available to a unit distinguishes them. The initiator is not a site of the cluster.

Remark 6.2 (The species alternation is what makes a pair well defined)**. [E]** In the intended reading the six sites are substituted chrysene units of two species in alternation, a disubstituted unit at the 6 and 12 positions and a tetrasubstituted unit at the 3, 6, 9 and 12 positions, π-stacked face to face. The alternation is supplied by the attachment data of the axiom system and is not an additional premise. It is what makes the adjacent pair of Section 7 a well-defined object rather than a choice of two neighbours out of six.
This remark enters no proof. Nothing in Sections 6 or 7 requires the units to be chrysene, or indeed to be molecules.

Hypothesis 6.3 (H_{clu}, the cluster length)**. [D]** The reacting unit of the architecture is a stack of six units alternating in species, hence a cluster in the sense of Definition 6.1, with three vessels.

Remark 6.4 (The order in which the length is fixed)**. [A]** Hypothesis 6.3 is a statement about the architecture. It makes no reference to codons, to the length of a codon, or to the number of residues, and it would be the same statement if no genetic code existed. The triplet follows from it, and so does the ceiling of twenty; neither number is used to justify the cluster, and neither is used to justify the other.
The order is the whole of the arc's claim to non-circularity at this stage, and Section 9 states it again where the two numbers are derived. Section 6 and Section 7 are placed before it so that the claim can be checked rather than taken.

6.2 A class is a cluster

Proposition 6.5 (A class is a cluster)**. [C]** *The map from clusters to frame classes is a bijection. The two or four marker assignments a class contains are one physical object described under the available frames, and not an equivalence class of descriptions.*

Remark 6.6 (Why this is the hinge)**. [A]** Proposition 6.5 is imported and it is the statement on which everything downstream turns. Its effect is to move an assumption. Before it, invariance of a product under the frame is a hypothesis about the chemistry; after it, a function of the cluster is automatically constant on the class, and the invariance is a consequence of two other hypotheses, which are stated next and which are where a reader should attack.
In the article that first proves it, the corresponding assertion appears in a table caption of its own predecessor, and the article observes that a caption cannot carry a hypothesis register. This paper makes the same point one level up: a proposition of the corpus that carries the whole arc should be visible at the front of a coordinating account, and it is placed here for that reason and not because anything is added to it.

6.3 The two exposures

Hypothesis 6.7 ($H_{\mathrm{prod}}(0)$, locality)**. [D]** The product of a cluster is a function of its marker assignment alone: not of temperature, of concentration, of neighbouring clusters, or of reaction history.

Hypothesis 6.8 ($H_{\mathrm{prod}}(0')$, initiator independence)**. [D]** The pathway does not involve the initiator; consequently the product is independent of the direction sign and of the projection reference.

Corollary 6.9 (Frame invariance is not a hypothesis)**. [D]** *Under Hypotheses 6.7 and 6.8 the product of a cluster is a function of the cluster, hence by Proposition 6.5 a function on the class set. No further invariance assumption is required.*

Remark 6.10 (Which of the two carries what)**. [A]** The two are not of equal standing and the difference is used twice below.
Locality is what makes the product a function of the carrier at all. Without it there is no function to bound and the capacity argument does not begin. It is also the hypothesis a synthesis programme is least likely to test, since a determination under fixed conditions does not probe it.
Initiator independence decides a number rather than the existence of one. By Corollary 5.25 it is exactly the hypothesis that the pathway is blind to the section the initiator supplies, and the difference between a ceiling of twenty and a ceiling of thirty-two is the presence or absence of that blindness.

6.4 The carrier in the language of Section 5

Recovery Lemma 6.11 (Stage 0 restated)**. [A]** *Under Definition 6.1 with Hypotheses 6.7 and 6.8, a product is an admissible function in the sense of Definition 5.7: the marker assignment is a* 0*-cochain on the site complex, locality makes the product a function of that cochain, initiator independence makes it invariant under the gauge translation and under reversal, and Proposition 6.5 identifies the quotient with the set of clusters. Consequently*

$$\Delta \in \mathrm{Inv}_{\mathrm{Fr}}(k),$$

and every statement of Section 5.1 applies to it: it factors through the registry coboundary, it is blind to the placement of any single unit and to the designation of either end, and the algebra it lies in has dimension $2^{2N-2} + 2^{N-1}$.

Scholium 6.12 (What has and has not been assumed at this point)**.** Three premises are in force at the end of this section and no others. That the reacting unit is six sites alternating in species; that the product depends on the marker assignment alone; and that the pathway does not involve the initiator. The first is about the architecture, the second and third about a pathway.
None of them mentions a base, a codon, a residue or a code. A reader who grants all three has granted an object with twenty distinguishable states and nothing else, and the remainder of the arc is the question of what those states can be made to carry.

7 Two to four: the vessel and the base-four intermediary

The carrier has two placements at each of six sites. A code over four letters at three positions has the same cardinality, and this section states the correspondence, what it preserves, and — at greater length, because it is the distinction most easily lost in a coordinating account — what it does not identify.

7.1 The vessel

Definition 7.1 (Vessel and its coordinates)**. [C]** A vessel is an adjacent pair of sites at the fixed offset; a cluster of six sites carries three. A vessel is assigned two binary coordinates (b_1, b_2), the first independent of the frame and the second determined by it. The vessel alphabet $\Sigma_{\mathfrak{v}}$ is the set of four orientational states so coordinatised.

Remark 7.2 (Which datum is which)**. [E]** In the intended reading a vessel is one disubstituted unit together with its tetrasubstituted neighbour, and its two coordinates separate as follows. The first records whether the two aromatic planes present the same or opposite sense, which is a relation between the two units and is available without reference to anything outside the pair. The second records the sense of the pair against an external reference, and is therefore a datum of the reading rather than of the pair.
The separation is the reason the base-four alphabet is a pair alphabet and not a site alphabet: one binary comes from the pairing and one from the frame, and neither alone gives four values. This remark enters no proof; the formal content is Proposition 7.5 and Proposition 7.3.

Proposition 7.3 (The frame-free coordinate)**. [C]** *The coordinate* b_1 *of a vessel is independent of the frame and* b_2 *is determined by it. Consequently the partition of* $\Sigma_{\mathfrak{v}}$ *into the two fibres of* b_1 *is a datum of the cluster, while the identity of a vessel within its fibre is not.*

Remark 7.4 (Where this is used)**. [A]** Proposition 7.3 is the whole reason a mechanism may read one property of a neighbouring vessel and not another, and it is used at Section 11 in that form. It is stated here, with the coordinates, because it is a property of the vessel and not of any chemistry, and because stating it late invites the reading that it was introduced to license a mechanism.

7.2 The recoding

Proposition 7.5 (The recoding is an equivariant bijection)**. [C]** *The assignment of* (b_1, b_2) *to the marker pair of a vessel is an affine bijection of* $(\mathbf{Z}/2)^2$*. Applied vesselwise it carries the six binary markers of a cluster to three letters of* $\Sigma_{\mathfrak{v}}$*, and*

$$2^6 = 4^3 = 64.$$

It intertwines the frame actions, so the two presentations have the same orbits.

Corollary 7.6 (Nothing is lost in the recoding)**. [D]** *The invariant algebra computed over the six binary markers and the invariant algebra computed over the three base-four letters are canonically identified. The two-step passage — six binary faces, then three base-four letters — is information-preserving at each step, and whatever is lost is lost at the quotient by the frame and not in the recoding.*

Proof. By Proposition 7.5 the recoding is a bijection intertwining the actions, so it carries Fr-orbits to Fr-orbits and induces an isomorphism of the algebras of invariant functions, by Theorem 5.8. □

Remark 7.7 (What the corollary locates)**. [A]** Corollary 7.6 answers a question a reader of the arc will raise at exactly this point: the carrier has sixty-four states and the classification has twenty, so something is discarded, and where.
It is not discarded in the passage from two letters to four. That passage is a bijection and the corollary says so. It is discarded at the quotient by the frame, which is the passage from C^0 to $C^1/\langle\rho\rangle$ of Section 5.1 — one factor of two at the gauge translation and one at the reversal, sixty-four to thirty-two to twenty — and the second of those is exactly the conditional of Corollary 5.25.

7.3 Three four-element objects

Proposition 7.8 (No two are canonically identified)**. [D]** *The following three sets each have four elements and no two of them are canonically isomorphic.*

(i) The vessel alphabet $\Sigma_{\mathfrak{v}}$, the orientational states of an adjacent pair.

(ii) The set Φ of frame-setters.

(iii) The nucleobase alphabet $\Sigma'_{\mathfrak{v}} = \{A, C, G, U\}$.

For (i) against (ii): each is a torsor under $\mathbf{Z}/2\times\mathbf{Z}/2$ carrying exactly one canonically pointed coordinate, so each is, after that coordinate, a $\mathbf{Z}/2$-torsor; a $\mathbf{Z}/2$-torsor has a transitive automorphism group, so of the two structure-preserving bijections $\Sigma_{\mathfrak{v}} \to \Phi$ neither is distinguished. The one natural map between them, carrying a frame-setter to the state it designates as zero, is two-to-one onto a single fibre of b_1 and is not a bijection. For (iii) against either: $\Sigma'_{\mathfrak{v}}$ carries no structure supplied by the formalism, and its correspondence with $\Sigma_{\mathfrak{v}}$ is the letter assignment of Section 8, which is an import and not a construction.

Scholium 7.9 (Why this is a proposition and not a remark)**.** The corpus records this as a remark. In a coordinating paper it has to be a proposition, for a reason particular to the genre. A review states the arc in one vocabulary, and a vocabulary in which three four-element objects appear is a vocabulary in which they will be written with the same letters. Once that happens the claim that the capacity argument does not use the nucleobases becomes unreadable, since the object it is stated over and the object it is said not to use look identical on the page.
Proposition 7.8 is the guard. It is used at Section 9, where the count is proved over $\Sigma_{\mathfrak{v}}$ and shown independent of the letter assignment; at Section 8, where the assignment enters as a documentary import and its status as such is the point; and at Section 11, where a mechanism is permitted to read a fibre of b_1 and forbidden to read an element of $\Sigma'_{\mathfrak{v}}$.

Remark 7.10 (The intermediary is not a nucleobase)**. [E]** A reader meeting a four-letter alphabet in this setting will take it for the nucleobases. It is not. In the intended reading the vessel alphabet is a construct of greater complexity than a nucleobase and is common to both products of the cluster, sitting upstream of the fork and not on the nucleic-acid side of it. This remark enters no proof and Proposition 7.8 is its formal content.

7.4 Falsification register for these two sections

8 Stage 1: the transformation, and the documentary layer

Section 6 has a cardinal and nowhere to put it. This section supplies a domain, and it is the section in which the arc stops being a statement about a combinatorial object and becomes a statement about a molecular architecture.

It is therefore the section in which this paper is most exposed, and the exposure is of a particular kind: almost nothing here is proved. The letter assignment is read off a filing; the product that results is exhibited there; the concurrent provision of a second class of material is claimed there and is worked in no article of the corpus. A coordinating paper that let those statements sit beside the theorems of Sections 9 and 11 in the same typography would be misrepresenting the arc.

The remedy adopted is quarantine. Section 8.5 collects every statement of this kind, marks each **[C]** or **[E]** , and states what depends on it, which in each case is nothing below Section 8. A reader who declines the whole of that subsection loses the interpretation of the arc as an account of origins and loses no numbered statement of Sections 9 through 15.

statement	what would refute it
Hypothesis 6.3	A determination of the reacting unit at a length other than six units; or a derivation of the length from a codon table, which would remove the non-circularity of Remark 6.4 without refuting the length itself.
Hypothesis 6.7	A product varying with a datum outside the cluster — temperature, concentration, a neighbouring cluster, or the order of assembly — with the class held fixed.
Hypothesis 6.8	A cluster prepared with the initiator at either end yielding different products.
Corollary 6.9, Recovery 6.11	A product constant on clusters but not on classes, which would refute Proposition 6.5 rather than the corollary.
Proposition 7.3	A frame change altering b_1, or leaving b_2 fixed.
Proposition 7.5, Corollary 7.6	A recoding failing to intertwine the actions; or two clusters with the same three vessel letters and different marker assignments.
Proposition 7.8	A canonical bijection between any two of the three, supplied by the formalism rather than by a convention or an import.

8.1 Non-implications

Proposition 8.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That the letter assignment is derived. It is read off a filing. That the same partition is recovered from block structure alone in Section 11, by an argument using nothing from this section, is a result of that section and is not evidence for the assignment here.

(ii) That the exhibited product is a prediction. It is an exhibit of a document, and its status is that of a report.

(iii) That the concurrent provision of phospholipid material is worked anywhere in the corpus. It is claimed in the filings and is addressed by no article. Section 8.5 records it and nothing in this paper rests on it.

(iv) That the identification of Section 8.4 is forced. It is an identification, the source states both outcomes, and Remark 8.10 says what the arc becomes if it is refused.

(v) That anything in this section bears on the capacity argument. By Proposition 9.1(iv) the count is independent of the letter assignment, and the whole of Section 9 is proved over $\Sigma_{\mathfrak{v}}$.

8.2 The tether, and what it leaves

Proposition 8.2 (Residual count)**. [C]** *The pattern of the adenine tether is the word AAA. Reversal fixes it and complementation does not. The residual frame group after the pattern is observed is therefore* $\langle \mathrm{rev} \rangle$*, and the residual count is thirty-six.*

Proposition 8.3 (A cross-article identification)**. [A]** *The residual count of Proposition 8.2 is the orbit count of* $\langle \mathrm{rev} \rangle$ *acting on the sixty-four marker assignments, and is the reading-direction entry of the sensitivity table of Article 48. The two articles state the same number about the same object and neither performs the identification. It passes.*

Proof. Burnside over each subgroup of Fr: the counts are 64, 32, 36, 36 and 20 under the trivial group, $\langle \mathrm{flip} \rangle$, $\langle \mathrm{rev} \rangle$, $\langle \mathrm{flip} \cdot \mathrm{rev} \rangle$ and Fr respectively. Appendix B, block R10, computed. □

Remark 8.4 (The numbers do not by themselves make the identification)**. [A]** Thirty-six is the orbit count under $\langle \mathrm{rev} \rangle$ and also under $\langle \mathrm{flip} \cdot \mathrm{rev} \rangle$, two different subgroups of the same index. Agreement of the counts is therefore necessary and not sufficient, and what fixes the identification is which generator the tether pattern kills — that reversal fixes AAA and complementation does not — which is stated in Article 57 and is not recomputed here.
The caution is recorded because a coordinating paper is exactly the place where two equal numbers in two articles get taken for one statement.

Remark 8.5 (Thirty-six is not a domain)**. [A]** A count of residual states is not the domain of a codon table. Without a datum removing the reversal, a function on residual states is not a function on words of length three, and Section 12 would have nothing to be stated on.

8.3 The letter assignment

Definition 8.6 (Letter assignment)**. [C]**

$$FF = A, \qquad FB = C, \qquad BF = G, \qquad BB = U,$$

so that the registry partition is carried to $\{A, U\} \mid \{C, G\}$.

Remark 8.7 (The status of the assignment)**. [A]** Definition 8.6 is an import. It is read off the filing, which gives coding rules and synthesis mechanisms for the four registry states, and it is not a definition adopted for convenience, nor is it selected by any criterion stated in the corpus.

Two consequences, and they pull in opposite directions, which is why both are stated here.
By Proposition 7.8 the nucleobase alphabet is not canonically identified with the vessel alphabet, so an assignment between them is data. This paper therefore cannot treat Definition 8.6 as a construction, and Section 9 is stated so as not to use it at all.
And by the result recovered in Section 11 the partition governing block degeneracy, obtained there from block structure alone and using nothing from this section, is the partition of Definition 8.6. That coincidence is checkable by a reader against published statements and is the strongest evidential item in the arc. It is a result of Section 11 and it is not adduced here, for the reason Proposition 8.1(i) records: an import does not become a derivation because something downstream agrees with it.

8.4 The arrow, and the passage to sixty-four

Proposition 8.8 (The arrow)**. [C]** *Identifying the bilayer-to-coding arrow with reversal trivialises the residual group of Proposition 8.2. The pairs of a class with a relative frame then number sixty-four and may be identified with the word space.*

Remark 8.9 (The arrow in the language of Section 5.3)**. [A]** Proposition 8.8 is the second appearance in the arc of a section-supplying datum, and it is worth naming as such. The initiator supplies a section of the frame torsor; the arrow supplies a direction, removing the quotient by $\langle \mathrm{rev} \rangle$ and returning the state count to $|C^0| = 64$, which is the word space 4^3.
This makes explicit a relation that looks like a conflict and is not. Hypothesis 6.8 asserts that the product pathway does not involve the initiator, that is, that the pathway is blind to a section; the present proposition asserts that the reading is not blind to one. The two are consistent because they concern different maps out of the same object, and the whole of the difference between a ceiling of twenty and a domain of sixty-four is that one map sees a section and the other does not. A reader who has met the exclusion of the initiator in Section 6 and meets the arrow here is entitled to the reconciliation, and it is not stated in either source.

Remark 8.10 (If the identification is refused)**. [A]** The source states both outcomes and this paper carries both. If the identification is refused, Stage 1 stops at thirty-six, Section 12 has no domain, and the arc terminates at Section 9 with a capacity theorem and no placement. Sections 6, 7 and 9 are unaffected: they are stated over the carrier and over $\Sigma_{\mathfrak{v}}$, and neither uses the word space.

8.5 The documentary layer

Every statement in this subsection is imported from the filings and is worked in no article of the corpus. Each is marked **[C]** where it is a report of a document and **[E]** where it is a molecular reading of one. No numbered statement of Sections 9 through 15 depends on any of them.

Proposition 8.11 (The exhibited integrated product)**. [C]** *After transformation the filing exhibits RNA intercalated with tethered chrysene: a disubstituted remnant on adenine at the* 6*-position, a remnant anchoring a phospholipid bilayer, and a coding strand departing from the anchored poly-A tail.*

Remark 8.12 (Why one clause of this proposition is load--bearing)**. [A]** One clause is used downstream and the rest are not. That the two arms of the marked vessel are not symmetric in the exhibited product — one anchored to the base and one not — is the realization datum that selects a representative of the involution orbit in Section 11. It is a documentary premise and it is the one place where the documentary layer enters a construction.
It is recorded here rather than in Section 11 so that a reader auditing the arc's dependence on the filings finds the whole of it in one place.

Remark 8.13 (The initiator and the identity of the strand)**. [E]** In the intended reading the initiator that begins the subsequent sequence determines whether the coding strand that departs is ribonucleic or deoxyribonucleic. This is a claim of the filings.
It is recorded and not used, and the reason is worth stating. No article of the corpus addresses it, no numbered statement of this paper depends on it, and it stands in a relation to Hypothesis 6.8 that a reader will want clarified: the initiator is excluded from the cluster and the product pathway is assumed blind to it, so a claim that the initiator selects between two classes of strand is a claim about the *other* branch of the fork — the nucleobase branch — and not about the branch the capacity theorem bounds. Whether that separation survives examination is not determined here.

Remark 8.14 (Concurrent provision of bilayer material)**. [E]** The filings claim that the architecture provides, concurrently with the coding material, the phospholipid material of a bilayer, and Proposition 8.11 exhibits a remnant anchoring

one.
No article of the corpus works this. There is no structure series for it, no consistency relation, no registry count and no falsification register; the corpus has developed one branch of the fork and has not developed the other. This paper accordingly records the claim, cites the filings for it, and makes no statement about it.
Two observations, both of which are about the shape of the claim rather than its content. The claim is of the same kind as the arc's own: a single architecture is said to supply two classes of material whose co-occurrence is otherwise unexplained, which is structurally the same argument as the one Section 13 makes about a single delivery serving two residues. And it is the largest undeveloped region adjacent to the corpus, in the sense that it is claimed in the same documents that supply the letter assignment and the integrated product, both of which are load-bearing here.
Neither observation is an argument that the claim is correct, and neither is used. The matter is entered as Target 8.15.

Target 8.15 (The second branch)**. [A]** Determine whether the concurrent provision of bilayer material admits a treatment of the kind the corpus gives the coding branch: a series, a consistency relation, and a registry count. Nothing in this paper bears on it, and the target is entered so that the asymmetry of development between the two branches is visible in the inventory rather than only in the filings.

8.6 What Stage 1 costs and buys

Scholium 8.16 (The exchange, stated plainly)**.** Stage 1 costs one identification and one documentary premise. The identification is the arrow of Proposition 8.8, without which the arc stops at thirty-six. The premise is the asymmetry of the two arms, without which Section 11 cannot select a representative.
It buys a domain: sixty-four places for a cardinal that Stage 0 fixes and cannot locate.
What it does not buy is any part of the capacity argument. Nucleobases are not added to the cluster; they are what the registry states are called once a specified transformation has run, and Definition 8.6 is the calling. This is the only section in which biology appears, and it appears as the exhibited endpoint of a specified synthesis. A reader wishing to deny the origins reading may do so here and nowhere else: Sections 9 through 15 are statements about a carrier and a consistency relation, and would stand verbatim if Proposition 8.11 had no biological interpretation at all.

8.7 Falsification register for this section

9 Why three and why twenty

Two numbers descend from one chemical input, and neither is used to justify the other. That is the whole of this section, and its force lies in the order of derivation rather than in either result taken alone.

The section is stated over the carrier and over the vessel alphabet. It does not use the letter assignment of Section 8, it does not use the nucleobases, and it does not use a codon table. Where a published table appears — twice, in Section 9.6 — it appears to show what the account does not reach.

9.1 Non-implications

Proposition 9.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That twenty classes give twenty residues. The theorem is a ceiling; the count requires saturation, and Remark 9.7 exhibits a witness satisfying both standing hypotheses whose image has one element.

(ii) That the theorem yields any assignment of residues to codons. It forbids one: by Theorem 9.12 no table with a fibre of odd cardinality is produced at this level, and the standard mapping has four.

(iii) That twenty at three vessels says anything about other lengths. The counts are 2, 6, 20, 72, 272, 1056.

(iv) That the theorem bears on the nucleobase alphabet, or any statement about the nucleobases on the theorem. The count is proved over $\Sigma_{\mathfrak{v}}$ and is invariant under all twenty-four letter assignments.

(v) That a bound on the products of a cluster is a statement about the biological residue alphabet. That identification is declined here, as the corpus declines it.

(vi) That the sufficiency of the codon supply constrains the cluster length. By Proposition 9.8 the ratio is below one at every length, so the classical argument for the triplet cannot be run.

9.2 The triplet

Hypothesis 9.2 (H_{int}, one base per interface)**. [D]** Each of the three catalyst–substrate interfaces of a cluster produces exactly one nucleobase.

statement	what would refute it
Proposition 8.2	A tether pattern not fixed by reversal, or fixed by complementation; either would change which subgroup survives and with it the residual count.
Proposition 8.3	A recomputation disagreeing with block R10; or a demonstration that the surviving subgroup is $\langle \text{flip} \cdot \text{rev} \rangle$ rather than $\langle \text{rev} \rangle$, which the equality of counts does not exclude.
Definition 8.6	A filing specifying a different assignment; or a demonstration that the coding rules there do not determine one.
Proposition 8.8	A demonstration that the arrow cannot be identified with reversal, which would leave the arc at thirty-six (Remark 8.10).
Remark 8.12	An exhibited product in which the two arms are symmetric, which would remove the datum selecting a representative in Section 11.
Remark 8.13, Remark 8.14	Nothing in this paper. Neither enters a proof and neither is refuted or supported by any statement of the corpus; the entry is made so that the register is not read as certifying them.

Corollary 9.3 (The codon is a triplet)**. [D]** *Assume Hypothesis 6.3 and Hypothesis 9.2. A cluster has three interfaces, each producing one base, so the output of a cluster is a base triplet. The length of the codon is a consequence of the length of the cluster and is not assumed.*

Remark 9.4 (The direction of the derivation)**. [A]** The conventional account derives the codon length from the alphabet size: twenty residues require more than sixteen codons, so codons are triplets. Here the derivation runs the other way. The cluster is fixed at six units on grounds that mention neither codons nor residues, and both numbers descend from it.
Remark 6.4 states this where the cluster is defined and it is restated here because this is where the two numbers appear together and where a reader will test the claim. By Remark 9.9 the conventional derivation is in any case unavailable inside this formalism.

9.3 Capacity

Theorem 9.5 (Capacity)**. [D]** *Let a cluster of* $2N$ *sites produce a chemical product and assume locality and initiator independence.*

(i) (Ceiling.) *The product takes at most* $2^{2N-2} + 2^{N-1}$ *distinct values; under Hypothesis 6.3, which fixes* $N = 3$*, at most twenty.*

(ii) (Saturation.) *If in addition every cluster produces a residue and clusters of distinct classes produce distinct ones, the number of distinct products is exactly twenty.*

Proof. By Recovery 6.11 the product lies in $\mathrm{Inv}_{\mathrm{Fr}}(k)$, and by Theorem 5.8 that algebra has dimension $2^{2N-2} + 2^{N-1}$; the image of a function on a finite set has at most as many elements as the set has points, which gives (i). Clause (ii) adds totality, which makes the function residue-valued, and injectivity, which makes it injective, so the image has exactly that cardinality. □

Remark 9.6 (The two clauses are not of the same kind)**. [A]** Clause (i) is a bound and rests on two hypotheses whose content is physical but whose form is modest: that the product depends on the cluster alone, and that the pathway does not involve the initiator. Clause (ii) asserts that the system uses its capacity, which is a substantive claim about the chemistry that neither the corpus nor this paper establishes.
The statement is written in two clauses so that a reader may grant the first without the second, and every restatement of the theorem in this paper — in the abstract, in the summary of established results, and in the register of Section 15 — says ceiling before it says count.

Remark 9.7 (How much the saturation clause carries)**. [A]** The constant map carrying every class to one residue is a function of the marker assignment and is independent of the initiator, so it satisfies both standing hypotheses, and its image has one element. The ceiling is therefore attained nowhere in general, and the passage from *at most twenty* to *exactly twenty* is carried entirely by the two clauses of saturation.
The witness is worth keeping in view because the arc's headline result is the number twenty, and the number twenty is the value of the bound and not of the map.

9.4 The classical argument is unavailable

Proposition 9.8 (The codon supply is never the binding constraint)**. [A]** *For every* $N \geq 1$*,*

$$\frac{|X|}{4^N} = \frac{2^{2N-2} + 2^{N-1}}{2^{2N}} = \frac{1}{4} + 2^{-(N+1)} < 1,$$

so the class count is below the codon supply at every cluster length.

Proof. Division; both terms are positive and the sum is at most $1/2$ at $N = 1$, decreasing to $1/4$; the surrounding elementary enumeration is standard [Sta12]. Verified at $N = 1, \ldots, 8$;

Appendix B, block R2. □

Remark 9.9 (The conventional derivation cannot be run here)**. [A]** The conventional account of the codon length is that $4^2 = 16 < 20 \leq 64 = 4^3$, so a doublet code cannot carry twenty residues. Inside this formalism that inequality is automatic and therefore distinguishes nothing: the classes are a quotient of the words, so by Proposition 9.8 the alphabet cannot outrun the codon supply at any length, and the sufficiency condition holds at one vessel as at three.
The cluster length must therefore come from elsewhere, and it does. The causation runs from the cluster to both numbers and not from either number to the cluster.

9.5 Twenty, or thirty-two

Corollary 9.10 (The conditional, restated)**. [D]** *Under initiator independence the ceiling is* $|C^1/\langle\rho\rangle| = 20$ *at* $N = 3$*. With the initiator in view the acting group is the gauge translation alone and the ceiling is* $|C^1| = 32$*. The difference between the two numbers is the presence or absence of the section the initiator supplies, and nothing else.*

Remark 9.11 (The conditional is made visible, not defended)**. [A]** Corollary 9.10 is stated because it makes the arc's dependence legible and not because it supports the count. Twenty is available only if both frame data are re-descriptions of one cluster rather than data of it. For the codon they are not, the initiator supplying both; for the product they are, by the hypothesis.
A reader who declines that hypothesis should read this section as a theorem about thirty-two. Nothing else in the section changes: the triplet, the ratio of Proposition 9.8, and the parity results of Section 9.6 are all unaffected.

9.6 What capacity forbids

The property that explains twenty also forbids something, and the two cannot be separated. This subsection states the obstruction, and corrects the form in which the corpus states its witness.

Theorem 9.12 (Parity)**. [A]** *Every class has size two or four, so every fibre of a function on classes, pulled back to the sixty-four words, has even cardinality. The standard mapping has four fibres of odd cardinality, of sizes three, three, one and one. It is therefore not a function on classes, and no operator satisfying locality and initiator independence produces it.*

Proof. No class has size one, the gauge translation having no fixed point (Proposition 5.5), and a fibre of a class function is a union of classes. The fibre sizes of the standard mapping are counted at Appendix B, block R11. □

Corollary 9.13 (Termination is not an assembly quantity)**. [A]** *The termination fibre of the standard mapping has cardinality three, which is odd. No function on classes assigns termination to exactly those three codons. Termination is therefore supplied by the reading and not by the cluster.*

Remark 9.14 (A witness corrected, and a conclusion strengthened)**. [A]** The corpus states Corollary 9.13 by exhibiting a size-two class carrying a stop and a residue, and names the pair. That witness is stated under the keto/amino letter assignment of the coarsenings paper. Article 57 adopts a different assignment, read off the filing, and under that assignment the same marker orbit carries a different pair of codons; the two articles name one orbit and two different pairs of codons.
Neither article is in error. What has happened is that a statement about *which codons* lie in a class has been made in a paper whose other results are invariant under the letter assignment, and has been carried into a corpus that later adopts a different one.
The separation is exact and is computed at block R11. The class count is invariant under all twenty-four assignments. Which codons lie in which class is not. And the parity conclusion is invariant, by the route taken in Theorem 9.12 and Corollary 9.13: an odd fibre is not a union of classes under any assignment, a relabelling of four letters permuting codons within a class and changing no class size. An exhaustive check over the twenty-four assignments finds the termination fibre a union of classes under none of them.
This paper therefore states the conclusion by fibre parity rather than by a named pair. The route is shorter, the conclusion is stronger — it covers every assignment rather than one — and it removes the arc's only statement in which two articles disagree about which codons are under discussion.

Audit Item 9.15. [A] The published witness of the termination corollary is to be re-examined, and any statement of the corpus citing the named pair of codons is to be checked for which letter assignment it is stated under. The conclusion is unaffected; the witness is assignment-dependent and is not labelled as such where it appears. Entered in Appendix C.

Remark 9.16 (Parity and the account of initiation)**. [A]** Theorem 9.12 names two singleton fibres, one of which

is the residue that initiates, and Section 13 reaches a start codon. A reader meeting the two in sequence will take the first to forbid the second. It does not.
What parity forbids is an *assembly-level* operator producing the standard mapping. What Section 13 supplies is an account at the *reading* level, which is where Corollary 9.13 independently requires punctuation to live. The two results agree, and they agree in a direction worth stating: the obstruction here is not an embarrassment that the later account has to survive, it is a constraint that predicts where the later account must be located, and the later account is located there.
The disposition is recorded in Appendix C as C2 and the point is made once more in Section 15.

9.7 The family at other lengths

Remark 9.17 (The capacity is a law with a free parameter)**. [A]** The counts are 2, 6, 20, 72, 272, 1056 at one through six vessels. The claim of this section is therefore a structural law with a free parameter that the chemistry sets, and not an assertion that twenty is distinguished among integers. A four-interface cluster carries a ceiling of seventy-two, which is the cleanest falsifiable corollary the capacity theorem admits, and a cluster whose products exceeded seventy-two would refute the theorem outright.

Remark 9.18 (One clause of that target does not stand as stated)**. [A]** The corpus supports the four-interface target with the observation that such a cluster admits no vessel-localised pathway, so that a negative result would bear on localisation as well. By Proposition 5.15 a cluster of four vessels has a fixed locus which is an edge, and admits a pathway localised there, yielding two products. The supporting observation is therefore outside its scope; what is excluded at even count is localisation at a vessel, not localisation.
The target itself is unaffected — it is a statement about a ceiling and the ceiling is the orbit count at the length — and the ceiling of seventy-two stands. Audit Item C1 of Appendix C carries the clause.

9.8 Falsification register for this section

10 Reachability and handedness: why C5, and what the cage delivers

Sections 6 to 9 are about a carrier with two states at each of six sites, and nothing in them requires the sites to be molecules. This section is the first in which a chemical transformation is asserted, and it supplies three things the arc needs: that the transformation from the resting tether to the residue connectivity exists as a well-typed object; that the carbon at which the side chain begins is the base point of the vessel graph, which is what makes the structure series of Section 11 a series of subgraphs rooted there; and that the centre formed in the course of it is stereogenic and that one of its two branches may be excluded.

The third is the arc's answer on handedness, and it is narrower than the question usually asked. Section 10.6 states exactly what it delivers, in the vocabulary of Section 5.3, and Scholium 10.14 states what it does not.

10.1 Non-implications

Proposition 10.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That any transformation is favourable. No energy is computed and no barrier estimated. A reachability result does not establish an experimentally accessible barrier, and a favourable barrier would not establish that the required cage geometry is populated.

(ii) That the reaction word is unique. The reaction category is free by construction, precisely so that target existence and reaction-word uniqueness are separate questions; an alternative factorization of the carbonyl-forming portion is developed in the source and neither is selected.

(iii) That the architecture produces the L-series. What is established is the exclusion of one branch. The naming of the surviving branch is a separate datum and Proposition 10.12 states the separation.

(iv) That the transport across substitution patterns is unconditional. Chemical transport is exact under local concordance; cage-level persistence additionally requires supplied candidate lifts meeting a margin condition.

(v) That the notation of Section 10.4 corrects a result. It reconciles two naming conventions and identifies one statement that is inconsistent under either.

10.2 Four levels, kept apart

Convention 10.2 (The four levels)**. [C]**

connectivity ≠ chemical admissibility ≠ geometric accessibility ≠ p

A change of connectivity may be chemically inadmissible; an admissible rewrite may have no geometric lift in the cage that is to realize it; and a liftable transition carries no kinetic

statement	what would refute it
Corollary 9.3	A cluster whose interfaces do not each produce one base; or a derivation of the cluster length from a codon table, which would remove the order of Remark 9.4.
Theorem 9.5(i)	A product varying with a datum outside the cluster, or with the initiator; either refutes a standing hypothesis and with it the bound.
Theorem 9.5(ii)	A collision: two classes with the same product. This refutes saturation and leaves the ceiling intact, which is the most informative negative result the programme admits.
Proposition 9.8	A recomputation disagreeing with block R2.
Theorem 9.12, Corollary 9.13	A class of size one; or a recount of the fibres disagreeing with block R11.
Remark 9.14	An assignment under which the termination fibre is a union of classes, which block R11 excludes exhaustively.
Remark 9.17	A four-interface cluster whose products exceed seventy-two.

claim. The first three are formalized; the fourth belongs to a certification layer and enters no statement of this paper.

Remark 10.3 (Why the convention is carried into the review)**. [A]** A coordinating paper mixes claims of all four kinds within a page: Section 9 is combinatorial, Section 11 is a classification of subgraphs, Section 13 asserts a reaction, and the filings of Section 8 report an exhibited product. Convention 10.2 is the corpus's own instrument for keeping them apart and it is adopted here as the review's.
It also fixes the meaning of the section's principal verb. To say a target is *reachable* is to say that a hom-set is non-empty in a category whose morphisms are chemically admissible and cage-liftable. It is not to say the transformation occurs.

Definition 10.4 (Chemical state, and the two categories)**. [C]** A chemical state carries a molecular graph with persistent atom identities, chemical state labels, a stereochemical label, reaction resources, and an admissible cage domain. Local transformations are persistent-atom typed graph rewrites, generating the free chemical path category Chem. An admissible rewrite is promoted to a cage-constrained transition when it possesses a compatible geometric lift, and the resulting free category is Reach. Target existence is the statement that a hom-set of Reach is non-empty.

10.3 The motif, the target, and the base point

Proposition 10.5 (The reference transformation)**. [C]** *The resting motif is the saturated tether*

$$\mathrm{C6-O-C6}\alpha\mathrm{H_2-C6}\beta\mathrm{H_2-OPO_3}R_A,$$

and the target connectivity is

$$\mathrm{C5-C6}\alpha\mathrm{(H)(NH_2)-C6}\beta\mathrm{(=O)-O2'Ado},$$

reached while preserving the inherited chrysene C5–C6 *framework bond and complete atom provenance. The canonical reaction word is a composite of six generators, and the chrysene molecular anchor is preserved throughout: no ring of the framework is cleaved by it. The source states the motif and the target with the arm carbons written* Cα *and* Cβ*; they are restated here in the settled notation of Notation 10.7.*

Remark 10.6 (Why the base point is C5)**. [D]** Three features of Proposition 10.5 together answer the question the arc puts as *why C5*.
The arm is borne at C6 and the bond formed is to C5. The transformation is therefore transannular in the strict sense: the arm reaches across to the adjacent framework carbon, and the framework bond between the two is retained rather than broken.
Consequently the backbone carbons of the residue are supplied by the arm, and the carbon at which the side chain begins is a framework carbon — C5 itself. Every structure of the series of Section 11 retains C5, except the one whose retained set is empty, and the structures are connected subgraphs containing it. The base point of the vessel graph and the first side-chain carbon of the residue are the same atom, and that identification is what makes the series of Section 11 a series of rooted subgraphs rather than an unstructured list. And the centre that becomes stereogenic is not C5 but the first arm carbon, which is where the nitrogen is installed. The handedness question and the side-chain question are therefore about different atoms, which is worth saying because the arc puts them in one sentence.

10.4 A notation collision, resolved

Notation 10.7 (Two conventions for the Greek locants)**. [A]** The corpus uses Cβ in two senses and they denote different atoms.
In the reachability development, the tether is written C6 – O – CαH$_2$ – CβH$_2$ – OPO$_3$$R_A$, so C$\alpha$ and Cβ are the two carbons of the arm, and in the target Cβ is the carbon bearing the carbonyl and the ester to the ribose oxygen. It is the carboxyl carbon of the residue.
In the atom map of the junction development, the same two

arm carbons are C6α and C6β, and the Greek locants follow residue nomenclature: C′ is the carboxyl carbon (= C6β), Cα is the α carbon (= C6α), and Cβ is the first side-chain carbon, which is C5.
So Cα agrees between the two, and Cβ does not: it is the carboxyl carbon under the first convention and a framework carbon of the vessel graph under the second.

Ruling. The locants C6α and C6β take precedence. The two carbons of the substitution arm are C6α and C6β throughout the corpus and throughout this paper, and every statement written in the other convention is restated in these terms rather than reconciled by context. The Greek locants without a numeric prefix are reserved for residue nomenclature, in which Cβ is the first side-chain carbon and is C5. The substitution is entered in the concordance of Section 2.2.

Proposition 10.8 (The residue, in the settled notation)**. [D]** *Under Notation 10.7 the residue formed at a vessel is*

$$\mathrm{C6}\alpha(\mathrm{NH_2})(R) - \mathrm{C6}\beta(=\mathrm{O})\mathrm{O} - \mathrm{C2}',$$

in which C6β *is oxidised and transferred onto the* 2′*-hydroxyl of the adenosine ribose as an ester,* C6α *bears the* α*-nitrogen and is the stereogenic centre, and R is the side chain. For every residue except the one of empty retained set, R begins at* C5.

Remark 10.9 (Restatement of a statement written in the other convention)**. [A]** The sources of the two carboxyl oxygens in the junction balance are given in the corpus as the phosphate oxygen *at* Cβ and the 2′-oxygen of the ribose. Read in residue nomenclature that is C5, which bears no phosphate oxygen, and the same article's account of an error it corrected in that balance describes the atom as carrying the α carbon, the sulfur and two hydrogens — which is C5 and is not phosphate-bearing.
Under Notation 10.7 the statement is restated: the atom is C6β, which bears the phosphate oxygen of the resting tether, and the two carboxyl oxygens are therefore that oxygen and the ribose 2′-oxygen, both carrier-internal. So read, the statement is correct and unambiguous, and no result depends on the reading being settled either way, the affine form of the demand being independent of it.
The entry is made in Appendix C as a restatement rather than an audit item, the conflict having a cause — one article stating a quantity in another's notation — and a ruling.

10.5 The witness, and the freedom of the category

Theorem 10.10 (Conditional cage-constrained reachability)**. [D]** *Under the reference hypothesis package — chemical admissibility of each generator, a geometric lift for each, and admissible terminal states — the canonical word is a morphism of* Reach *from the resting state to a target state carrying the connectivity of Proposition 10.5. The target hom-set is therefore non-empty.*

Remark 10.11 (The category is free on purpose)**. [A]** An alternative factorization of the carbonyl-forming portion is developed in the source, and neither it nor the canonical one is selected. Because the reaction category is free, distinct rules, matches and generator orderings remain distinguishable, and the theory separates target existence from reaction-word uniqueness without assigning physical probability to any word.
This is a methodological choice the review should carry rather than smooth over. A coordinating paper is under pressure to present one route as *the* route; the source declines to, and the freedom of the category is how it declines.

10.6 Handedness

Proposition 10.12 (Selection, and naming, separated)**. [D]** *Installation of the nitrogen at* C6α *produces a stereogenic centre there. The two local approach branches, distinguished by the sign of the attack scalar against an oriented local frame, form a torsor under* $\mathbf{Z}/2$ *in the sense of Definition 5.22. An oriented cage condition excluding one branch is a section-supplying datum, and under strong exclusion the realized configuration is the selected one,*

$$\chi(c_\alpha) = \chi^\star.$$

The identification $\chi^\star = \chi_L$ *is not part of this statement. It is the composite of the substituent-priority ordering of the completed product with the biochemical* L/D *convention, and by Remark 5.23 a torsor supplies no canonical naming of its own elements. No universal identification of* χ_L *with R or with S is assumed anywhere in the corpus.*

Remark 10.13 (A weaker realization is admitted by the source)**. [A]** Strong exclusion is one of two cases the source admits. A realized system may instead exhibit only an energetic discrimination between the two branches, which supports preferential rather than deterministic selection. Under that case the conclusion of Proposition 10.12 weakens from a section to a bias, and nothing in this paper distinguishes the two cases.

Scholium 10.14 (What the cage can and cannot deliver)**.** This is the arc's answer on handedness and it is worth stating positively rather than as a series of qualifications.
What the cage delivers is homochirality in the strict sense: a mechanism by which one of two approach branches is excluded, so that the product of the architecture is of one configuration rather than of a mixture. That is a substantive conclusion, and it is reached from the geometry of the stack rather than assumed.
What the cage does not deliver, and what no argument of its kind could deliver, is that the surviving configuration is the one called L. Naming it requires the complete substituent ordering and a convention adopted outside the architecture, and the source declines the universal identification for exactly that reason.
The formulation of Section 5.3 does not repair this and is not intended to. It relocates it. The gap is not a missing step in a chemical argument but the standard fact that a torsor has no canonical base point; and a reader who asks the architecture to produce the letter L is asking a question about a labelling convention rather than about the architecture.
Two consequences for how the arc is summarised. A sentence of the form *the formalism explains why the residues are of the L series* is not available and is not written anywhere in this paper. A sentence of the form *the formalism supplies a mechanism producing one configuration rather than a mixture, and the identification of that configuration with the L series is made by convention after the fact* is available, and is what Section 15 records.

10.7 Transport across substitution patterns

Theorem 10.15 (Local transformation invariance)**. [D]** *Let the reference witness be established in one substitution context. Chemical rewrite transport to another context of the family* $\{6, 12\}$*,* $\{3, 6, 12\}$*,* $\{3, 6, 9, 12\}$ *is exact under local concordance of the reactive subgraph and a reaction-inert external context. Cage-level persistence additionally requires corresponding supplied candidate geometric lifts whose hard-constraint deviation satisfies a stated margin condition; persistence of the selected stereochemical branch requires the transported amino-installation lift to meet the same condition.*

Remark 10.16 (Why the arc needs this, and how far it reaches)**. [A]** The carrier of Section 6 alternates two species, a disubstituted unit and a tetrasubstituted one, and the reference witness is developed in one context. Without Theorem 10.15 the arc would have a chemistry for one member of the family and a combinatorics for the stack, with no statement connecting them.

The reach is uneven and the unevenness should be carried. The chemical half is exact: under local concordance the same ordered word applies, and remote substitutions lie outside the reactive subgraph. The geometric half is conditional on lifts that must be supplied context by context and on a margin. A reader who grants the chemical transport has not thereby granted the cage transport, and the source is explicit on the point.

Remark 10.17 (Two further realization variants)**. [C]** The same transport framework carries the witness to a dual-cipher architecture in which the roles of C5 and C6 are exchanged, the two locant pairs being perimeter-adjacent primary–dual cipher pairs; and to a variant adenine anchor. Neither is used in this paper and both are recorded so that the reference context is not mistaken for the only one.

10.8 Falsification register for this section

11 The structure space and the consistency relation

Section 10 establishes that a residue connectivity is reachable from the resting tether, with the side chain rooted at C5. This section classifies what can be rooted there, and states which codons admit which.

The two halves are of different kinds and the difference is the reason they are in one section. The classification is finite and checkable: it is a statement about subgraphs of a graph on eighteen vertices, and Appendix B recomputes it. The consistency relation is a pair of hypotheses abstracted from the series it describes, and is therefore the weakest joint in the arc. Placing them together keeps the reader from inheriting the confidence of the first when reading the second, and Proposition 11.1(iv) says so before either is stated.

11.1 Non-implications

Proposition 11.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That any chemical species is identified. The objects are structures: subgraphs with decorations. Their reading as residues is the interpretive appendix and enters no numbered statement.

(ii) That a code is derived. A consistency relation constrains which structures may sit where; it does not produce a mapping, and Section 12 exhibits two admissible assignments precisely to show that it does not.

statement	what would refute it
Proposition 10.5	A route to the target connectivity that cleaves a framework ring; or a loss of atom provenance in the canonical word.
Theorem 10.10	A generator admitting no geometric lift in the reference cage; or a terminal state outside the admissible domain.
Proposition 10.12	A cage condition excluding neither branch, which removes the section; or a derivation of the L/D assignment from the cage alone without the substituent ordering and the convention, which would establish more than the proposition allows and refute it in the other direction.
Theorem 10.15	A substitution context in which the reactive subgraph is concordant and the transported word is not admissible; or a context meeting the margin condition at which the selected branch does not persist.
Notation 10.7	A reading of the two developments under which Cβ denotes one atom.

(iii) That the definition of a structure is taken from the corpus unamended. Two fields are added at Remark 11.7, on findings the decoration record exposed; nothing upstream of them changes.

(iv) That the classification is exceptionless. It holds at nineteen of twenty and fails at one, and the obvious repair fails with it (Remark 11.11). The theorem is not to be cited without its exception.

(v) That the hypotheses of Section 11.6 are derived. They are abstracted from the series, which is therefore their source and not their confirmation. A reader who treats the series as evidence for them has read the dependency backwards, and this is the arc's weakest joint.

(vi) That the recovered partition of Section 11.7 is explained. It is recovered and not explained, and what invariant it is the level set of is open.

11.2 The vessel, and its marking

Proposition 11.2 (The vessel graph)**. [A]** *The vessel graph* X *has eighteen vertices carrying the locant registry, twenty-one edges, and cycle rank four: an eighteen-cycle together with three chords. Its four hexagonal subgraphs are determined by the chord set, and the six vertices of degree three are exactly the six chord endpoints.*

Proof. Construction of the perimeter cycle and the chords from the locant registry, and a finite check of the ring closures and the degree sequence; Appendix B, block R7, computed. The graph is here reconstructed rather than imported. □

Definition 11.3 (Marked vessel)**. [C]** The marked vessel is X together with two distinguished vertices carrying arms, at C6 and C12, and a base point C5.

Proposition 11.4 (The marking is not symmetric)**. [D]** *The involution of* X *exchanging the two outer rings with the two inner rings interchanges the two arms and moves the base point. The marking therefore selects one representative of its orbit.*

Remark 11.5 (Which representative, and on what authority)**. [A]** The representative is selected by a datum of Section 8: in the exhibited product the two arms are not symmetric, one being anchored to the base and one not. That is a documentary premise and it is the one place where the documentary layer enters a construction in this paper.
It is worth marking because the selection looks like a convention and is not. A convention could be reversed without cost; this one is fixed by what the filing exhibits, and if the exhibited product had symmetric arms the marking would be undetermined and the structure space would be defined only up to the involution.

11.3 Structures

Definition 11.6 (Structure)**. [D]** A structure is a triple (S, δ, γ) in which $S \subseteq V(\mathsf{X})$ induces a connected subgraph containing the base point; δ assigns to the vertices of S a terminal type from a finite set, together with a finite set of heteroatom *bridges*, each joining two vertices of S; and γ is a set of *closures*, each a bond from a vertex of S to an atom of the backbone other than the base point. Write Σ for the set of structures realized by the cluster.

Remark 11.7 (Two fields the earlier definition did not have)**. [A]** Definition 11.6 is stated in the corpus with two fields, a retained set and a decoration comprising terminal types and heteroatoms inserted *into edges of* S. Printing the decoration record for all twenty structures shows that neither clause is wide enough, and the two failures are of different kinds.
Bridges that are not insertions. Of the five heteroatom bridges in the series, three join vertices adjacent in the vessel graph and are insertions into an edge as the corpus has it. Two do not: they join retained vertices that are *not* adjacent, so the heteroatom creates a bond rather than

interrupting one. The definition above says *bridge* for that reason, and the distinction is recorded at Appendix B, block R17(a2).

Closures. The corpus's definition gives a structure exactly one attachment to the backbone — the transannular bond at the base point, which is structural and is not a value of δ. One structure has a second: its retained set closes onto the backbone nitrogen. That bond runs from a vertex of S to an atom outside S, so it is neither a terminal type nor a bridge, and the two-field definition cannot express it. It is the only structure with the datum and the only one whose amine is secondary, and those are one fact.

Neither amendment disturbs anything upstream. The retention classification and the fibration are statements about S alone, and γ is empty at nineteen of twenty.

Definition 11.8 (Arc)**. [D]** For $p, q \geq 0$ with $p + q \leq 5$, let $\mathrm{arc}(p, q)$ be the path in the ring containing C4b and C10b that contains C4b and extends p vertices in one direction and q in the other; the empty arc is written $\mathrm{arc}(\,,\,)$. When $p + q = 5$ the path closes and the arc is the whole ring.

Remark 11.9 (The side chain is the arc)**. [A]** Under Proposition 10.8 the side chain R of a residue begins at C5 and is the retained subgraph rooted there. Definition 11.8 is therefore not an auxiliary construction: the parameters p and q are the extent of the side chain in the two directions around one ring, and η records whether the carbon adjacent to the base point on the other side is retained with it. The classification below says that these three numbers determine the side chain, at nineteen of twenty.

11.4 The retention classification

Theorem 11.10 (Retention)**. [D]** *Every S arising from a structure of Σ satisfies*

$$S = \{\mathrm{C5}\} \cup \{\mathrm{C6}\}^{\eta} \cup \mathrm{arc}(p, q), \qquad \eta \in \{0, 1\},$$

with one exception. Nineteen of the twenty structures are of this form. The exception retains, in addition, one outer ring entire; its arc has reached a fusion vertex of that ring.

Proof. Exhaustive over Σ: the predicted set is computed from the published parameters for each structure and compared against the published retained set. Nineteen agree; the twentieth retains four further vertices, which together with the two fusion vertices already in its arc are the outer ring entire. Appendix B, block R12, computed. □

Remark 11.11 (The exception is not cosmetic, and the repair fails)**. [A]** The classification is a statement about three parameters and it fails once. The natural repair — that an arc reaching a fusion vertex carries the ring fused there — does not survive, and the witnesses are explicit.

One structure has the arc of extent one toward the first fusion vertex, reaching it, and does not carry the ring fused there. The exceptional structure has an arc reaching the other fusion vertex of the same ring, and does carry it. So reaching a fusion vertex is not sufficient, and no condition stated here is; the two cases are distinguished by which fusion vertex is reached and nothing in the classification records which.

The exception is recorded as an exception and is a standing target. This paper does not repair it and Section 17 carries it.

11.5 The fibration

Theorem 11.12 (Excision is coarser than structure)**. [D]** *Let $\pi : \Sigma \to 2^{V(\mathrm{X})}$ be the forgetful map $(S, \delta) \mapsto S$. Then π takes eleven values on the twenty structures, and five of its fibres are non-trivial, of sizes three, three, three, three and two, covering fourteen structures. The remaining six values are attained once each.*

Proof. Exhaustive; Appendix B, block R12, computed. □

Scholium 11.13 (The economy the arc turns on)**.** Theorem 11.12 is the reason the account is as small as it is, and its content is a separation of variables.

The subgraph S is fixed by the excision and the decoration δ by the edge data, and the two are independent: one excision carries up to three structures, differing only in what a terminal vertex becomes. So a codon reaches S, and δ is downstream of it.

Two consequences run through the rest of the paper. The consistency relation of Section 11.6 can be stated on codons without mentioning a residue, which is why Sections 11 and 12 are statements about a carrier. And the demand functional of Section 14 splits along the same seam — a skeletal term determined by S and a decoration term determined by δ — which is Proposition 14.5 and is the reason that section can compute half of its object from the published record and no more.

11.6 The consistency relation

Definition 11.14 (Register)**. [D]** A register is the pairing state of a tethered adenine against a coding base; $\mathcal{R}$ has four elements. Each carries three invariants: the number of contacts it completes, its width, and the locus of its defect.

Proposition 11.15 (Separation of the registers)**. [A]** *No single invariant separates $\mathcal{R}$. Of the three pairs of invariants, exactly two separate it — contacts with width, and width with defect — and contacts with defect does not, two registers agreeing on both.*

Remark 11.16 (Why width cannot be dropped)**. [A]** Both separating pairs contain width, and the pair that omits it fails on exactly the two defective registers — which are the two that admit anything into the cluster at all.

Remark 11.17 (The relation, as stated in Section 5.5)**. [A]** The two hypotheses carrying the relation are stated in Section 5.5 as a monotonicity and a factorization, and are not repeated here. Accommodation is monotonicity of arc extent along a partial order on $\mathcal{R}$ in which one register is incomparable. Gating is the factorization of Con through the triple consisting of the second register, the first register, and the width relation of the third against the second.
Three consequences established there are used below and in Section 12: that the factorization is proper, its image having at most thirty-two values on sixty-four codons; that it takes at most two values on a block, one on each third-position half; and that every assignment admitting Con is therefore regular.

Remark 11.18 (Where the incomparable register sits)**. [D]** One register is complete and narrow, and is therefore not more or less accommodating than the others but differently so: maximal when the cluster is uniform in width and minimal when it is not. Stating it as incomparable, rather than inserting it into the chain, is what keeps the accommodation hypothesis falsifiable.

11.7 Degeneracy, and a partition recovered

Proposition 11.19 (The splitting rule)**. [A]** *Say a block splits when its four codons carry two structures, the two pyrimidine-third codons agreeing and the two purine-third codons agreeing. Across the sixteen blocks, a block splits never when the second position is one particular base, always when it is another, and otherwise exactly when the first position lies in a two-element set. This holds at sixteen of sixteen blocks.*

Proof. Exhaustive over the sixteen blocks; Appendix B, block R12, computed. □

Open problem 11.20 (The splitting invariant)**. [A]** The rule turns on a two-element partition of the bases at position one. That partition is the registry partition of the letter assignment imported in Section 8 — but naming it is not explaining it, and it is the level set of no invariant of Definition 11.14: not contacts, not width, not defect locus, nor any pair of them. Exhibit the invariant.

Scholium 11.21 (The strongest evidential item in the arc)**.** That the partition recovered here from block structure coincides with the one specified in the filing is a result and not a construction. Section 8 takes the letter assignment as an import; nothing in this section uses it; and the rule of Proposition 11.19 is obtained from block degeneracy alone. Three cautions, and they are what make the item quotable rather than merely striking.
It is a coincidence of two statements, not a derivation of either. Open problem 11.20 records that the partition is not the level set of any invariant the relation supplies, so the agreement is unexplained on both sides.
It is checkable by a reader against published statements, the assignment being stated in one place and unused in the other. That is what makes it evidence rather than an artefact of a single development, and it is why Section 8 declines to adduce it there.
And it does not transfer its strength to the hypotheses it sits beside. The accommodation and gating hypotheses remain abstracted from the series, by Proposition 11.1(iv), and a striking agreement elsewhere in the section does not repair that.

11.8 Two failure modes

Proposition 11.22 (The failure modes are distinguishable)**. [D]** *There are two ways a codon may carry no structure, and they differ in whether the carrier is consumed:*

(a) no structure is consistent with the codon, and the carrier is not consumed;

(b) a structure is consistent and is not released, and the carrier is.

A function constant on registry classes cannot separate these; the relation Con *can.*

Remark 11.23 (Where this is used, and where it is contested)**. [A]** Proposition 11.22 is used at Section 13, where termination is obtained as the second mode — a structure forms, is not liberated, and the carrier is consumed — and at Section 15, where it supplies the contrast between a stop and the structure of empty retained set.
It is also the arc's one point of contact with an open conflict. A companion development concludes from the code data that the limiting step is engagement rather than escape; if that is right, the non-releasing codons are nearer mode (a) than mode (b) and the carrier is not consumed there. The two statements are not reconciled and the conflict is entered as C9 in Appendix C. Nothing in Sections 11 to 13 depends on which is correct.

11.9 Falsification register for this section

12 Placement: slots, admissibility, and what forces one

Section 11 gives a relation between codons and structures. An assignment is a choice of which structure sits where, subject to it. This section counts what is admissible, and establishes that one placement is not a choice.

The section's two halves differ in force and the difference should be carried. Admissibility is a constraint on slot sets and it does not discriminate between the assignments the arc has to distinguish; that is Scholium 12.8 and it is the section's own warning against its first result. What does discriminate is complementarity, at one pair of slots, under one hypothesis — and the placement it forces turns out to fall at the block the arc needs most, which is Section 12.6.

12.1 Non-implications

Proposition 12.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That admissibility is evidence. Two assignments occupy the same slots and the matching cannot see the difference (Theorem 5.33). Equal footing is not preference.

(ii) That either assignment is prior to the other. An exchange is a relation between two assignments and carries no direction in time.

(iii) That the counts of Section 12.4 are probabilities. They are exhaustive counts over a finite set, offered so that the scarcity can be checked, and the uniqueness statement would be unaffected were they larger. One null model is *posed in this paper, at Proposition 12.22, and it is posed in order to reject an observation rather than to support one.*

(iv) That the coincidence of Section 12.6 is a finding. It is demoted by the null computation of Proposition 12.22 and is recorded as a fact about where the marks fall.

(v) That the exhaustiveness of the complementarity count is verified here. The three pairs are checked; that there are exactly three requires the full slot list, which is not in the published record.

12.2 Slots and demands

Definition 12.2 (Slot)**. [C]** A block is a set of four codons agreeing in their first two bases. A slot is a block or one of its two halves, pyrimidine or purine, at the third base.

Proposition 12.3 (Transversality)**. [A]** *A block and a registry class meet in at most one codon.*

Proof. The registry classes are reconstructed as codon sets from the letter assignment and intersected with each block; the maximum intersection over all class–block pairs is one. Appendix B, block R4a, computed. This is a computed fact of this paper rather than an import. □

Proposition 12.4 (Slot and demand count)**. [A]** *The assignment induced by the consistency relation occupies the eighteen slots of Table 4 and seeds seventeen distinct structures, one structure being seeded at two slots. Under the ruling of Remark 12.5 the eighteen slots take eighteen distinct classes, leaving two of the twenty unassigned; the corresponding demand-reading quantities are seventeen and three.*

Proof. The slot list is exhibited at Table 4 and every quantity is computed from it; Appendix B, blocks R4b and R15(b), computed. The list reproduces each of the eight adjacencies the corpus prints, including the one slot that is not in it. □

Remark 12.5 (A counting convention the corpus does not fix)**. [A]** The corpus states the demand count as seventeen at one proposition, inferring that a single class may serve both slots of the doubly-seeded structure, and as eighteen at the next, where the matching is reported as eighteen matched of eighteen with deficiency zero. The two are consistent only if the object matched is the slot and not the demand. The distinction is not idle. A matching on slots requires *distinct* classes for the two slots of the doubly-seeded structure;

statement	what would refute it
Proposition 11.2, Theorem 11.12	A recomputation disagreeing with block R7 or R12.
Theorem 11.10	A structure outside the three-parameter family other than the one recorded; or a condition on the arc that predicts the exception and is not refuted by the witness of Remark 11.11.
Proposition 11.4, Remark 11.5	An exhibited product in which the two arms are symmetric, which leaves the marking undetermined.
Proposition 11.15	A recomputation of the register invariants disagreeing with the separation table.
Accommodation (Section 5.5)	A column in which arc extent is not monotone in the order.
Gating (Section 5.5)	A block whose third position acts otherwise than through its width relation to the second; or a Con-admissible assignment that is not regular.
Proposition 11.19	A block at which the rule fails.
Open problem 11.20	Exhibition of an invariant of Definition 11.14 whose level sets are the partition, which would close the problem rather than refute it.

a matching on demands does not. The two formulations can therefore differ in deficiency in general, and the corpus does not say which it intends.

At the assignment in question they do not differ. The two slots of the doubly-seeded structure are met in common by two classes, and between them they reach two further classes, so distinct representatives exist either way, and both readings are admissible. Appendix B, blocks R13 and R15, computed.

Ruling. The matched object is the slot. The ground set of the matroid is the slot set, as Definition 5.32 has it, and the criterion of Theorem 5.35 is stated on slots accordingly.

The ground is Theorem 5.33(i): the incidence is determined by the slot set and the occupying structure is not an argument of it. A demand reading reintroduces the structure into the matching, through the identity of what is seeded twice, which is what that clause denies. The demand count remains reportable as a derived quantity wherever the corpus needs it.

One published quantity moves with the ruling and the restatement is carried here rather than left to a reader. The corpus records seventeen demands and three spare classes. That pair is a demand-reading pair: under the slot ruling the eighteen slots take eighteen distinct classes and the spare count is two. Neither number is wrong and they count different things — the ruling fixes which is the paper's, and Appendix C carries the restatement. Appendix B, block R15(d).

12.3 Admissibility

Corollary 12.6 (Admissibility is independence)**. [A]** *By Theorem 5.33 the incidence, hence the transversal matroid* M*, is determined by the slot set alone; an assignment is admissible exactly when its slot set is independent in* M*; and its deficiency is the corank. The slot set induced by the consistency relation is independent, and the published witness, occupying the same slots, has the same deficiency.*

Proposition 12.7 (An inadmissible variant)**. [A]** *Relocating one demand to a slot not previously carrying one gives a slot set of rank seventeen and deficiency one, the obstruction being a Hall violation in which eight slots reach seven classes between them. Under Theorem 5.35 the relocated demand lies in the closure of the retained ones, and the criterion returns the same verdict without exhaustive search over subsets.*

Proof. Computed on the full slot set and on the relocated variant: rank eighteen against rank seventeen, with the violating set and the seven classes it reaches exhibited. The adjacency agrees with the published record on all eight rows the corpus prints. Appendix B, blocks R5, R4b and R15(a), computed. □

Scholium 12.8 (Why the first result carries less than it appears to)**.** Corollary 12.6 looks like a result in favour of the assignment the consistency relation induces, and it is not.

Deficiency cannot distinguish that assignment from the published witness, because the two occupy the same slots and by Theorem 5.33 the matching never sees which structure sits where. Admissibility is a constraint on slot sets and not a criterion on assignments, and Section 12.5 does not appeal to it.

What Proposition 12.7 shows is that the constraint is not vacuous. A third exchange, made in an earlier draft of the source in order to collect the non-releasing codons into one block, moves a demand and fails. It is withdrawn there, and the collection it was made for is obtained without moving anything.

12.4 Complementarity

Definition 12.9 (Complementary slots)**. [D]** Two slots are complementary when the position-wise complement of the codon set of one is the codon set of the other.

Theorem 12.10 (The complementarity count)**. [A]** *Among the eighteen slots there are exactly three complementary pairs, of the one hundred and fifty-three possible. Of these, exactly one has both slots of size two. Ten of the eighteen slots have size two, giving forty-five pairs, of which one is complementary.*

Remark 12.11 (The count is exhaustive)**. [A]** All four quantities are computed from the slot list of Table 4 over the one hundred and fifty-three unordered pairs: three complementary pairs, ten slots of size two, forty-five pairs among those, and exactly one complementary pair with both slots of size two. Appendix B, blocks R13 and R15(e), computed.
An earlier form of this remark recorded that the exhaustiveness was not verified, the slot list not having been printed. It is now verified and the count is unchanged, so no statement resting on Theorem 12.10 requires restatement.

Remark 12.12 (The scarcity is structural, not numerical)**. [A]** A pyrimidine half is complementary only to the purine half of the complemented block, and most purine halves are not slots at all — they are supplied by the refinement and carry no seed. The count is used once, in Section 12.5, and it is used there as a uniqueness statement and not as a probability.

12.5 The exogenous pair, and what forces its placement

Definition 12.13 (Exogenous)**. [D]** A decoration is exogenous when the heteroatom it introduces has no source within the carrier, so that its introduction is an event of the medium and not of the cluster.

Proposition 12.14 (There are exactly two)**. [D]** *Exactly two structures carry an exogenous decoration of one and the same species, and no structure carries two.*

Remark 12.15 (Why this makes placement a question)**. [A]** A decoration sourced inside the carrier is available wherever the carrier is; an exogenous one is not. Two structures requiring the same exogenous species must therefore either be served by one event or by two that coincide. That is the whole of the reason the placement of these two is a question and the placement of the other eighteen is not.

Hypothesis 12.16 (Paired delivery)**. [D]** The two structures of Proposition 12.14 are seeded at complementary slots, so that one delivery serves both.

Theorem 12.17 (The placement is forced)**. [D]** *Assume Hypothesis 12.16. Both structures occupy slots of size two. By Theorem 12.10 exactly one complementary pair of the eighteen slots has both slots of size two. Their placement is therefore unique, and it is the placement of the assignment the consistency relation induces.*

Remark 12.18 (The hypothesis is the whole of the chemistry here)**. [A]** Hypothesis 12.16 is not derived. It says that one event is preferred to two that must coincide, which is an argument about the medium and not about the cluster, and neither the corpus nor this paper establishes it. What is established is what follows from it.
Section 13 returns to this hypothesis in a different setting, where the complementarity it assumes is a consequence rather than a premise; that promotion is entry C5 of Appendix C and it inherits the premises of the setting that supplies it.

Remark 12.19 (The witness is not a second solution)**. [A]** Under the published witness neither of the two structures has the other at its complementary slot: one has a structure of a different kind there, and the complement of the other is not a slot at all. The witness is therefore not a second placement satisfying Hypothesis 12.16; it is a placement in which the hypothesis fails.

12.6 A convergence at one slot

Proposition 12.20 (The forced pair, named)**. [A]** *The unique complementary pair of slots with both slots of size two is the pyrimidine half of one block against the purine half of its complement, and the second of these two slots is the purine half of the block* AU*, whose two codons are* AUA *and* AUG*.*

Proof. Complementation of the two codon sets, and their sizes; Appendix B, block R13, computed. □

Remark 12.21 (Three marks on one block, and how they stand to one another)**. [A]** The block AU is distinguished in the arc three times, and a coordinating paper is the first place at which the three can be seen together — and the first place at which their relation can be stated, which matters more.

By Theorem 12.17 it carries the second of the two exogenous structures, its purine half being one of the two slots of the unique complementary pair of size two. That placement is forced by Hypothesis 12.16 and by a count over slots.
By Corollary 5.45 and Proposition 5.47 it is one of the two blocks at which the standard mapping leaves Con-admissibility, its purine half being the one at which that mapping is irregular; and it is the only such block that no exchange of the corpus reaches.
And it is the block carrying the codon at which reading initiates, which Section 13 reaches by an argument passing through neither of the above.

The first and third are *not* independent, and an earlier form of this remark said they were. The two slots the junction of Section 13 presents are exactly the pair of Theorem 12.17, and the junction route *derives* the complementarity that the placement route *assumes*. Their agreement is therefore explained rather than coincidental, and the explanation is the promotion recorded as entry C5 of Appendix C. Appendix B, block R14, computes the identity of the two pairs.
The second mark is independent of both. It rests on the gating hypothesis and on nothing the other two use.

Proposition 12.22 (The coincidence is not improbable)**. [A]** *Let the two blocks at which the standard mapping is irregular fall uniformly at random among the sixteen. Then the probability that at least one of them lies in the forced complementary pair is* $1 - \binom{14}{2}/\binom{16}{2} = 29/120 \approx 0.24$*, and the probability that the block* AU *specifically is irregular is* $1 - \binom{15}{2}/\binom{16}{2} = 0.125$.
Moreover, of the sixteen blocks, six carry at least one of the arc's four marks — irregularity, the forced pair, the blocks the exchanges touch, and the blocks at which non-release occurs — and all six pairs of those marked sets intersect.

Proof. Exhaustive over the $\binom{16}{2}$ placements of the two irregular blocks, and by intersection of the four marked sets; Appendix B, block R16, computed. □

Remark 12.23 (The observation is demoted)**. [A]** An earlier form of this section reported the coincidence at the block AU as a finding and opened a target asking whether the marks have a common source or whether the arc is too narrow for marks to fall apart. The target is discharged and the answer is the second.
At a null rate near one in four, one coincidence among sixteen blocks is what the arithmetic produces. With over a third of the blocks carrying some mark and every pair of marked sets intersecting, pairwise coincidence is the expected condition and not an observation. The coincidence is therefore recorded as a fact about where the marks fall and is *not* reported as a convergence, here or in Section 15.
Two things are unaffected. The agreement of the placement route with the junction route is not a coincidence at all and no null bears on it: one route derives the complementarity the other assumes, which is the promotion of entry C5, and Remark 12.21 states it in that form. And the forced placement itself is untouched, resting on Hypothesis 12.16 and on a count and not on where the result falls.
Proposition 12.22 is also the paper's one posed null model, and Proposition 12.1(iii) is amended accordingly: the counts of Section 12.4 remain exhaustive enumerations and not probabilities, and this one statement is of the other kind.

12.7 The exchanges, and the dilemma

Remark 12.24 (The exchanges, ranked)**. [A]** The two assignments differ at two exchanges, and three claims are involved because the first is argued from one side and forces the other. They are not of equal standing.
The exogenous pair. Forced, by Theorem 12.17. A uniqueness result, conditional on Hypothesis 12.16 and on nothing else.
The displaced structure. Not a second exchange but the other side of the first: the slot required was occupied, and its occupant moves. No independent argument is offered and none is needed.
Block coherence of a paired decoration type. An organizational property of the mapping. No uniqueness result, and it is offered rather than pressed.

Scholium 12.25 (The dilemma, stated and not decided)**.** Two assignments occupy the same slots and are admissible together, differing at two exchanges. One is the published witness, whose refinement outputs an observed mapping. The other is induced by the consistency relation, and at one exchange its placement is forced.
Either the consistency relation is wrong at two exchanges, or the observed mappings stand two exchanges from an assignment that structural consistency selects and that is neither of them.
This paper does not decide between these, and it is the arc's principal undecided question. What would settle it is an independent ground for Hypothesis 12.16, or a demonstration that the placement it forces is unavailable to the medium. Section 13 supplies a conditional ground for the first in a different setting, at the cost of a premise about assembly; Appendix C, entry C5, states what that discharge does and does not reach.
The dilemma propagates. Every result of Section 13 that is stated in the selected assignment inherits it whole, and

Section 15 says so at the point where a reader is most likely to forget.

12.8 Falsification register for this section

13 The junction: why sulfur, why the start, what a stop is

Two questions survive Sections 9 to 12. Why should the same exogenous element be required twice, and why should a reading have a beginning. This section presents the account that answers both at one object, and it is the arc's most productive construction and its most heavily premised.

The order of the section is its method and should be preserved in any restatement. The object is fixed first, then the reaction it carries, and the reading is taken off the reaction rather than assumed. Nothing about frames is assumed before the chemistry; what is assumed about the chemistry is five premises, listed at Remark 13.33, of which one is about assembly and is not supplied anywhere in the corpus.

13.1 Non-implications

Proposition 13.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That the formation of a junction is explained. It is a premise about how carriers assemble; why two strands should terminate against one another, how often, and under what conditions are not addressed.

(ii) That anything is favourable. No energy is computed and no barrier estimated, by the scope convention of Section 2.6.

(iii) That the localisation rule is excepted at the junction. By Theorem 5.17 the odd and even cases are two instances of one statement; no exception is admitted and none is needed.

(iv) That a reading direction is reversed. The operation relating the two strands is face inversion with order kept, and both order-reversing alternatives fail at the discriminating case.

(v) That the observed start codon is explained. The two residues are frame-related in the assignment structural consistency selects and not in the observed mapping (Proposition 13.31), so the dilemma of Section 12 is inherited whole.

(vi) That all termination is accounted for. Two of the three stop codons of the standard mapping are produced and the third is not, and the account is scoped to the two mappings the corpus treats.

(vii) That the agreement of this section with Section 12 at one pair of slots is a second datum. It is the same datum (Remark 13.29).

13.2 The object

Hypothesis 13.2 (The junction)**. [D]** Two poly-*A*-chrysene complexes meet chrysene to chrysene, with no intervening nucleobase, the two facing units stacked π-face to π-face.

Definition 13.3 (The junction cell)**. [D]** The junction cell is the six vessels flanking a junction, three drawn from each strand, with the junction between the third and the fourth. The hexamer is the six bases they present.

Proposition 13.4 (The two strands run oppositely)**. [D]** *One strand runs into the junction and the other out of it. The reading is continuous across the boundary, and the cell is not symmetric under exchange of its two halves.*

Corollary 13.5 (The cell, in the language of Section 5.2)**. [D]** *The junction cell has six vessels. By Proposition 5.15 the fixed locus of the reversal on a complex of six vessels is an edge, namely the pair flanking the central interface; by Theorem 5.17 an equivariantly localised pathway on it transforms two vessels and yields two products, one on each of the two facing units.*
A codon cell has three vessels, an odd count, a fixed locus that is a vertex, and one product. The two are instances of one statement and not a rule together with a departure from it.

13.3 Two residues, and what does not join them

Proposition 13.6 (Both paths are the corpus's rows)**. [D]** *The two excisions are those the structure series records for the two sulfur-bearing structures, with their retained sets and cut lists used as published, one on each facing unit.*

Remark 13.7 (The row, as ruled)**. [A]** The first of the two residues is one of three rows of the series that record two vertices removed entire and no severed edge, and the junction development exhibits for it a cut list of two edges at the base point instead. The two are different operations and the discrepancy was entered as C11.

statement	what would refute it
Proposition 12.3	A class meeting a block in two codons; a recomputation disagreeing with block R4a.
Corollary 12.6	A maximum matching of deficiency greater than zero on the slot set; or an incidence depending on the structure at a slot.
Proposition 12.7	An admissible relocation lying in the closure of the retained demands, which would refute Theorem 5.35 rather than this proposition.
Theorem 12.10	A fourth complementary pair, or a second with both slots of size two.
Proposition 12.14	A third structure carrying the exogenous species, or one structure carrying two.
Theorem 12.17	A placement satisfying Hypothesis 12.16 at other slots.
Proposition 12.20, Remark 12.21	A recomputation disagreeing with block R13; or a full slot list under which the pair of Theorem 12.17 is not the one named.

It is ruled in favour of the series: *two vertices removed entire*. A vertex removed entire loses every edge, which is how a structure terminating on a vertex flanked by framework vertices is freed, and the ruling is made on that ground and not on the authority of either article.

Proposition 13.6 is therefore true of the series' rows and the junction development's Definition and fragmentation block both require correction. What changes there is recorded at Audit Item 13.8; what does not change is the second residue, no vertex being removed entire in its row, and with it the sulfur sites, the bridge and the whole of the reading.

Audit Item 13.8. **[A]** Two printed statements of the junction development are incorrect under the ruling of Remark 13.7 and are to be corrected rather than rescoped.

Its fragmentation block reports one remnant of seventeen carbons for the first unit. Under removal entire the remnant is three pieces, of fifteen, one and one carbons. The three-asymmetry theorem's fragmentation clause therefore reads three remnants against two, of eight and seven, and *the asymmetry survives the correction*: the two units still differ, and still differ in the same direction.

Its balance is derived over the carbons of each unit whose incidences change. Removal entire changes the incidences of two further carbons of the first unit, so the constant term is to be recomputed. The affine form in the remnant level is unaffected, the parameter entering only at the oxygen-bearing termini, so Corollary 13.18 survives in form and its vanishing point awaits the recomputation.

Proposition 13.9 (Nothing joins the two residues through the carrier)**.** **[D]** *The two residues occupy different molecules. They share no atom, no bond and no cut, and no path through either carrier connects them.*

Corollary 13.10 (The bridge is load-bearing)**.** **[D]** *Until the disulfide is formed, and after it is cleaved, the two residues are unconnected objects. The bridge is the only thing that makes the cell one reaction rather than two.*

13.4 Why sulfur, and why twice

Proposition 13.11 (The demand)**.** **[D]** *The junction cell requires two sulfur atoms, one terminal on one unit and one internal on the other: two atoms delivered to two different molecules.*

Hypothesis 13.12 (Disulfide delivery)**.** **[D]** The cell receives its sulfur as a disulfide, in a single event, and the two sulfurs of that disulfide become the two sulfurs of the pair.

Corollary 13.13 (One event, two molecules)**.** **[D]** *A disulfide supplies two atoms, so one delivery serves both residues exactly, with no atom left over and none required from a second event.*

Scholium 13.14 (The reading offered for the exogenous pair)**.** The corpus records that exactly two structures require an element the carrier cannot supply. At a junction that fact acquires a reading it does not have elsewhere, and this is the arc's answer to *why sulfur*.

A disulfide is a linkage between two sulfur atoms. It is therefore the one species in the account that can be delivered to two separate molecules at once and hold them together while both fragment. Everything else the medium supplies is delivered to a single carrier. So at the one place in the architecture where a reaction must span two carriers, the reagent that spans them is a disulfide, and the two residues formed there are the two that carry sulfur.

The reading is offered and not pressed, and its scope should be read exactly. It says why the two sulfur-bearing structures are the junction's residues, *given* that the junction exists and that sulfur is exogenous. It establishes neither. That exactly two structures need an exogenous species is a fact of the series obtained by inspection, and nothing in the corpus says why those two should be the two.

13.5 The bridge, and the three asymmetries

Proposition 13.15 (The bridge closes without distortion)**. [D]** *Between two sites on one aromatic plane the exocyclic directions are fixed by the ring, so the separation of two substituents is determined and cannot be adjusted. Between two sites on different molecules only the separation normal to the planes is fixed, the lateral register of a stacked pair being free. At the stated resting separation, and against a sulfur–sulfur single bond of* 2.02 *to* 2.06 *Å in an organic disulfide [AKW+87, EH91], of which* 2.05 *Å is used throughout, the bond closes at a lateral offset in one sense of the internal sulfur and cannot close at any offset in the other, so that sense is forced.*

Remark 13.16 (The separation is a resting value)**. [A]** The figure used is the separation of two units stacked and unbonded. Once the bridge is formed the two are covalently joined and the separation is an output of the bonded geometry. The proposition therefore uses the resting value to conclude that the bonded state is reachable, which is an approximation and is declared as one; computing the bonded geometry lies outside the declared scope.

Theorem 13.17 (Three asymmetries, one unit)**. [D]** *The two units of the central pair differ in three respects: in fragmentation, in whether the sulfur site is terminal or internal, and in whether the strand runs into the junction or out of it. All three distinguish the same unit.*

Corollary 13.18 (The balance adds no fourth)**. [D]** *The external electron demand of the cell is affine in the remnant level and vanishes at a single value, at which both oxygen-bearing remnant termini stand at the aldehyde level. The two units make the same demand there, so the balance adds nothing to Theorem 13.17 and subtracts nothing from it.*

Remark 13.19 (Two caveats carried from Section 14)**. [A]** Two entries of Appendix C bear on Corollary 13.18 and neither disturbs its form.

The fragmentation clause of Theorem 13.17 reads one remnant against two as printed in the junction development, and under the ruling of Remark 13.7 the first unit gives three remnants. The asymmetry survives; the clause as printed does not, and Audit Item 13.8 carries the correction.

The constant term of the balance is affected by the same ruling, and by the restatement of Remark 10.9 fixing which atom bears the phosphate oxygen. The affine form in the remnant level is unaffected by both, the parameter entering only at the termini. The vanishing point is therefore to be recomputed, and Target 14.13 carries it.

Corollary 13.18 is nevertheless the arc's most directly testable consequence: a single product analysis decides whether the termini stand at the aldehyde level.

13.6 The reading, taken off the reaction

Proposition 13.20 (The phase is underdetermined by one position)**. [A]** *For an alternating hexamer over two complementary letters, the face inversion of the hexamer equals the hexamer shifted by one position. Changing the frame and changing the phase by one position therefore have the same effect on every window, and the sequence determines the reading only up to one position.*

Proof. A finite check over the four alternating hexamers; Appendix B, block R14, computed. □

Scholium 13.21 (Why a junction can set a frame)**.** Proposition 13.20 is worth reading as a positive statement rather than as a deficiency.

A sequence that fixed its own phase would need nothing to set a frame, and a frame would not be a thing that could be set. An alternating hexamer fixes its phase to within one position and no further, so something outside the sequence must supply the last position — and a physical discontinuity in the carrier is exactly such a thing: available once, at one place, and not re-readable.

The sequence leaves precisely one degree of freedom and the junction supplies precisely one datum. In the vocabulary of Section 5.3 the junction is a phase-fixing datum; Remark 5.29 records that this paper does not present the set of readings as a torsor, and Target 5.30 states what would settle it.

Theorem 13.22 (Only face inversion relates the two codons)**. [D]** *Let the junction bases be fixed and assume that the outer position of the outgoing codon is the complement of the outer position of the incoming one. Of the three operations of the frame group, only face inversion carries the incoming codon to the outgoing one at every value of the outer positions.*

At an alternating hexamer the three cannot be told apart, every window being a palindrome. At the discriminating case — a pyrimidine outside the incoming codon and a purine outside the outgoing one — face inversion succeeds and both order-reversing operations fail.

Proof. The three operations applied at each value of the outer position; at one value two operations agree and at the discriminating value exactly one does. Appendix B, block R14, computed. □

Scholium 13.23 (The start codon is what proves the frame)**.** The order of Theorem 13.22 should be preserved in any restatement, and it is the opposite of the order a reader expects.
The account does not assume face inversion and then find a start codon. It finds that the start codon is the only case at which the two junction codons are frame-related at all, and that at that case exactly one operation works. The composition the complex assembles cannot decide the question — every window of an alternating hexamer is a palindrome — and the deciding case is the one in which the outgoing codon is the start.
The theorem also settles the vocabulary. Order reversal fails at the deciding case, so no reading direction is reversed at a junction.

13.7 Start and stop at one position

Hypothesis 13.24 (Release at the outer position)**. [D]** A structure formed at a unit of the central pair is released only when the register at the outer position of that unit's codon is narrow. Where it is wide, the structure engages the base point, is not liberated, and the carrier is consumed.

Theorem 13.25 (One position decides start and stop together)**. [D]** *Assume Hypothesis 13.24 and the outer-base hypothesis. A purine at the outer position of the incoming codon terminates that reading and, by complementarity of the outer bases, withholds the outgoing start: one event at one position. In both failing cases a structure forms and is not liberated, which is the second failure mode of Proposition 11.22 and not the first.*

Corollary 13.26 (The two start codons arise together)**. [D]** *The purine cases at the outgoing outer position are two, and both give the second sulfur residue. The account does not choose between the two codons at which that residue is observed to initiate; both are starts, and the pyrimidine cases are not.*

Remark 13.27 (Termination, and what it does not cover)**. [D]** Termination is produced as the failure of a reaction and not as a residue assigned to a codon. Two bounds. The standard mapping has a third stop codon which nothing here produces. And published translation tables [Nat24] deliver residues at the pair this account finds terminating, so the claim is scoped to the two mappings the corpus treats, as the corpus scopes its own.

13.8 What the section returns to Section 12

Corollary 13.28 (Complementarity is a consequence here)**. [D]** *The two strands are related by face inversion; face inversion is position-wise complementation; so the two codons of a junction are complementary of necessity. And one delivery serves both because the two sites are one bond apart across the stack, not because one event is preferred to two that must coincide.*

Remark 13.29 (The same datum, not a second one)**. [A]** The two slots the junction presents — the pyrimidine half of one block and the purine half of its complement — are exactly the pair that Theorem 12.17 forces, and the second of them is the block carrying the start codon. Appendix B, block R14, computes the identity.
This is not a convergence of two independent routes and should not be reported as one. The junction route *derives* the complementarity that the placement route *assumes*, so the agreement is an explanation and not a second datum. It is the promotion recorded as entry C5 of Appendix C, and Remark 12.21 is stated in that corrected form.
What remains independent of both is the third mark on that block: that the standard mapping leaves Con-admissibility there, by Corollary 5.45, which uses neither the junction nor paired delivery.

Remark 13.30 (What the promotion discharges, and at what price)**. [A]** The paired-delivery hypothesis of Section 12 is a premise there and a consequence here, so the target asking for an independent ground is discharged — conditionally on this section's own premises, which are not fewer.
Two bounds, both stated by the source. The identity holds in the assignment structural consistency selects, which is where the placement theorem also lives, so the ground reaches no further than that theorem does. And it requires the outer-base hypothesis, without which the two codons are not complementary at all.

13.9 What the section does not reach

Proposition 13.31 (The pair is frame-related in the selected assignment only)**. [A]** *In the observed standard mapping, no operation of the frame group carries either codon of the first sulfur residue to the codon of the second: face inversion*

gives codons of a third residue, and the two order-reversing operations give codons of others again.

Proof. The three operations applied to each codon of the first residue in the standard mapping; Appendix B, block R14, computed. □

Scholium 13.32 (The result, bounded)**.** Proposition 13.31 is the section's least comfortable statement and it belongs in the body rather than in a discussion.
Everything above holds of the assignment that structural consistency selects. The observed mapping stands two exchanges from that assignment, and the dilemma of Scholium 12.25 is inherited whole. This section shows that a junction in the selected assignment sets a frame at a start codon and terminates at a stop; it does not show that the observed start arises this way, and a reader who declines the selected assignment is not answered here.

Remark 13.33 (The premises, counted)**. [A]** Five premises of this section, and one import. That a junction forms; that a structure is released only at a narrow outer register; that the sulfur arrives bonded; that neither sulfur afterwards migrates; that the two outer bases are complementary; and, imported, that sulfur has no source in the carrier.
They are of three kinds: one about how carriers assemble, two about what the medium delivers and where it stays, and two about the cell's own reading and release. None is about the code, and none amends the corpus.
The first is the one on which everything rests and the one no paper of the corpus supplies. A demonstration that no junction forms removes the object and with it every statement of this section. Sulfur delivered otherwise than as a bridged pair, or free to migrate, leaves the object standing and removes the reaction, leaving a pair of independent excisions on adjacent units and no account of initiation. A decision against the selected assignment leaves the cell, the reaction and the balance intact and removes the reading.

13.10 Falsification register for this section

14 The redox functional on the structure series

Article 59 derives, for the junction cell, an external electron demand affine in a single parameter — the number of oxygen-bearing remnant termini standing at the aldehyde level rather than the alcohol level — and finds that it vanishes at one value only, both termini at the aldehyde level. The derivation is atom by atom from explicit bond lists, and it is confined to two structures.

The same construction is available at every structure of the series, and this section was planned to carry it out. It does not, and the reason is stated in full at Section 14.4: the printed series does not contain the data the construction needs. What the section does carry is the part of the functional that is graph-theoretic, which is computed here for all twenty structures, together with an exact statement of what remains and a target that would close it.

The section also reports a discrepancy between two articles of the corpus, encountered in the course of the computation and entered in the ledger.

14.1 Non-implications

Proposition 14.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That a redox balance establishes feasibility. It shows that a transformation is not excluded on electron-counting grounds and says nothing about any barrier. The scope statement of Section 2.6 forbids the second and this section computes no energy.

(ii) That the functional is a mechanism. It is global over a structure and says nothing about how electrons reach any bond.

(iii) That the skeletal data of Table 1 determine the functional. They are one of its two inputs, and Section 14.4 states what the other is.

(iv) That the ruling of Section 14.4 is an evidential finding. Two articles describe one row of the series differently and the ruling settles which this paper uses, on a valence ground. It determines a convention and a set of corrections; it establishes no chemistry.

(v) That the residual-valence count of Table 1 is an invariant of anything beyond the excision. It is a count of severances and no property of a residue is inferred from it.

14.2 The index, and the parameter

Definition 14.2 (Oxidation index)**. [A]** For an atom, ω is the sum of bond orders to more electronegative partners less the sum to less electronegative ones, bonds between atoms of one element contributing nothing. For a transformation, $\Delta\omega$ is taken over the atoms whose incidences change. A negative total means the object must be reduced from outside, a positive total oxidised.

statement	what would refute it
Hypothesis 13.2	A demonstration that two complexes cannot terminate against one another chrysene to chrysene.
Corollary 13.5	A recomputation disagreeing with block R3; or a localised pathway on an even count transforming one vessel.
Proposition 13.6	A retained set or cut list differing from the published row — and see Remark 13.7 and Audit Item 13.8.
Proposition 13.15	A stacking separation at which the normal gap exceeds a sulfur–sulfur bond in both senses of the internal sulfur.
Corollary 13.18	A self-sufficient cell exhibiting a remnant terminus below the aldehyde level; or a demand not affine in the remnant level.
Proposition 13.20, Theorem 13.22, Proposition 13.31	A recomputation disagreeing with block R14; or an operation of the frame group other than face inversion carrying the incoming codon to the outgoing one at the discriminating case.
Theorem 13.25	A junction terminating at a pyrimidine outer position, or setting a start at a pyrimidine outgoing one.
Hypothesis 13.12	A sulfur source that is not a disulfide, or delivery of the two sulfurs in separate events.

Definition 14.3 (Remnant level)**. [D]** The fracture of a vessel leaves certain carbons of the remnant bearing a new hydrogen; among them, those bearing the ether oxygen of a tether may terminate at the alcohol level or at the aldehyde level. For a structure x let $\tau(x)$ be the number of such oxygen-bearing termini and let $k \in \{0, 1, \dots, \tau(x)\}$ be the number of them standing at the aldehyde level. The remaining remnant carbons are taken at the hydrocarbon level, which is an assumption and not a result.

Definition 14.4 (The demand functional)**. [D]** For a structure x write $\nu_x(k)$ for the total index change of the excision producing x, as a function of the remnant level k.

14.3 The decomposition, and what is computed

Proposition 14.5 (The functional splits)**. [D]** *Let x be a structure with retained set S. Then*

$$\nu_x(k) \;=\; \underbrace{\sigma(x)}_{\text{skeletal}} \;+\; \underbrace{\eta(x)}_{\text{decoration}} \;+\; k,$$

where $\sigma(x)$ is determined by the excision as a subgraph operation, $\eta(x)$ by the terminal types and heteroatom insertions of x, and the coefficient of k is one for each oxygen-bearing terminus promoted from the alcohol to the aldehyde level.

Proof. Each atom whose incidences change contributes to $\Delta\omega$ either through a bond to a framework carbon severed or formed, which is a function of S and of the cut list, or through a bond to a heteroatom introduced by a decoration, which is a function of δ; the two sets of contributions are disjoint because a bond has one pair of endpoints. Promotion of an oxygen-bearing terminus from the alcohol to the aldehyde level raises the index of that carbon by one and changes no other incidence. □

Proposition 14.6 (The skeletal input, computed)**. [A]** *For every structure of the series, the number of bonds each retained vertex loses to the framework is determined by the retained set and the vessel graph. The totals, and the residual after the transannular bond to c_α consumes one severance at* C5*, are those of Table 1. In addition, every cut list of the series is complete: every edge from a retained vertex to the framework appears in the cut list or is incident to a vertex removed entire.*

Proof. Appendix B, blocks R7 and R9, computed. The completeness check is block R8 and agrees with the published record of Article 57. □

Remark 14.7 (One entry, noted and not used)**. [A]** The series has exactly one structure of residual count zero, and it is the structure with empty retained set. Its excision severs no framework bond, fills no valence and requires no decoration.

The observation is recorded here because Section 15 uses it in distinguishing a null excision from a formation that fails to be released, and because a reader of Table 1 will notice it. It is a property of the excision and no property of a residue is inferred from it.

14.4 The obstruction, and a discrepancy

Remark 14.8 (The decoration record, supplied and audited)**. [A]** By Proposition 14.5 the functional requires $\eta(x)$, a function of the terminal types and the heteroatom bridges. That record is now printed for all twenty structures at Table 5, and it is audited rather than taken: each row is reconstituted into a side-chain molecular formula and compared against the formula the interpretation requires, and independently each retained vertex is checked for valence completeness, which is the stronger test. All twenty rows pass both. Appendix B, block R17(a).

The two structures of the exogenous pair are distinguished in the record in a way visible nowhere else: one carries its

structure	retained set	total severances	r
Gly	∅	0	
Ala	C5	2	
Cys	C5	2	
Ser	C5	2	
Asn	C4b, C5	3	
Asp	C4b, C5	3	
Thr	C4b, C5	3	
Val	C4b, C5, C6	3	
Arg	C4b, C5, C10b, C11	4	
Gln	C4b, C5, C10b	4	
Glu	C4a, C4b, C5	4	
His	C4b, C5, C10b, C11	4	
Ile	C4b, C5, C6, C10b	4	
Lys	C4b, C5, C10b, C11	4	
Met	C4b, C5, C10b	4	
Phe	C4a, C4b, C5, C10b, C11, C12, C12a	4	
Pro	C4b, C5, C10b	4	
Trp	C1–C4, C4a, C4b, C5, C10b, C12a	4	
Tyr	C4a, C4b, C5, C10b, C11, C12, C12a	4	
Leu	C4a, C4b, C5, C10b	5	

Table 1: The skeletal input to the demand functional. *Total severances* counts, over the retained vertices, the bonds lost to the framework; *residual valences* deducts the one severance at C5 consumed by the transannular bond to c_α. Each residual valence is filled by a new hydrogen, by a heteroatom, or by an oxygen-bearing terminus, and which of the three is the decoration datum that Section 14.4 finds absent from the printed series. Ordered by residual count; Appendix B, blocks R7 and R9.

sulfur as a terminal type at the base point and the other as a bridge across an edge of its retained set. That the pair divides this way is the structural content of the exogenous demand, and it is legible only once η is printed.

Remark 14.9 (Supplying η does not close the functional)**. [A]** It would be convenient to report that Section 14 is now a theorem. It is not, and the evidence that it is not is internal to the computation.

The retained-set term of the balance is computable from Table 5 and is reported at Appendix B, block R17(c). Six of its twenty totals are *odd*. A complete balance over a cell cannot be odd, electrons being transferred in pairs, and the corpus records an odd total as the signature of precisely this failure. The retained-set term is therefore a proper part of the balance and not the balance.

What is missing is stated exactly. Every bond severed at the boundary leaves a framework carbon needing a substituent, and every vertex removed entire departs as a fragment whose valences must also be filled. Those atoms lie outside the retained set, so δ does not describe them; their contribution is the remnant term, and it is not available in the published record.

So η closes one of the two inputs of Proposition 14.5 and not both. Target 14.13 is narrowed accordingly and is not discharged.

3

Proposition 14.10 (Two readings of a row, and their fragmentations)**. [A]** *Three rows of the series — those retaining* C5 *alone — record two vertices as removed entire and record no severed edge. Two readings of such a row are available.*

(i) A vertex removed entire loses every edge and departs as a one-carbon fragment. The remnant is then three pieces, of fifteen, one and one carbons.

(ii) Only the edges incident to the retained vertex are severed, the flanking vertices remaining attached to the framework. The remnant is then one piece of seventeen carbons.

No other row of the series distinguishes the two readings: where no vertex is removed entire the two coincide, as they do at the second junction residue, whose remnant is two pieces of eight and seven carbons under either.

Proof. Component counts of the vessel graph after each removal; Appendix B, block R8, computed. □

Remark 14.11 (The two articles read the row differently, and the ruling)**. [A]** Article 57 states the convention of

reading (i) explicitly, and gives the reason: severing an edge would leave the flanking neighbour attached, whereas a structure terminating on a vertex flanked by framework vertices must be freed.
Article 59 states for the same structure a boundary cut list of two edges at C5, which is reading (ii), and its fragmentation block reports one remnant of seventeen carbons, which is reading (ii) and is not reading (i). Its Proposition 5.3 states that both retained sets and both cut lists are the corpus's rows unamended, and its re-scoping appendix attributes the substitution of a severance for a removal to the single-unit account and states that at a junction the corpus's row stands. The two statements of Article 59 are not consistent with one another: the cut list it exhibits is the substitution its appendix attributes elsewhere.

Ruling. Reading (i): two vertices removed entire. A vertex removed entire loses every edge, which is how a structure terminating on a vertex flanked by framework vertices is freed; severance at the base point alone does not free the flanking vertices, which the series requires to depart. The ruling is made on that ground and not on the authority of either article, and it is made because only one reading closes the valence.
Article 59's Definition 5.2 and its fragmentation block are therefore to be brought to reading (i). This is a correction and not a rescoping, and it is entered in Appendix C accordingly. What is affected is recorded at Audit Item 14.12. What is not affected is the second junction residue, at which the readings coincide, and therefore the sulfur site, the bridge geometry and the reading results of Article 59, none of which uses the fragmentation of the first residue.

Audit Item 14.12. [A] Three statements of Article 59 require correction under the ruling.
The fragmentation clause of its three-asymmetry theorem reads *one remnant, seventeen carbons* against *two remnants, seven and eight*. Under the ruling the first unit gives three remnants, of fifteen, one and one carbons, and the clause is to be restated as three against two. The asymmetry itself survives, the two units differing under either reading; what does not survive is the clause as printed.
Its balance is derived over the carbons of each unit whose incidences change. Under the ruling two flanking carbons of the first unit lose two bonds each rather than one, and the total index change is to be recomputed. The affine form in k is unaffected, the parameter entering only at the oxygen-bearing termini; the constant is not.
Its claim that both rows are used unamended is false as printed and is to be restated: the rows of the series are used unamended, and the cut list exhibited is not one of them.

14.5 Status of the result

Target 14.13 (The demand functional on the series)**. [A]** Supply the remnant accounting — for each structure, the substituent filling each valence left on a framework carbon by a severed bond, and the fate of each vertex removed entire — and thereby evaluate $\nu_x(k)$; determine at which structures the demand vanishes for some admissible k, and whether the self-sufficient structures are distinguished in any other way.
Two of the three inputs are now in this paper: the skeletal term at Table 1 and the decoration term at Table 5. The third is the remnant term, and parity is the test that it is still absent: six of the twenty partial totals are odd and a complete balance cannot be.
Two conditions on the execution, both taken from the corpus's own account of how this computation has failed before. Every bond list is to be derived from the retained set, the cut list and the decoration record rather than entered by hand, a tabulated block being one that formats an assertion with no computation able to disagree with it. And the parity of each total is to be reported, an odd total being one that closed-shell chemistry cannot give and being visible on the face of the output.

Scholium 14.14 (Why the section is published in this form)**.** The plan for this paper carried one new result and this was to be it, with a contingency stated in advance: if the computation did not close from the published series, the result would be demoted to a target with the partial results tabulated. It did not close and the contingency is taken.
What is published is therefore less than was planned and more than nothing, and it is more than at first submission. The decomposition of Proposition 14.5 is stated and proved; two of its three inputs are computed for all twenty structures, the decoration record having since been supplied and audited; the missing term is named exactly; and parity is exhibited as the test showing it is missing. A reader with the remnant accounting can close the target without reconstructing anything above.
The record also did something the plan did not anticipate. Printing δ exposed two respects in which the corpus's definition of a structure is too narrow to express its own series (Remark 11.7). That is a finding about a definition, obtained by attempting a computation, and it is the second time in this paper that attempting one has been worth more than completing it.
Two by-products are worth more than a partial result usually is. The completeness of every cut list in the series is independently recomputed here from the vessel graph, agreeing with the published record. And the attempt located a discrepancy between two articles on one row of the series,

> which no reader of either article alone would meet, and which is the kind of thing a coordinating paper exists to find.

14.6 Falsification register for this section

15 The consolidated register

This section answers, in one place, the questions the arc is usually said to answer. Each subsection gives the answer in one sentence, names the premises it rests on, states its standing, and says what would refute it. Nothing here is proved; every entry cites the section that proves it.

The section exists because the arc is stated across eight articles and the answers are stated across all of them, so that no reader has ever been able to see what each rests on without assembling it. Assembling it is the first of this paper's three functions and this is where that function is discharged.

Three entries do more than assemble. The entry on handedness restricts a claim the arc is habitually summarised as making; the entry on stop and glycine states a contrast the corpus makes nowhere in one place; and the closing subsections argue three precedence calls that no constituent article could have argued.

15.1 Two states

Answer. Each site of the carrier presents one of two placements, and no operation available to a unit identifies them.

Rests on. The axiom system, through the non-collapse of the marker. No hypothesis of the arc.

Standing. Structural. This is the only entry in the register that is not conditional on anything the arc adds.

Refuted by. An operation available to a unit identifying the two placements, which would collapse the marker and remove the object.

15.2 Four letters

Answer. A vessel is an adjacent pair of sites, one disubstituted unit with its tetrasubstituted neighbour; its two binary coordinates are the relation of the two planes, which is frame-free, and the sense of the pair against an external reference, which is not. Two binaries give four states, and the recoding of six markers to three vessel letters is a bijection.

Rests on. The species alternation, supplied by the attachment data. For the *naming* of the four states as nucleobases, the letter assignment, which is an import from the filings and not a construction.

Standing. The four-state count is structural. The identification of those four states with $\{A, C, G, U\}$ is documentary, and by Proposition 7.8 the two four-element sets are not canonically isomorphic.

Refuted by. A frame change altering the first coordinate; or a recoding failing to intertwine the frame actions.

15.3 Three per word

Answer. A cluster of six sites has three interfaces, each producing one base, so its output is a base triplet. The codon length is a consequence of the cluster length.

Rests on. That the reacting unit is six units alternating in species, and that each interface produces one base. Both are chemical premises registered before any codon is mentioned.

Standing. Derived, conditionally, and — this is the entry's point — derived in a direction opposite to the conventional one. The conventional account derives the triplet from the alphabet size; here both numbers descend from the carrier and neither justifies the other. The conventional derivation is in any case unavailable inside the formalism, the class count lying below the codon supply at every length, so the sufficiency condition distinguishes no length.

Refuted by. A cluster whose interfaces do not each produce one base; or a derivation of the cluster length from a codon table, which would remove the non-circularity without refuting the number.

15.4 Twenty

Answer. A product attributable to the assembly is an admissible function on the carrier, the algebra of such functions has dimension $2^{2N-2} + 2^{N-1}$, and that is twenty at three vessels.

Rests on. That the product depends on the marker assignment alone, and that the pathway does not involve the initiator. For the passage from *at most twenty* to *exactly twenty*, in addition: that every class produces a residue and that distinct classes produce distinct ones.

Standing. *This is a ceiling.* The constant map satisfies both standing hypotheses and has an image of one element, so the entire distance from the bound to the count is carried by saturation, which neither the corpus nor this paper establishes. And the bound itself is twenty only under initiator independence; with the initiator in view it is thirty-two, and the difference between the two numbers is the presence or absence of one section of a torsor.

Refuted by. A product varying with a datum outside the cluster, or with the initiator, either of which removes the bound; or a collision — two classes with the same product — which removes saturation and leaves the ceiling standing.

> **Remark 15.1** (The sentence this entry licenses)**. [A]** Not available: *the formalism explains why there are twenty residues.* Available: *a carrier of six units admits exactly twenty distinguishable states, so any product attributable to it is bounded by twenty; whether the bound is attained is a separate assertion the account does not establish.*

statement	what would refute it
Proposition 14.5	A contribution to $\Delta\omega$ that is a function of neither the excision nor the decoration; or a dependence on k that is not affine.
Proposition 14.6, Table 1	A recomputation disagreeing with blocks R7 or R9; or an edge from a retained vertex to the framework unaccounted for in a cut list.
Proposition 14.10	A component count disagreeing with block R8; or a third reading of a row recording vertices removed entire.
Remark 14.11	A reading of the two articles under which the cut list of the first residue and the fragmentation reported for it are both reading (i).

15.5 Why the side chain begins at C5

Answer. The arm is borne at C6 and the bond formed is to C5, the framework bond between them being retained. The backbone carbons are therefore supplied by the arm — C6α bearing the α-nitrogen and C6β oxidised and transferred onto the ribose 2′-oxygen — and the first side-chain carbon is a framework carbon, C5 itself. Every structure of the series is a connected subgraph rooted there, except the one whose retained set is empty.

Rests on. The reachability hypothesis package: chemical admissibility of each generator of the canonical word, a geometric lift for each, and admissible terminal states.

Standing. Conditional target existence. A hom-set is non-empty; no transformation is asserted to occur and no barrier is estimated.

Refuted by. A route to the target connectivity that cleaves a framework ring, or a loss of atom provenance; or a generator admitting no lift in the reference cage.

15.6 One handedness

Answer. Installation of the nitrogen at C6α produces a stereogenic centre whose two approach branches form a torsor under $\mathbf{Z}/2$; an oriented cage condition excluding one branch supplies a section, so the product is of one configuration rather than a mixture.

Rests on. The oriented-cage condition, in its strong form. The source admits a weaker realization in which the two branches are only energetically discriminated, under which the conclusion drops from a section to a bias.

Standing. Homochirality in the strict sense is established, conditionally. *Which* configuration results is not. Naming the surviving branch requires the complete substituent ordering and the L/D convention, both adopted outside the architecture, and the corpus twice declines a universal identification.

Refuted by. A cage condition excluding neither branch. Or, in the other direction, a derivation of the L/D assignment from the cage alone — which would establish more than the claim allows and refute it by exceeding it.

> **Remark 15.2** (The sentence this entry licenses)**. [A]** Not available: *the formalism explains why the residues are of the L series.* Available: *the architecture supplies a mechanism producing one configuration rather than a mixture, and the identification of that configuration with the L series is a labelling made by convention after the fact.*
> The gap is not a missing step in a chemical argument. It is the standard fact that a torsor has no canonical base point, and no argument of this kind could close it.

15.7 Sulfur, and why twice

Answer. Exactly two structures of the series require an element the carrier cannot supply, which is a fact of the series obtained by inspection. At a junction those two are the cell's two residues, because a disulfide is the one species the medium delivers that can be given to two separate molecules at once and hold them together while both fragment — and a junction is the one place in the architecture where a reaction must span two carriers.

Rests on. That a junction forms; that the sulfur arrives as a disulfide in one event; that neither sulfur afterwards migrates. Plus the import that sulfur has no source in the carrier.

Standing. The count of two is a fact of the series and is not explained: nothing in the corpus says why those two should be the two. The disulfide reading explains why, *given* a junction and given that sulfur is exogenous, the junction's residues are the two that carry it. It establishes neither antecedent.

Refuted by. A third structure requiring the exogenous species; a sulfur source that is not a disulfide; migration between sites after attachment.

15.8 The start

Answer. An alternating hexamer determines its reading only up to one position, face inversion and a one-position phase shift having the same effect on it; a junction is a discontinuity supplying exactly that one datum. Of the three frame operations only face inversion relates the two codons of a junction, and the case that proves it — the only case at which the two are frame-related at all — is the one in which the outgoing codon is the start.

Rests on. The junction; release at a narrow outer register; the outer bases being complementary; and the assignment that structural consistency selects.

Standing. The weakest of the register's positive entries, and it should be read with two restrictions attached. In the observed standard mapping no frame operation carries either codon of the first sulfur residue to the codon of the second, so the result

holds in the selected assignment and not in the observed one; the dilemma of Section 12 is inherited whole. And the junction itself is a premise about assembly that no article of the corpus supplies.

Refuted by. A demonstration that no junction forms, which removes the object entirely; an operation other than face inversion succeeding at the discriminating case; a junction setting a start at a pyrimidine outgoing position.

Remark 15.3 (The order of the argument, which is easily inverted)**. [A]** The account does not assume face inversion and then find a start codon. It finds that the start codon is the only case at which the two junction codons are frame-related at all, and that at that case exactly one operation works. Any restatement that reverses this order misrepresents the result and makes it look circular when it is not.

15.9 A stop, and how it differs from glycine

This entry states a contrast the corpus makes nowhere in one place, because its three components are in three different articles.

Answer. Three outcomes must be kept apart, and they differ in whether an excision occurs and in whether the carrier survives.

Glycine is the residue of a cell in which no excision occurs. Its retained set is empty; no framework edge is severed; the residual valence count is zero, uniquely in the series. The tether transformation runs and delivers $\mathrm{C6}\alpha(\mathrm{NH_2})(\mathrm{H}) - \mathrm{C6}\beta(=\mathrm{O})\mathrm{O} - \mathrm{C2}'$, in which the side chain is a hydrogen because nothing is retained at C5. The reaction completes, the residue is released, and the carrier is intact.

A stop of the first kind is a cell at which no structure is consistent with the codon. Nothing forms, nothing is delivered, and the carrier is not consumed.

A stop of the second kind is a cell at which a structure is consistent and forms, engages the base point, and is not liberated. The carrier is consumed. This is the mode the junction account produces: termination is the failure of a reaction to complete, and not a residue assigned to a codon.

So glycine and a stop are not two entries in one column. Glycine is a null excision that releases; a stop is either a reaction that never begins or a completed formation that fails to leave.

Rests on. For glycine: the structure series and the residue form of Section 10. For the two stop modes: the failure-mode distinction of Section 11 and, for the second, the release hypothesis of Section 13.

Standing. The glycine statement is a fact of the series and of the residue form. The two-mode distinction is a definition with a consequence — that a function constant on registry classes cannot separate the modes, and the consistency relation can. *Which mode the observed stops are in is not settled.* A companion development concludes from the code data that the limiting step is engagement rather than escape, which would put them nearer the first mode; the junction account puts them in the second. The two are not reconciled and the conflict is entry C9 of Appendix C.

Refuted by. A stop at which the carrier is demonstrably intact, under the second reading, or consumed, under the first — which is the observation that would settle C9.

Remark 15.4 (A terminological caution)**. [A]** The corpus describes the glycine block as one at which no extent is attained, no framework edge is severed, and the carrier is not consumed, and cites it both as the source of the clause gating consistency and as the contrast against which the two failure modes are drawn. Read strictly, *no structure is consistent* and *the empty structure is consistent* describe the same event and differ only in whether the empty retained set counts as a structure.

This paper counts it as one, the empty set inducing a connected subgraph containing the base point vacuously and the residue being delivered. A reader who counts otherwise should read the first stop mode and the glycine case as distinguished by whether a residue is delivered, which is the operative difference either way.

15.10 The initiator

Answer. The initiator supplies a section of the frame torsor — a direction and a projection reference — and is excluded from the cluster. The product pathway is assumed blind to that section; the reading is not. The whole distance between a ceiling of twenty and a domain of sixty-four is that one map sees the section and the other does not.

Rests on. Initiator independence, for the blindness of the product; and the identification of the bilayer-to-coding arrow with reversal, for the domain.

Standing. The reconciliation is structural and is stated in this paper for the first time, the two halves lying in different articles. The further claim of the filings — that the initiator determines whether the departing strand is ribonucleic or deoxyribonucleic — is documentary, is worked in no article, and is recorded and not used.

Refuted by. A cluster prepared with the initiator at either end yielding different products, which removes the blindness and with it the count of twenty.

15.11 Summary of standing

15.12 Three precedence calls

Scholium 15.5 (Parity is satisfied, not survived)**.** The capacity argument forbids an assembly-level operator from producing the standard mapping, and names among its witnesses the residue that initiates. The junction account reaches a start codon. A reader meeting the two in sequence

question	what is established	standing
Two states	Two placements, not identified	Structural; unconditional
Four letters	Four vessel states; recoding a bijection	Structural; the *naming* documentary
Three per word	Triplet from the carrier	Derived; two chemical premises; direction opposite to the conventional one
Twenty	Dimension of the invariant algebra	**Ceiling**, not a count; twenty only under initiator independence
C5	Side chain rooted at the base point	Conditional target existence; no kinetics
One handedness	One configuration, not a mixture	Conditional; *which* configuration is a labelling, not a result
Sulfur, twice	Disulfide spans two carriers at the one place that needs it	The count of two is unexplained; the reading is conditional on the junction
The start	Only face inversion relates the two codons, proved at the start	Selected assignment only; junction unestablished
Stop vs glycine	Null excision that releases, against formation without release	The glycine half is a fact of the series; which mode the stops occupy is open (C9)
The initiator	Section supplied; product blind, reading not	Structural reconciliation; the strand-identity claim documentary

takes the first to forbid the second.

It does not, and the relation is stronger than compatibility. The same argument that forbids the assembly-level operator *derives* that punctuation must live at the reading level; the junction account is located at the reading level; so the earlier result predicts where the later account must sit, and the later account sits there.

The disposition is CONSISTENT and the entry is C2. Nothing is withdrawn and no audit arises. This paper states the call because no constituent article has both halves in view.

Scholium 15.6 (The junction is primary, and is not superseding)**.** For the object it treats — a cell spanning a junction — the junction account governs, and this paper cites it there. Its advantages are real: the published rows used as they stand, no ring pyramidalisation, a cell asymmetric before anything happens, and the promotion of paired delivery from premise to consequence.

It is nonetheless entered as RE-SCOPED and not SUPERSEDED, and the reason is not a hedge. The junction article itself states that the two accounts describe different cells, that nothing forbids both, and that neither is evidence against the other. A coordinating paper that overrode that refusal would be asserting on its own authority a ranking the senior article declined to assert on its own.

The asymmetry of premises is recorded rather than resolved. The junction buys its advantages with an assumption about how carriers assemble that no article of the corpus supplies; the single-unit account assumes nothing of the kind. If the junction does not form, the single-unit account is what remains and the junction account falls entire; if it does, the single-unit account is what happens away from junctions.

Scholium 15.7 (The dilemma propagates, and is not narrowed)**.** Two assignments occupy the same slots and are admissible together. One is the published witness whose refinement outputs an observed mapping; the other is induced by the consistency relation, and at one exchange its placement is forced. Either the consistency relation is wrong at two exchanges, or the observed mappings stand two exchanges from an assignment that structural consistency selects and that is neither of them.

Every result of the arc stated in the selected assignment inherits this whole, and the start codon is such a result. Three things in this paper might be mistaken for narrowing it and none does.

The promotion of paired delivery discharges a target, but conditionally on the premises of the setting that supplies it, and it lives in the same selected assignment.

The convergence at the block carrying the start codon is, at two of its three marks, an explanation of why two routes agree rather than a second datum — and the third mark is a statement about a *failure* of admissibility, which is not evidence for what would repair it.

And the observation that the start-codon block is the one block no exchange of the corpus reaches is a gap in the account, not a result of it.

What would settle the dilemma is what the corpus says would settle it, and nothing in this paper is a step toward it.

15.13 One item the arc does not contain

Remark 15.8 (The block no exchange reaches)**. [A]** Under the factorization of Section 5.5, every assignment admitting the consistency relation is regular. The standard mapping is irregular at two blocks and therefore lies outside Con-admissibility there. One of those two blocks is reached by an exchange of the corpus; the other is not, and the other is the block whose purine half carries the start codon, its irregularity being the disagreement of that half.

So the corpus offers no account of that block as the standard mapping fills it. The placement route reaches its purine half by forcing the second exogenous structure there; the junction route reaches the start codon by a path that does not pass through Con-admissibility at all; and neither addresses the irregularity.

This is recorded as a gap and not as a finding, and the coincidence that the gap falls where the placement falls is not reported as a convergence: a null computation puts a coincidence of that kind at roughly one in four, and every pair of the arc's marked block sets intersects. It is also conditional on the gating hypothesis, whose provenance is abstraction from the series, and a failure of admissibility at a block is not an argument for any particular repair.

16 The enigma: encoding, code, and a theory with one model

The question this section addresses is not one the arc answers by a theorem, and a coordinating paper that presented it as though it were would be the worst kind of review. The question is what *kind* of answer the arc gives to the ordering problem — a code requires machinery that the code specifies — and what that answer costs.

The answer is of an unusual kind. The arc does not order the stages and does not claim that one preceded another; it holds that the stages coexist, so that no ordering is available to be claimed. That is a dissolution rather than a solution, it is forced by the architecture rather than adopted for convenience, and it is paid for in a way Section 16.4 states. One place in the arc is an exception, and the exception turns out to be the arc's account of initiation.

The section closes on the limitation that bounds everything above it: the structure the arc describes has one model.

16.1 Non-implications

Proposition 16.1 (Non-implications of this section)**. [A]** *None of the following is asserted below.*

(i) That any chronology is claimed or denied. An exchange is a relation between two assignments and carries no direction in time; the word originating *in the corpus names a transition from a carrier with no nucleobase to a domain of sixty-four, and not a sequence of codes.*

(ii) That persistence is established. It is a reading of the architecture, stated in a scholium of the corpus, and it enters no numbered statement there or here.

(iii) That the arc answers which chemical species the twenty are. It does not; Section 16.2 states where that answer lives and what its status is.

(iv) That the nucleic-acid branch is worked. It is exhibited in the filings and is not developed, and Section 16.6 says how far the asymmetry runs.

(v) That a single model is sufficient. Section 16.7 states the limitation and does not mitigate it.

16.2 Two questions, and which one the arc takes

Remark 16.2 (The capacity theorem answers neither)**. [A]** A bound on the number of products of a carrier leaves two questions, and they are independent. *Which* products, and *at which codons*.

The arc takes the second. It classifies structures, states which codons admit which, counts the admissible placements, and forces one. At no point does it determine which chemical species arise.

That is not an omission and it is stated as a refusal throughout: no numbered statement of the structure-space development identifies a chemical species, the objects being subgraphs with decorations, and their reading as residues is confined to an interpretive appendix that enters no proof. A reader who deletes that appendix loses the interpretation and no result.

The consequence for how the arc is described is direct. The account is of *where* twenty things sit, not of *what* they are, and the identification of the twenty structures with the twenty residues is made in an appendix at the level of a reading. It is the arc's largest unproved premise and the corpus records it as such.

16.3 Persistence rather than sequence

Remark 16.3 (The flow does not terminate at the code)**. [E]** The reading is this. A six-element stack carries an orientation at each element; those orientations are the registry; the registry is transformed into an integrated product of nucleobases tethered to intercalated chrysene; and that product forms structures and then chains of them.

Each of these persists while the next is produced. The stack is not consumed in becoming a registry, nor the registry in becoming a product. They coexist.

What that makes available is a mechanism of a self-referential rather than staged kind. A persisting stack has a definite external dimension, fixed by the aromatic rings of its six elements, and a persisting registry has a definite pattern; both are available as templates while structures are being formed. An emerging catalyst for a given structure may therefore be shaped externally against the stack and filtered internally against the structure as it forms, by dimension and by electrostatics respectively, without either step preceding the other.

This is a reading and enters no proof.

Remark 16.4 (Why no chronology is claimed, and why none is available)**. [A]** The refusal of chronology appears in the corpus as a non-implication clause and reads, on first encounter, like a disclaimer. Under Remark 16.3 it is not one. If the carrier, the registry and the structures formed from them are simultaneous and persistent, there is no sequence in which one could precede another, and the refusal is not a caution adopted by the author but a consequence of the architecture.
The distinction matters for how the arc answers the ordering problem. The conventional form of that problem asks which of two things came first and observes that each appears to require the other. The arc does not answer it in that form. It denies that the form applies, on the ground that the two things in question are not stages of a process but aspects of one persisting object.
Whether that denial is correct is not settled by anything in the corpus. What can be said is that it is not a convenience: the next subsection states what it costs.

16.4 What persistence forbids

Remark 16.5 (The price, paid once and visibly)**. [A]** A doctrine that dissolves an ordering problem is worth exactly as much as the moves it gives up, and this one gives up a move the corpus had occasion to want.
Published translation tables deliver residues at codons the corpus finds terminating. It would be convenient to set those mappings aside as the work of a device downstream of the carrier — a later apparatus acting on an earlier code. The formalism does not permit that reading, because it does not stage the carrier and the code in sequence. Having denied that one thing precedes another, the corpus cannot appeal to a later mechanism when a divergence is inconvenient, and it does not.
What it does instead is bound the claim. The proposition that the second register governs whether a codon releases is bounded to the two mappings it is stated for, and is replaced by a weaker claim about *what* is released rather than *whether*, which holds across a wider set of recorded instances.
This is the clearest instance in the corpus of a doctrine costing something and being kept anyway, and a coordinating paper should record it as such rather than presenting persistence as a free interpretive choice.

Remark 16.6 (Where the degeneracy comes from, on this reading)**. [E]** If the templates are the registry classes there are twenty of them, and a catalyst shaped against one is shaped against a pattern that twenty must share out. A limited registry admits imperfect fits, and two consequences follow, both of which the arc has had to record.
A structure may be shaped at one site and accommodated at a second, which is a duplication requiring no exchange. And a structure whose fit at its own site is marginal may be displaced to another, which is what an exchange is.
On this reading an exchange is not an anomaly in the assignment but the expected residue of fitting twenty patterns to a registry that supports twenty and no more. The reading licenses no exchange in particular, and predicts no mapping. It says only that the architecture has room for exchanges of this kind, and that the room is bounded by the same count that bounds the repertoire. It enters no proof.

16.5 Where persistence fails, and why that is the point

Remark 16.7 (The junction does not persist)**. [A]** One object of the arc is an exception to Remark 16.3, and the exception is not an embarrassment.
The junction cell opens rings on both its units and is destroyed in the reaction it carries. Read one way that is a difficulty for the persistence doctrine. Read the other it is what the object is for. A frame boundary is the place where the regularity of the strand fails, and a punctuation mark that could be read twice would punctuate nothing. A discontinuity is available once, at one place, and is consumed in being used — which is exactly the character a frame-setting event must have, and exactly what a persisting template cannot supply.
The two statements are compatible because they concern different objects. Persistence is a statement about the carrier, the registry and the product along a *regular* strand; a junction is where the strand is not regular.
What the tension does bound is the scope of the result. The arc accounts for the *setting* of a frame and not for its *maintenance*, and a discontinuity consumed in being read cannot maintain what it set. What maintains a reading frame downstream is not addressed anywhere in the corpus.

Scholium 16.8 (Two kinds of object, and the arc needs both)**.** It is worth stating plainly that the arc requires objects of two opposite characters and has one of each.
Everything that carries information persists: the stack is a template because it is still there. Everything that punctuates is consumed: the junction sets a frame because it is not still there.
Neither could do the other's work. A persisting template cannot mark a boundary, since a boundary readable at any time marks no particular place. A consumed discontinuity cannot carry a code, since a code must be read more than once.
That the arc's account of information and its account of

punctuation rest on objects of opposite character is not a tension in it. It is what one would expect of an architecture that does both things, and it is the most economical statement available of why the junction had to be a different object from the cell.

16.6 The nucleic-acid branch

Remark 16.9 (What is worked, and what is exhibited)**. [A]** The arc develops one branch of a fork. The vessel alphabet sits upstream of the fork and is common to both products: the nucleobase on one side and the residue on the other. Everything from the structure space onward is the residue branch.

Of the nucleic-acid branch, the corpus supplies the letter assignment, which is an import; the residual count after the tether pattern is observed; the identification supplying a direction, without which there is no domain of sixty-four; and the exhibited integrated product — RNA intercalated with tethered chrysene, with a coding strand departing from an anchored poly-*A* tail. These are reports of documents and statements about a count. There is no structure series for that branch, no consistency relation, and no registry argument.

Two claims of the filings belong here and are recorded and not used. That the initiator determines whether the departing strand is ribonucleic or deoxyribonucleic — which, if it is a claim about the nucleobase branch, is consistent with the product pathway being blind to the initiator, and whether that separation survives examination is not determined. And that the architecture concurrently provides the phospholipid material of a bilayer, which is worked in no article.

So the relation between nucleic-acid encoding and the genetic code, which is the form in which the enigma is usually put, is in this corpus a relation between a branch that is developed and a branch that is exhibited. A reader should not take the asymmetry for a result in either direction.

16.7 A theory with one model

Remark 16.10 (The limitation, stated without mitigation)**. [A]** The only model of the structure the arc describes is the genetic code itself.

The consequence is not that the account is unsupported; it is that support and construction cannot be separated within it. The consistency relation was abstracted from the structure series, so the series is its source and not its confirmation. The letter assignment is imported from a filing. The hypotheses about the medium are arguments about a medium, not derivations. Each of these was fitted, directly or indirectly, against the one instance available, and a theory fitted to its only instance cannot be tested against it.

Three things in the arc are partial exceptions and they are worth naming precisely, because they are the whole of what an outside reader can check.

The class count and everything proved over the carrier use no codon table and no letter assignment; they would stand if no genetic code existed.

The partition governing block degeneracy is recovered from block structure alone and coincides with the one specified in a filing that the derivation does not use. That coincidence is checkable by a reader against published statements, which is what makes it evidence rather than an artefact of a single development — and it remains unexplained on both sides.

And the demand functional makes a prediction about a product state that a single analysis decides, and which no part of the account was fitted to.

What would relieve the limitation is a second instance of the structure, or a derivation of the hypotheses from independent grounds. Neither is available and neither is in prospect.

Scholium 16.11 (How the arc should be read, given that)**.** A theory with one model is not thereby wrong, and it is not thereby science of a lesser kind. What it is, is a theory whose claims have to be stated with their conditionals attached every time, because there is no independent instance against which a reader could recover the conditional after it has been dropped.

That is the reason this paper carries a hypothesis register, a precedence ledger, a falsification register per section, and a consolidated statement of what each answer rests on. In a field with many models those instruments would be pedantry. Here they are the only thing standing between a conditional result and its unconditional restatement, and the corpus's own record shows how quickly the second happens: a claim stated in the reading section and proved against the selected assignment; a proposition about release bounded only after a test was run; a witness stated under one letter assignment and carried into a corpus using another.

None of those was carelessness. Each was the ordinary consequence of working on a structure that cannot be checked against a second copy of itself.

17 Aggregated falsification register, and the targets

Each article of the corpus carries a falsification register scoped to its own statements, and a reader of one cannot see what a finding there would do to the rest. This section aggregates them, and sorts by what a finding would destroy rather than by which article states it.

The column that makes the aggregation worth having is the

third one: what would survive. No constituent article can supply it, because answering it requires knowing what every other article rests on. A reader who wants to know how much of the arc a given failure would cost should read that column and nothing else.

17.1 Method

Remark 17.1 (How the tiers are drawn)**. [A]** Four tiers, by what the finding removes.
The object. The carrier itself, and with it every statement of the arc.
A reaction. A transformation asserted at the carrier. The combinatorial statements survive; the chemistry of that transformation does not.
A reading. An assignment of codons to structures. The carrier, the reactions and the counts survive; what is removed is the placement and everything stated in terms of it.
A count. A number, leaving the object and the reactions standing.
A finding may sit in more than one tier and is entered at the highest it reaches.

17.2 What would remove the object

17.3 What would remove a reaction

17.4 What would remove a reading

17.5 What would remove a count

17.6 Targets requiring data that already exists

Remark 17.2 (The cheapest tier, and it is not empty)**. [A]** Three of this paper's open items are blocked not by unsettled science but by data held in supplementary records and not printed. They are separated here because they cost nothing to close and because a reader should not mistake them for open questions.
The slot list — supplied. The eighteen-slot set is printed at Table 4. The rank computation is carried out on the assignment and the complementarity count is exhaustive; both counts come out as published. This item is closed and is retained here so that a reader of an earlier form of the paper can see what changed.
The disputed row — ruled. Two vertices removed entire, on the valence ground stated at Remark 14.11. This closes the item and opens three corrections owed to the junction development, which are Audit Item 14.12.
The decoration record — supplied. The terminal types and heteroatom bridges are printed at Table 5 and audited atom by atom. Supplying them closed two of the three inputs of the demand functional and exposed two respects in which the corpus's definition of a structure was too narrow for its own series.
The remnant accounting — outstanding. What each severed boundary bond leaves on the framework carbon, and the fate of each vertex removed entire. This is the third input, it is what parity shows to be missing, and it is now the only item of this tier that is open — and the only one that would restore a result.

17.7 Targets requiring measurement

17.8 Targets requiring proof or an argument

17.9 Audit items outstanding

Remark 17.3 (Carried from Appendix C)**. [A]** Five items are open, one is resolved, and they are listed here so that the target inventory is complete.
The four-interface target is supported by a clause stating that such a cluster admits no localised pathway; under the fixed-locus theorem it admits an edge-localised one, and the clause is outside its scope. The ceiling of seventy-two is unaffected.
The published witness of the termination corollary names a pair of codons under one letter assignment and is carried into a corpus using another. The conclusion is unaffected, this paper stating it by fibre parity instead, which holds under every assignment.
The printed witness table is short of a row against the eighteen-slot count, the missing slot being identified in a verification record.
The disputed row of the structure series, above.
And the demand count is stated as seventeen at one proposition and eighteen at the next, the two being consistent only if the matched object is the slot. This paper takes the slot; the convention is to be fixed rather than inferred.
Resolved: the locant collision, by the ruling that the arm carbons are C6α and C6β, under which the statement naming the phosphate-bearing carbon reads correctly.

17.10 The two sharpest

Scholium 17.4 (Where a reader should look first)**.** Two statements in the arc are refutable by a single observation, and they are of different kinds.
The ceiling at four interfaces is refutable by a count: a cluster of four interfaces whose products exceed seventy-two removes the capacity theorem outright. It is the corpus's own nomination and it is the sharpest thing in the arc, but it requires an object that has not been prepared.
The remnant level is refutable by a product analysis on a cell of the kind the account already describes. It is narrower

finding	removes	survives
An operation available to a unit identifying the two placements	The marker, hence the carrier, hence every statement of the arc	Nothing.
A product varying with a datum outside the cluster — temperature, concentration, neighbouring clusters, order of assembly	The locality hypothesis, hence the existence of a function to bound; the capacity theorem and everything downstream of it	The carrier as an object; the recoding; the vessel graph and the structure classification, which are statements about subgraphs.
The reacting unit determined at a length other than six units	The triplet and the ceiling of twenty, both of which descend from it	The capacity theorem as a law with a free parameter; the counts at every other length; the structure space.

finding	removes	survives
A demonstration that two complexes cannot terminate against one another chrysene to chrysene	The junction entire: the two-residue cell, the disulfide account of the exogenous pair, the frame datum, the start and the stop	Everything through Section 12, including the forced placement, which rests on paired delivery as a premise and not on the junction. The single-unit account of the sulfur pair is what remains.
A sulfur source that is not a disulfide, or delivery in two events, or migration between sites after attachment	The pairing, hence the junction as one reaction. Two independent excisions on adjacent units remain and no account of initiation	The junction cell as an object; the vessel-parity statement; the structure rows; the whole of Sections 6 to 12.
A generator of the canonical word admitting no geometric lift in the reference cage	Conditional target existence for the residue connectivity, hence the chemical grounding of the base point and of handedness	The structure space as combinatorics; the classification and the fibration, which never use the reachability result.
A cage condition excluding neither approach branch	Deterministic stereochemical selection; the account reduces to a bias at best	Target existence; the connectivity; everything combinatorial.
A localised pathway on an even vessel count transforming one vessel	The two-product statement at the junction, hence the cell's two residues	The odd case, the codon cell, and the whole of the capacity argument.

finding	removes	survives
A decision against the assignment structural consistency selects	The placement results, the forced slot, the frame relation and the start; Section 13 becomes a statement about an assignment nobody holds	The cell, the reaction, the balance and the bridge — Sections 6 to 11 and 14 entire.
A column in which arc extent is not monotone in the accommodation order	The accommodation hypothesis, hence the consistency relation, hence the slot set and the placement	The retention classification and the fibration, which are stated on subgraphs and use no register.
A block whose third position acts otherwise than through its width relation to the second; or a Con-admissible assignment that is not regular	The gating hypothesis, the forced regularity, and the statement that the standard mapping leaves admissibility at two blocks	The splitting rule as an observation; the recovered partition, which is obtained from block structure and not from gating.
An operation of the frame group other than face inversion carrying the incoming codon to the outgoing one at the discriminating case	The frame relation and with it the start	The junction cell, the two residues, the bridge and the balance.
A junction terminating at a pyrimidine outer position, or setting a start at a pyrimidine outgoing one	The release hypothesis and the termination account	The start, which rests on the frame relation and not on release.
A demonstration that the bilayer-to-coding arrow cannot be identified with reversal	The domain of sixty-four, hence Sections 12 and 13 entire	Sections 6, 7 and 9, which are stated over the carrier and the vessel alphabet; the arc terminates at a capacity theorem with no placement.

finding	removes	survives
A cluster prepared with the initiator at either end yielding different products	The initiator-independence hypothesis; the ceiling becomes thirty-two	Everything else. The paper is then a theorem about thirty-two and nothing in it changes but the number.
A collision: two classes of the carrier with the same product	Saturation, hence *exactly* twenty	The ceiling, intact. This is the most informative negative result the programme admits.
A cluster of four interfaces whose products exceed seventy-two	The capacity theorem outright	Nothing of the capacity argument. This is the only statement in the corpus that a single negative observation refutes.

target	what would discharge it
The remnant level	A single product analysis. The demand functional vanishes at one value of the remnant level, at which both oxygen-bearing termini stand at the aldehyde level. This is the arc's most directly testable consequence, and nothing in the account was fitted to it.
Locality	A preparation in which the class of a cluster is known independently of its product, and in which one external variable can be moved with the class held fixed. The deepest of the targets and the one a synthesis programme is least likely to test, a determination under fixed conditions not probing it.
Initiator independence	A cluster prepared with the initiator at either end. Decides between a ceiling of twenty and one of thirty-two.
Saturation	The products of all twenty classes, determined independently. Their joint injectivity is then a prediction and not a construction.
The ceiling at another length	A cluster of four interfaces. The only statement a single negative observation refutes outright.
The junction	Conditions under which two complexes terminate against one another chrysene to chrysene, or a demonstration that they cannot. Everything in Section 13 rests on it and nothing in the corpus supplies it.

target	what would discharge it
The dilemma	What the corpus says would settle it. Nothing in this paper is a step toward it, and the start result stands or falls with the decision.
Independent grounds for the consistency relation	A derivation of accommodation and gating from grounds other than the series they were abstracted from; or a second model of the structure.
The splitting invariant	An invariant of the register whose level sets are the recovered partition. Not contacts, not width, not defect locus, nor any pair of them.
The retention exception	A condition distinguishing the two fusion vertices, one of which carries its fused ring and one of which does not.
Engagement or escape	Whether the limiting step at the non-releasing codons is engagement or escape, and whether the carrier is consumed there. Decides which failure mode the observed stops occupy.
The third stop codon	An account of the stop the junction does not produce.
Maintenance of a frame	What, if anything, maintains a reading frame downstream of a discontinuity consumed in setting it.
The phase group	The group acting on the readings an alternating hexamer leaves indistinguishable, and whether they form a torsor under it.
The second branch	Whether the concurrent provision of bilayer material admits a treatment of the kind the corpus gives the coding branch.
The marks on one block	Whether the three marks on the block carrying the start codon have a common source, or whether the arc is too narrow for marks to fall apart. A null computation over the slot set would bound the second, and requires the slot list.

— it bears on the balance and not on the capacity argument — but it is the only prediction in the arc that is both specific and available, and no part of the account was fitted to it. A programme with limited effort should attempt the second first and the first when it can.

18 Conclusion

18.1 What the arc establishes

Proposition 18.1 (Subject to the register of Appendix A)**. [A]**

(i) A stack of six units, each in one of two placements, carries an algebra of admissible observables of dimension $2^{2N-2} + 2^{N-1}$*, which is twenty at three vessels. Any product attributable to the assembly is bounded by that number.* The bound is a ceiling; that it is attained is a separate assertion the arc does not establish.

(ii) The codon length is three, derived from the cluster and not from any argument about alphabets — and the conventional derivation, from alphabet size to codon length, is unavailable inside the formalism at every length.

(iii) The transformation from the resting tether to the residue connectivity is a morphism of a category of chemically admissible, cage-liftable transitions, preserving the framework bond and complete atom provenance. The backbone carbons are supplied by the arm and the side chain is rooted at the base point, which is why the structure series is a series of rooted subgraphs.

(iv) The centre formed at C6α *is stereogenic and one of its two branches may be excluded by an oriented cage condition, so that the product is of one configuration rather than a mixture.* Which *configuration is a labelling made outside the architecture.*

(v) The structure space is three-parameter at nineteen of twenty, and excision is coarser than structure: eleven excisions carry twenty structures, five of them carrying more than one.

(vi) Every assignment admitting the consistency relation is regular, and admissibility of a slot set is independence in a transversal matroid, with an exchange criterion deciding which relocations preserve it.

(vii) Under paired delivery, the placement of the two structures requiring an exogenous species is unique, and falls at the unique complementary pair of size-two slots.

(viii) At a junction the vessel count is even, the fixed locus of the reversal is an edge, and a localised pathway yields two products — which is the same statement as the one product of an odd count, and not an exception to it.

(ix) A disulfide is the one species the medium delivers that can serve two carriers in one event, and a junction is the one place a reaction must span two. At a junction, complementarity of the two codons is a consequence rather than a premise.

(x) An alternating hexamer determines its reading up to one position; a junction supplies exactly that datum; of the frame group only face inversion relates the two junction codons, and the case that proves it is the one in which the outgoing codon is the start.

(xi) One position decides start and stop together, termination being the failure of a reaction to complete rather than a residue assigned to a codon.

18.2 What the arc assumes

Remark 18.2 (The premises, counted once)**. [A]** Eighteen, atomised, and Appendix A is the authority for the count; an earlier form of this remark gave twelve, grouping premises that are refutable one at a time. They fall into six kinds.
About the carrier. That the reacting unit is six units alternating in species; that each interface produces one base.
About the product pathway. That the product depends on the marker assignment alone; that the pathway does not involve the initiator; that every class produces a residue; that distinct classes produce distinct ones; that the pathway is localised at the fixed locus.
About reachability. Chemical admissibility of each generator of the canonical word; a geometric lift for each; admissible terminal states.
About stereochemistry and transport. Oriented cage exclusion of one approach branch in its strong form; local concordance with the margin condition.
About the medium. That the sulfur arrives as a disulfide in one event; that neither sulfur afterwards migrates; that the two structures requiring it are delivered together.
About the reading. That accommodation is monotone; that gating factors as stated; that a structure is released only at a narrow outer register; that the two outer bases of a junction are complementary.
And two that are neither premises nor results: the letter assignment, imported from a filing, and the identification supplying a direction, without which there is no domain of sixty-four.
Above all of these sits one that no article of the corpus supplies: that a junction forms. Every statement of the arc's account of initiation rests on it.

18.3 What this paper adds

Remark 18.3 (Three functions, and what each yielded)**. [A]** *A language.* The registry sequence is the coboundary of the marker on a tree, so the gauge group is the zeroth cohomology and capacity is the dimension of an algebra of invariants; localisation is support on the fixed locus of the reversal, which is a vertex at odd count and an edge at even; the initiator, the cage and the junction are all section-supplying data for torsors; admissibility is matroid independence; and the consistency relation is a monotonicity and a factorization. Each carries a recovery lemma, and two yielded statements the corpus does not contain: an exchange criterion deciding which demand relocations preserve admissibility, and the forcing of regularity on every assignment admitting the relation.
A precedence apparatus. Four dispositions stated as definitions, eleven ledger entries, and six audit items — of which the consequential ones are a clause supporting the four-interface target that is outside its scope, a parity witness stated under one letter assignment and carried into a corpus using another, and a row of the structure series described two ways in two articles.
A coordination. Several statements that exist in no article because no article has both halves in view: that the residual count after the tether pattern is the reading-direction entry of the sensitivity table; that the product pathway is blind to a section the reading is not, which is why twenty and sixty-four are both correct; that the parity obstruction predicts where the account of punctuation must sit rather than threatening it; that the placement route and the junction route reach one pair of slots because the second derives what the first assumes; and the contrast between a null excision that releases and a formation that does not.
And one thing it does not add. The paper was planned to carry one new result, a demand functional affine in the remnant level at every structure of the series. It is demoted to a target, the decoration record being unavailable in the published corpus. What is published is the decomposition, proved, with one of its two inputs computed for all twenty structures and the other named exactly.

18.4 What would overturn it

Scholium 18.4 (Three findings, at three weights)**.** A demonstration that no junction forms would remove the object of Section 13 and with it the arc's account of initiation, of termination, and of why the exogenous element is required twice. Sections 6 to 12 would stand entire, and the single-unit account of the sulfur pair is what would remain.
A product varying with a datum outside the cluster would remove the locality hypothesis, and with it the existence of a function to bound. The capacity theorem, the triplet and everything downstream would fall together; the structure space, being a statement about subgraphs, would not.
A cluster of four interfaces whose products exceeded seventy-two would remove the capacity theorem outright, and it is the only statement in the corpus that a single negative observation refutes.
None of the three is addressed by this paper, and the third is the one the arc itself nominates.

18.5 What remains

Scholium 18.5 (The account, stated at its true width)**.** A carrier of six units admits exactly twenty distinguishable states, and that count is a property of the carrier and of the group of frame changes, not of any codon table. Its output is therefore a base triplet, and any product attributable to it is bounded by twenty. Attaining the bound is a hypothesis. Producing the standard mapping is impossible at the assembly level, so punctuation belongs to the reading — and at a junction the reading acquires the one datum it lacks, which is a phase. A residue is rooted at the base point, is of one configuration rather than a mixture, and is delivered when the outer register is narrow and withheld when it is wide. A structure with nothing retained is delivered with a hydrogen for a side chain; a structure formed and not released is a stop.

Every clause of that paragraph is conditional, and the conditions are in Appendix A. The arc has one model, so the conditions cannot be recovered by a reader who meets a clause with them dropped; that is why this paper carries the registers it does, and it is the whole of the case for a coordinating account rather than a summary.

The rest is measurement.

A The global hypothesis register

A.1 Purpose, and one correction it forced

This appendix lists every premise on which any statement of the arc rests, where it is stated, where it is used, what would discharge or refute it, and what falls without it. It is the authority for the premise count, and no other statement of this paper may give a different one.

> **Remark A.1** (The count is larger than the prose summary)**. [A]** An earlier form of the concluding section gave the premise count as twelve, grouping accommodation with gating, totality with injectivity, and the three clauses of the reachability package as one. Atomised — which is the only form in which a register is useful, a premise being refutable one at a time — the count is eighteen, together with two identifications that are neither premises nor results and a set of imports.
> The concluding section is corrected to cite this appendix rather than to give a number of its own. The discrepancy is recorded rather than silently repaired because it is the ordinary failure this paper exists to catch: a grouped count in prose and an atomised count in a register are different numbers, and the register is the one a referee will use.

A.2 The register

#	premise	stated	used	discharged or refuted by	falls without it
About the carrier					
A1	The reacting unit is six units alternating in species	§6	§§9, 13	A determination of the reacting length	The triplet; the ceiling of twenty. The capacity law survives with another parameter
A2	Each interface produces one base	§9	§9 only	A cluster whose interfaces do not each produce one	The triplet only
About the product pathway					
B1	Locality: the product is a function of the marker assignment alone	§6	§§6, 9, 13	A product varying with an external datum, class held fixed	The existence of a function to bound; the capacity theorem and all downstream
B2	Initiator independence	§6	§§6, 9	A cluster with the initiator at either end yielding different products	The number twenty; the ceiling becomes thirty-two and nothing else changes
B3	Totality: every class produces a residue	§9	§9 only	Determination of all twenty products	*Exactly* twenty; the ceiling stands
B4	Injectivity: distinct classes, distinct residues	§9	§9 only	A collision	*Exactly* twenty; the ceiling stands
B5	The pathway is localised at the fixed locus	§5.2	§§9, 13	A delocalised pathway	The one-product and two-product statements; the ceiling is unaffected
About reachability					
C1	Chemical admissibility of each generator of the canonical word	§10	§10	A generator not admissible	Conditional target existence
C2	A geometric lift for each generator in the reference cage	§10	§10	A generator with no lift	Cage-constrained reachability; chemical reachability survives
C3	Admissible terminal states	§10	§10	A terminal state outside the domain	The target statement
C4	Oriented cage exclusion of one approach branch, in its strong form	§10	§10, §15	A cage excluding neither	Deterministic selection; a bias may survive

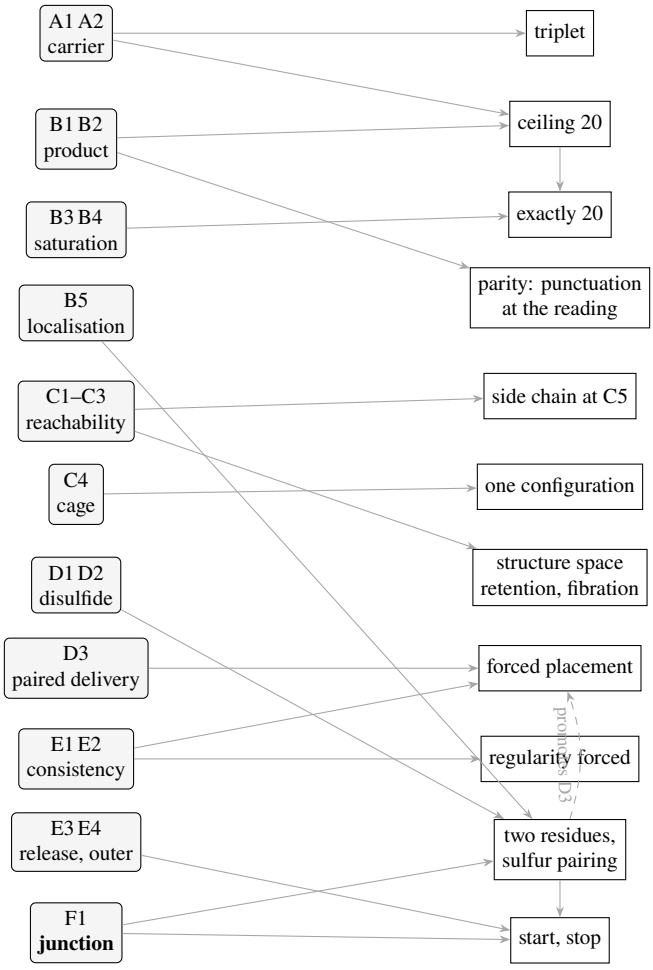
C5	Local concordance and the margin condition, for transport across substitution patterns	§10	§10	A concordant context at which the word fails	Transport; the reference context survives
About the medium					
D1	Sulfur arrives as a disulfide in one event	§13	§13	A source that is not a disulfide	The pairing; two independent excisions remain
D2	Neither sulfur afterwards migrates	§13	§13	Migration after attachment	The pairing, as D1
D3	Paired delivery: the two exogenous structures are seeded at complementary slots	§12	§12 only	Promoted at a junction (§13); or a placement satisfying it elsewhere	The forced placement; admissibility is unaffected
About the reading					
E1	Accommodation: arc extent monotone in the register order	§5.5	§§11, 12	A non-monotone column	The consistency relation, the slot set, the placement
E2	Gating: Con factors through the register triple	§5.5	§§11, 12, 15	A block acting otherwise; an admissible irregular assignment	Forced regularity; the admissibility failure at two blocks
E3	Release only at a narrow outer register	§13	§13	A junction terminating at a pyrimidine outer position	Termination; the start survives
E4	The two outer bases of a junction are complementary	§13	§13	—	The frame relation and the slot identity both
About assembly					
F1	A junction forms	§13	§13	Conditions under which two complexes so terminate, or a demonstration that they cannot	§13 entire: the two-residue cell, the sulfur pairing, the frame datum, the start, the stop

A.3 Two identifications, and the imports

Remark A.2 (Neither premises nor results)**. [A]** Two items carry weight and belong in neither column above.
The letter assignment. Read off a filing; not selected by any criterion of the corpus and not derived. Without it the arc has four vessel states and no names for them, and Sections 12 onward have no codons. The class count is unaffected, being invariant under all twenty-four assignments.
The direction identification. Identifying the bilayer-to-coding arrow with reversal removes the residual quotient and supplies a domain of sixty-four. Without it the arc stops at thirty-six residual states, and Sections 12 and 13 have nothing to be stated on. Sections 6, 7 and 9 are unaffected.

Imports, stated and not reproved: the axiom system and the non-collapse of the marker; the vessel graph and its locant registry — here reconstructed rather than imported, Appendix B block R7; the frame group and the bijection between clusters and classes; the tether word and the residual count; the exhibited integrated product; transversality — here computed, block R4a; and that sulfur has no source within the carrier.

A.4 The dependency graph



Premises left, headline results right. An arrow means the result fails if the premise does. The dashed arc is the promotion of entry C5 of Appendix C: at a junction the paired-delivery premise is a consequence, so the forced placement acquires a second route — one that derives what the first assumes, and that carries the junction premise with it.

A.5 Reading the graph

Remark A.3 (Four observations)**. [A]** *One premise reaches almost everything.* Locality is upstream of the ceiling, of the count, and of the parity obstruction, and through the last of these of the placement of punctuation. It is also the premise least probed by any determination under fixed conditions.
One premise reaches one number. Initiator independence decides between twenty and thirty-two and nothing else. A reader who declines it loses a number and keeps the account.
The chemistry and the combinatorics are less coupled than the narrative suggests. The reachability package and the cage condition reach the residue connectivity and the configuration, and reach nothing else: the structure space is a classification of subgraphs and does not use them. Conversely no combinatorial premise reaches the configuration.
The junction is a single point of failure for one region and for no other. Everything below the junction node falls with it; nothing above does. That isolation is why Appendix C enters the junction as re-scoped rather than superseding, and why Section 17 records that the single-unit account is what remains.

Scholium A.4 (What the register is for)**.** A register of this kind is usually treated as bookkeeping. In an account with one model it is the load-bearing instrument, for the reason Section 16 gives: there is no second instance against which a reader could recover a conditional that has been dropped, so the conditional has to be carried explicitly every time or it is lost.
The correction of Remark A.1 is the small demonstration. A count given in prose and a count given in a register differed, and the prose count was the smaller one — which is the direction such discrepancies run, grouping being the natural way to summarise and understatement the natural consequence of grouping.

B Verification

B.1 The files

All computations are emitted by six scripts, each requiring no input beyond the definitions it states. Nothing is imported from the tables of this paper.

script	blocks
`section5-checks.py`	R1–R6
`section8-checks.py`	R10
`section9-checks.py`	R11
`section11-checks.py`	R12
`section12-checks.py`	R13
`section13-checks.py`	R14
`section14-checks.py`	R7–R9
`R4b-R13.py`	R4b, R13 recomputed
`section12-audit.py`	R15
`section12-null.py`	R16
`delta-table.py`	the decoration record
`section14-delta.py`	R17

B.2 Three kinds of content

Remark B.1 (Computed, transcribed, comparand)**. [A]** Every *conclusion* of every block below is computed: derived from a cochain complex, a graph, a finite enumeration, or an incidence. No block of this paper formats an assertion with no computation able to disagree with it, which is the failure the corpus records against its own apparatus.
Two other kinds of content appear and are marked in place.
Transcribed. Source data entered by hand from printed tables: the retained sets, cut lists and parameters of the structure series (R8, R9, R12) and the published slot adjacencies (R4b/R5). Conclusions are computed from these, but a transcription error would pass undetected. This is the one place in the apparatus where that is true. It is mitigated where independent agreement is available: the cut-list completeness check computed at R8 reproduces the published result, which a mistranscription would be unlikely to preserve.
Comparand. A published value entered so that the computation may disagree with it. A comparand is never an input to a conclusion, and every comparand below is printed beside the computed value.

B.3 Index of blocks

block	kind	supports	content
R1	computed	Prop. 5.5, Lem. 5.6	Site complex: kernel and image of the coboundary; H^0, H^1; both equivariance identities, at four lengths
R2	computed	Thm. 5.8, Prop. 5.10	Invariant-algebra dimension at eight lengths against the closed form; weight fibres; palindromic classes; the unique ρ-fixed coordinate
R3	computed	Prop. 5.15, Thm. 5.17	Fixed locus of the reversal on the vessel complex, by parity, at eight lengths

R4a	computed	Prop. 12.3	Registry classes reconstructed as codon sets; transversality over all class–block pairs
R4b	computed	Thm. 5.33	Transversal matroid on the *full* eighteen-slot set of Table 4: rank 18, deficiency 0, Hall defect 0; and the relocation control at rank 17
R5	computed	Thm. 5.35, Prop. 12.7	Exchange criterion run against the published relocation; adjacency reconstruction against the published record
R6	computed	Cor. 5.45, Prop. 5.47	The factorization κ; forced regularity; irregular blocks against the blocks of the two exchanges
R7	computed	Prop. 11.2	Vessel graph reconstructed: perimeter, chords, ring closures, degree sequence
R8	computed, transcribed	Prop. 14.6, Prop. 14.10	Cut-list completeness; fragmentation under each of the two readings of a disputed row
R9	computed, transcribed	Prop. 14.6, Table 1	Boundary severances at retained vertices; residual valences after the transannular bond
R10	computed	Prop. 8.3	Orbit counts under every subgroup of the frame group; the cross-article identification of the residual count
R11	computed	Thm. 9.12, Rem. 9.14	The two letter assignments; the published witness under each; assignment-dependence separated; exhaustive check over all twenty-four
R12	computed, transcribed	Thm. 11.10, Thm. 11.12, Prop. 11.19	Retention classification and its exception; the failed repair with witnesses; the fibration; the splitting rule
R13	computed	Rem. 12.5, Thm. 12.10	The doubly-seeded structure and the two demand counts; the complementarity count *exhaustive* over all 153 pairs
R15	computed	Prop. 12.5, Rem. 12.5	Audit of the slot list against every value the corpus prints; the assignment identified; the spare-class count under each reading
R16	computed	Prop. 12.24	The null computation for the marks on one block: the coincidence rate, the marked-set intersections, and the exhaustive permutation test
R17	computed	Rem. 11.9, Rem. 14.10	The decoration record audited by valence at every retained vertex; the two kinds of bridge; the retained-set term of the balance and its parity
R14	computed	Prop. 13.20, Thm. 13.22	Alternating hexamers; palindromic windows; the three frame operations at the discriminating case; the observed mapping; the two junction slots

B.4 What is not emitted

Remark B.2 (Two classes of figure)**. [A]** The stacking separation and the sulfur–sulfur bond length are imported from the literature and are labelled **[C]** where used. And no energy, barrier or rate appears anywhere, Convention 2.11 excluding them.

B.5 The slot list

The eighteen slots of the seeded assignment are printed at Table 4. Blocks R4b, R13 and R15 are computed from it.

Remark B.3 (What the list closed)**. [A]** An earlier form of this appendix marked R4b *partial*: the list was not printed in any published verification record, only the eight-slot subset carrying the Hall violation, so the rank computation was verified on that subset and the exhaustiveness of the complementarity count was not verified at all.

With the list supplied, R4b is computed on the assignment — rank eighteen, deficiency zero, Hall defect zero — and R13 is exhaustive over all one hundred and fifty-three pairs. *Both counts come out as published*, so no statement resting on either required restatement.

Block R15 is the audit that licenses this. The list reproduces every adjacency the corpus prints, including the one slot that is not in it; it gives eighteen slots seeding seventeen distinct structures with one seeded twice, as the corpus states; and it is the assignment structural consistency selects rather than the published witness, the first sulfur residue and the aromatic being interchanged with respect to the standard mapping.

#	slot	codons	size	classes meeting it
1	UU pyr	UUC UUU	2	1,11
2	UC all	UCA UCC UCG UCU	4	4,13,17,18
3	UA pyr	UAC UAU	2	3,15
4	UG pyr	UGC UGU	2	12,13
5	UG pur	UGA UGG	2	2,14
6	CU all	CUA CUC CUG CUU	4	5,9,15,19
7	CC all	CCA CCC CCG CCU	4	8,14,18,20
8	CA pyr	CAC CAU	2	16,19
9	CG all	CGA CGC CGG CGU	4	6,12,17,20
10	AU pyr	AUC AUU	2	10,16
11	AU pur	AUA AUG	2	3,15
12	AC all	ACA ACC ACG ACU	4	2,12,13,14
13	AA pyr	AAC AAU	2	9,10
14	AG pyr	AGC AGU	2	4,17
15	GU all	GUA GUC GUG GUU	4	7,11,16,19
16	GC all	GCA GCC GCG GCU	4	6,12,17,20
17	GA pyr	GAC GAU	2	5,15
18	GG all	GGA GGC GGG GGU	4	8,14,18,20

Table 4: The eighteen-slot list of the seeded assignment, with the registry classes meeting each slot. Blocks R4b and R13 are computed from this table.

B.6 The decoration record

The decoration δ for the twenty structures is printed at Table 5. Block R17 audits it.

structure	terminal type at each retained vertex	inserted into edges	side chain
Gly	—	—	$C_0H_0N_0O_0$
Ala	5: H,H,H	—	$C_1H_3N_0O_0$
Ser	5: H,H,OH	—	$C_1H_3N_0O_1$
Cys	5: H,H,SH	—	$C_1H_3N_0O_0$
Thr	5: H,OH, 4b: H,H,H	—	$C_2H_5N_0O_1$
Val	5: H, 6: H,H,H, 4b: H,H,H	—	$C_3H_7N_0O_0$
Ile	5: H, 6: H,H,H, 4b: H,H, 10b: H,H,H	—	$C_4H_9N_0O_0$
Leu	5: H,H, 4a: H,H,H, 4b: H, 10b: H,H,H	—	$C_4H_9N_0O_0$
Met	5: H,H, 4b: H,H, 10b: H,H,H	4*b*–10*b*: S	$C_3H_7N_0O_0$
Pro	5: H,H, 4b: H,H, 10b: H,H	—	$C_3H_6N_0O_0$
Asp	5: H,H, 4b: =O,OH	—	$C_2H_3N_0O_2$
Asn	5: H,H, 4b: =O,NH2	—	$C_2H_4N_1O_1$
Glu	5: H,H, 4b: H,H, 4a: =O,OH	—	$C_3H_5N_0O_2$
Gln	5: H,H, 4b: H,H, 10b: =O,NH2	—	$C_3H_6N_1O_1$
Lys	5: H,H, 4b: H,H, 10b: H,H, 11: H,H,NH2	—	$C_4H_{10}N_1O_0$
His	5: H,H, 10b: H, 11: H	4*b*–11: NH, 11–10*b*: N	$C_4H_5N_2O_0$
Arg	5: H,H, 4b: H,H, 10b: H,H, 11: NH2,=NH	10*b*–11: NH	$C_4H_{10}N_3O_0$
Phe	5: H,H, 4a: H, 10b: H, 11: H, 12: H, 12a: H	—	$C_7H_7N_0O_0$
Tyr	5: H,H, 4a: H, 10b: H, 11: H, 12: OH, 12a: H	—	$C_7H_7N_0O_1$
Trp	5: H,H, 1: H, 2: H, 3: H, 4: H, 10b: H	10*b*–12*a*: NH	$C_9H_8N_1O_0$

Table 5: The decoration δ for the twenty structures: the terminal type filling each residual valence of each retained vertex, and the heteroatoms inserted into edges of the retained set. The last column is the reconstituted side-chain formula, against which each row is checked.

Remark B.4 (Audited twice, and by the stronger test)**. [A]** Each row is reconstituted into a side-chain molecular formula and compared against the formula the interpretation requires; all twenty agree. Independently, each retained vertex is checked for valence completeness — the bonds it keeps to other retained vertices, the transannular bond at the base point, any bridge, any closure, and its terminal types must total four at an sp^3 carbon and three σ at an aromatic one. All pass. The second test is the stronger, a formula being insensitive to where within a structure a valence is misplaced.
The audit is also what exposed the two amendments of Remark 11.7: six vertices failed until bridges between non-adjacent retained vertices were distinguished from insertions into edges, and one failed until the closure onto the backbone was admitted as a field.

B.7 One block that does not close

Remark B.5 (Recorded rather than absorbed)**. [A]** No block evaluates the demand functional. Two of its three inputs are computed — the skeletal term at R9 and the decoration term at R17 — and the third, the remnant accounting, is not in the published corpus. Parity is the evidence that it is missing: six of the twenty partial totals at R17(c) are odd and a complete balance cannot be. This is the reason Section 14 is published in demoted form, and it remains the only computation in this paper blocked on a record rather than on a question.

B.8 The emitted output

What follows is reproduced verbatim from the scripts. Comparands are printed beside computed values throughout.

Blocks R1–R6

```
======================================================================
R1  [COMPUTED]  Site complex: ker d, im d, H^0, H^1, equivariance
======================================================================
  N=1  sites= 2  |ker d|=2  dim H^0=1  |im d|=2  |C^1|=2  H^1=0  d.flip=d: True   d.rev=rho.d: True
  N=2  sites= 4  |ker d|=2  dim H^0=1  |im d|=8  |C^1|=8  H^1=0  d.flip=d: True   d.rev=rho.d: True
  N=3  sites= 6  |ker d|=2  dim H^0=1  |im d|=32  |C^1|=32  H^1=0  d.flip=d: True   d.rev=rho.d: True
  N=4  sites= 8  |ker d|=2  dim H^0=1  |im d|=128  |C^1|=128  H^1=0  d.flip=d: True   d.rev=rho.d: True

  ker d is the constants {0, 1-bar} at every N, so H^0 = F_2 and the
  gauge group <flip> is exactly translation by H^0.
  The path is a tree, so d is onto and H^1 = 0 at every N.

======================================================================
R2  [COMPUTED]  Invariant algebra dim; weight fibres; palindromes; centre
======================================================================
  closed form  |X| = 2^(2N-2) + 2^(N-1),  taken as dim Inv_Fr

   N   |C^0|   |C^1|   palindromes   orbits of rho   closed form   agree
   1       4       2             2               2             2    True
   2      16       8             4               6             6    True
   3      64      32             8              20            20    True
   4     256     128            16              72            72    True
   5    1024     512            32             272           272    True
   6    4096    2048            64            1056          1056    True
   7   16384    8192           128            4160          4160    True
   8   65536   32768           256           16512         16512    True

  Direct check that Fr-orbits on C^0 and rho-orbits on C^1 agree (N=3):
    Fr-orbits on C^0      : 20
    rho-orbits on C^1     : 20
    Fr-orbit size profile : {2: 8, 4: 12}

  Stratification of the 20 classes at N = 3:
    weight fibres |D| = 0..5 : [1, 3, 6, 6, 3, 1]   (published comparand: [1, 3, 6, 6, 3, 1])
    classes of size two      : 8   (published comparand: 8)
    classes of size four     : 12   (published comparand: 12)
    size two <=> D palindromic: True
    central entry D_3 on the size-two classes: 4 with 0, 4 with 1   (published comparand: 4 and 4)

  Uniqueness of the rho-fixed coordinate of C^1 (index N of 2N-1):
    N=2  n=3  rho-fixed coordinates (0-indexed): [1]   -> 1-indexed [2]
    N=3  n=5  rho-fixed coordinates (0-indexed): [2]   -> 1-indexed [3]
    N=4  n=7  rho-fixed coordinates (0-indexed): [3]   -> 1-indexed [4]
    N=5  n=9  rho-fixed coordinates (0-indexed): [4]   -> 1-indexed [5]

  Comparand: the D-column of the published table of twenty classes.
    published entries: 20   computed orbit reps: 20
    published set is a transversal of the rho-orbits: True

======================================================================
R3  [COMPUTED]  Fixed locus of the reversal on the vessel complex
======================================================================
   M   fixed vertices   fixed edge        theta_M          |theta_M|  products
   1   [1]             []               {v1}                   1  1
   2   []              [(1, 2)]         {v1, v2}               2  2
   3   [2]             []               {v2}                   1  1
   4   []              [(2, 3)]         {v2, v3}               2  2
   5   [3]             []               {v3}                   1  1
   6   []              [(3, 4)]         {v3, v4}               2  2
```

```
   7   [4]            []               {v4}                  1  1
   8   []             [(4, 5)]         {v4, v5}              2  2

  M odd  -> theta is a vertex, one product, the central vessel.
  M even -> theta is an edge,   two products, the two flanking units.
  Comparands: M=3 gives the middle vessel of a codon cell;
              M=6 gives the central pair {v3, v4} of a junction cell.

======================================================================
R4a  [COMPUTED]  Registry classes as codon sets (letter assignment import)
======================================================================
  classes constructed: 20
  size profile: {2: 8, 4: 12}

  Comparands from the published verification record of Article 57:
    class  4 computed = ['AGU', 'UCA']      published = ['AGU', 'UCA']
    class 16 computed = ['AUC', 'CAU', 'GUA', 'UAG']   published = ['AUC', 'CAU', 'GUA', 'UAG']
    agree: True

  Transversality (a block and a class meet in at most one codon):
    maximum |class n block| over 20 x 16 pairs = 1   (transversality requires 1)

======================================================================
R4b/R5  [PARTIAL]  Transversal matroid; exchange criterion
======================================================================
  Reconstructed adjacency against the published comparand:
    UA pyr    computed [3, 15]                published [3, 15]                OK
    CU all    computed [5, 9, 15, 19]         published [5, 9, 15, 19]         OK
    CA pyr    computed [16, 19]               published [16, 19]               OK
    AU pur    computed [3, 15]                published [3, 15]                OK
    AA pyr    computed [9, 10]                published [9, 10]                OK
    GA pyr    computed [5, 15]                published [5, 15]                OK
    AU pyr    computed [10, 16]               published [10, 16]               OK
    UA pur    computed [10, 16]               published [10, 16]               OK
  adjacency reconstruction agrees with the published record: True

  |subset| = 8   |N(subset)| = 7   reached = [3, 5, 9, 10, 15, 16, 19]
  Hall defect on this subset = 1   (published comparand: 8 demands reaching 7 classes, defect 1)

  Independence of the eight-demand subset in the transversal matroid:
    maximum matching = 7 of 8   independent: False
    corank (deficiency) = 1

  Exchange criterion, run on the published relocation
  (demand moved from the AG pyrimidine half to the UA purine half):
    A \ {s} independent: True  (matching 7 of 7)
    (A \ {s}) u {s'} independent: False  (matching 7 of 8)
    therefore s' in cl(A \ {s}): True
    criterion predicts the relocation is INADMISSIBLE: True
    published comparand: the relocation gives deficiency one. AGREES: True

  NOTE ON SCOPE.  The full eighteen-slot list of the seeded
  assignment is not printed in the published verification record;
  only the eight-slot subset carrying the Hall violation is.  The
  criterion is therefore verified against that subset and against
  the reconstructed adjacency, and the full-rank computation of
  Theorem 5.21(ii) awaits the slot list from the Article 57
  supplementary script.  This is a data-availability limit, not a
  limit of the criterion.

======================================================================
R6  [COMPUTED]  kappa; forced regularity; irregular blocks vs exchanges
======================================================================
  |image kappa| = 32   bound 4 x 4 x 2 = 32   |codons| = 64
  kappa takes at most two values on each block: 2
  the two values separate the pyrimidine-third and purine-third halves: True

  standard mapping, irregular blocks      : ['AU', 'UG']   (published comparand: ['UG', 'AU'])
  mitochondrial mapping, irregular blocks : none   (published comparand: none)
  blocks at which the two mappings differ : ['AG', 'AU', 'UG']

  THE COMPARISON SENT TO VERIFICATION BY REMARK 5.27.

  Corollary 5.25 forces regularity on any Con-admissible assignment,
  so Corollary 5.26 places the standard mapping outside Con-
  admissibility at its irregular blocks.  The question left open was
  whether those blocks are the blocks at which the two exchanges of
  Article 57 act.  The exchanges, entered as the comparand:

    E1  exogenous pair : Cys <-> Tyr, blocks UG (pyr) and UA (pyr)
```

```
    E2  amides         : Asn <-> Gln, blocks AA and CA

    irregular blocks of the standard mapping : ['AU', 'UG']
    blocks touched by the two exchanges      : ['AA', 'CA', 'UA', 'UG']
    intersection                             : ['UG']
    irregular but untouched by any exchange  : ['AU']
    touched but not irregular                : ['AA', 'CA', 'UA']

    THE TWO PAIRS DO NOT COINCIDE.  They share the block UG and
    nothing else.  The block AU is irregular in the standard mapping
    and is touched by neither exchange; its irregularity is the pair
    Ile/Met at the purine third, which is the start codon itself.

    Reported as it falls, per Remark 5.27.  The identification is
    withdrawn from the draft and the residual finding -- that the
    start-codon block is a failure of Con-admissibility that no
    exchange of the corpus addresses -- is entered for Section 15.

======================================================================
END OF BLOCKS R1-R6
======================================================================
```

Blocks R7–R9

```
======================================================================
R7  [COMPUTED]  Vessel graph: perimeter, chords, rings, degrees
======================================================================
  vertices 18   edges 21   cycle rank 4   (comparand: 18, 21, 4)
  degree-3 vertices: ['10a', '10b', '12a', '4a', '4b', '6a']
  comparand        : ['10a', '10b', '12a', '4a', '4b', '6a']
  ring A ['1', '2', '3', '4', '4a', '12a']            closed: True
  ring B ['4a', '4b', '10b', '11', '12', '12a']       closed: True
  ring C ['4b', '5', '6', '6a', '10a', '10b']         closed: True
  ring D ['6a', '7', '8', '9', '10', '10a']           closed: True

======================================================================
R8  [COMPUTED]  Cut-list completeness; fragmentation of the remnant
======================================================================
  Completeness: every edge from a retained vertex to the framework
  must be in the cut list or incident to a vertex removed entire.

   res   retained  cuts  rm-entire   unlisted boundary edges
   Ala          1     0          2   none
   Arg          4     5          0   none
   Asn          2     3          0   none
   Asp          2     3          0   none
   Cys          1     0          2   none
   Gln          3     4          0   none
   Glu          3     4          0   none
   Gly          0     0          0   none
   His          4     5          0   none
   Ile          4     4          0   none
   Leu          4     5          0   none
   Lys          4     4          0   none
   Met          3     5          0   none
   Phe          7     4          0   none
   Pro          3     4          0   none
   Ser          1     0          2   none
   Thr          2     3          0   none
   Trp          9     4          0   none
   Tyr          7     4          0   none
   Val          3     3          0   none

  every residue-to-framework bond accounted for: True   (published comparand: True)

  Fragmentation, under the two readings of a row that carries
  vertices removed entire:

   res   reading                      remnant pieces   sizes
   Ala   (i) removed-entire detached                3   [15, 1, 1]
         (ii) edges at retained set cut             1   [17]
   Cys   (i) removed-entire detached                3   [15, 1, 1]
         (ii) edges at retained set cut             1   [17]
   Ser   (i) removed-entire detached                3   [15, 1, 1]
         (ii) edges at retained set cut             1   [17]
   Met   (i) removed-entire detached                2   [8, 7]
         (ii) edges at retained set cut             2   [8, 7]
   Asn   (i) removed-entire detached                1   [16]
         (ii) edges at retained set cut             1   [16]
```

```
   Phe   (i) removed-entire detached               2   [7, 4]
         (ii) edges at retained set cut            2   [7, 4]
   Trp   (i) removed-entire detached               2   [7, 2]
         (ii) edges at retained set cut            2   [7, 2]

  COMPARAND, Article 59, block K6, for the two junction residues:
    first residue  (Cys, on X3): one remnant, seventeen carbons
    second residue (Met, on X4): two remnants, seven and eight

  Met under either reading: no vertices removed entire, so the two
  readings coincide.  Reading gives the sizes printed above.
  Cys: reading (i) gives three pieces (15, 1, 1); reading (ii)
  gives ONE piece of seventeen.  Only reading (ii) agrees with K6.

====================================================================
R9  [COMPUTED]  Boundary severances at retained vertices
====================================================================
  For each structure, the number of bonds each retained vertex loses
  to the framework.  This is the skeletal input to the redox
  functional: each such severance is a valence that must be filled,
  by a new hydrogen, by the transannular bond to C-alpha, or by a
  decoration.  The first two are graph data; the third is not.

   res   retained set                          per-vertex loss      total
   Ala   ['5']                                 {'5': 2}                2
   Arg   ['10b', '11', '4b', '5']              {'10b': 1, '11': 1, '4b': 1, '5': 1}     4
   Asn   ['4b', '5']                           {'4b': 2, '5': 1}       3
   Asp   ['4b', '5']                           {'4b': 2, '5': 1}       3
   Cys   ['5']                                 {'5': 2}                2
   Gln   ['10b', '4b', '5']                    {'10b': 2, '4b': 1, '5': 1}     4
   Glu   ['4a', '4b', '5']                     {'4a': 2, '4b': 1, '5': 1}     4
   Gly   []                                    {}                      0
   His   ['10b', '11', '4b', '5']              {'10b': 1, '11': 1, '4b': 1, '5': 1}     4
   Ile   ['10b', '4b', '5', '6']               {'10b': 2, '4b': 1, '5': 0, '6': 1}     4
   Leu   ['10b', '4a', '4b', '5']              {'10b': 2, '4a': 2, '4b': 0, '5': 1}     5
   Lys   ['10b', '11', '4b', '5']              {'10b': 1, '11': 1, '4b': 1, '5': 1}     4
   Met   ['10b', '4b', '5']                    {'10b': 2, '4b': 1, '5': 1}     4
   Phe   ['10b', '11', '12', '12a', '4a', '4b', '5']  {'10b': 1, '11': 0, '12': 0, '12a': 1, '4a': 1, '4b': 0, '5': 1}     4
   Pro   ['10b', '4b', '5']                    {'10b': 2, '4b': 1, '5': 1}     4
   Ser   ['5']                                 {'5': 2}                2
   Thr   ['4b', '5']                           {'4b': 2, '5': 1}       3
   Trp   ['1', '10b', '12a', '2', '3', '4', '4a', '4b', '5']  {'1': 0, '10b': 2, '12a': 1, '2': 0, '3': 0, '4': 0, '4a': 0, '4b': 0, '5': 1}     4
   Tyr   ['10b', '11', '12', '12a', '4a', '4b', '5']  {'10b': 1, '11': 0, '12': 0, '12a': 1, '4a': 1, '4b': 0, '5': 1}     4
   Val   ['4b', '5', '6']                      {'4b': 2, '5': 0, '6': 1}     3

  The transannular bond to C-alpha consumes one severance at C5 in
  every entry retaining C5.  The residual count is therefore:

    Ala   total  2   transannular 1   residual valences to fill: 1
    Arg   total  4   transannular 1   residual valences to fill: 3
    Asn   total  3   transannular 1   residual valences to fill: 2
    Asp   total  3   transannular 1   residual valences to fill: 2
    Cys   total  2   transannular 1   residual valences to fill: 1
    Gln   total  4   transannular 1   residual valences to fill: 3
    Glu   total  4   transannular 1   residual valences to fill: 3
    Gly   total  0   transannular 0   residual valences to fill: 0
    His   total  4   transannular 1   residual valences to fill: 3
    Ile   total  4   transannular 1   residual valences to fill: 3
    Leu   total  5   transannular 1   residual valences to fill: 4
    Lys   total  4   transannular 1   residual valences to fill: 3
    Met   total  4   transannular 1   residual valences to fill: 3
    Phe   total  4   transannular 1   residual valences to fill: 3
    Pro   total  4   transannular 1   residual valences to fill: 3
    Ser   total  2   transannular 1   residual valences to fill: 1
    Thr   total  3   transannular 1   residual valences to fill: 2
    Trp   total  4   transannular 1   residual valences to fill: 3
    Tyr   total  4   transannular 1   residual valences to fill: 3
    Val   total  3   transannular 1   residual valences to fill: 2

  WHAT THIS DOES NOT GIVE.  The residual valences are filled by a
  hydrogen, by a heteroatom, or by an oxygen-bearing terminus, and
  which of the three applies at which vertex is the decoration data
  of the structure.  Table 3 of Article 57 does not carry it: the
  register at each position, the departing fragments and the
  terminal assignments are stated there to be held in the
  supplementary record.  The oxidation index of a vertex differs by
  one between a new C-H and an unchanged bond, and by two or three
  between a C-H and a carbonyl, so the functional cannot be closed
  from the printed series.
```

```
================================================================
END OF BLOCKS R7–R9
================================================================
```

Blocks R10

```
======================================================================
R10  [COMPUTED]  Residual counts under each subgroup of Fr
======================================================================

  subgroup                          fixed points per element   orbits
  trivial                          [64]                       64
  <flip>   (projection ref only)   [64, 0]                    32
  <rev>    (reading direction)     [64, 8]                    36
  <flip.rev>                       [64, 8]                    36
  Fr = <flip, rev>                 [64, 0, 8, 8]              20

  Published comparand, sensitivity table of Article 48:
    trivial 64,  <flip> 32,  <rev> 36,  <flip.rev> 36,  Fr 20
    agrees: True

  THE IDENTIFICATION.

  Article 57 states that the pattern of the adenine tether is the
  word AAA; that reversal fixes it and complementation does not;
  that the residual frame group after the pattern is observed is
  <rev>; and that the residual count is thirty-six.

  Article 48 tabulates the orbit count under every subgroup of Fr
  and records thirty-six against <rev>.

  These are the same number and the same object: 36
  Neither article performs the identification.  It is a consistency
  check between them and it passes.

  CAUTION.  The count thirty-six is also the orbit count under
  <flip.rev>, which is 36, a different subgroup with the same
  index.  The agreement of the numbers is therefore not by itself
  the identification; what fixes it is which generator the tether
  pattern kills, and that is stated in Article 57 and is not
  recomputed here.

  The passage to sixty-four: supplying a direction datum removes
  the quotient by <rev> entirely, returning the state count to
  |C^0| = 64, which is the word space 4^3.

======================================================================
END OF BLOCK R10
======================================================================
```

Blocks R11

```
================================================================
R11  [COMPUTED]  Two letter assignments; what depends on which
================================================================

  The registry partition each assignment induces (b1 = XOR of the
  two markers, so the partition is {FF,BB} against {FB,BF}):
    filing   (Art. 57)    ['A', 'U'] | ['C', 'G']
    keto/amino (Art. 48)  ['G', 'U'] | ['A', 'C']
    comparand, Art. 57: {A,U} | {C,G}
    comparand, Art. 48: keto {G,U} | amino {A,C}

  THE PUBLISHED WITNESS OF THE TERMINATION COROLLARY.

  Article 48 states that the codons UAG and GCU lie in one class of
  size two, the marker assignments FFBFBB and BBFBFF, exchanged by
  flip.  Under each assignment those two markers read:
    filing   (Art. 57)    FFBFBB -> AGU   BBFBFF -> UCA
```

```
    keto/amino (Art. 48)  FFBFBB -> UAG   BBFBFF -> GCU

  So the witness pair is {UAG, GCU} under the keto/amino assignment
  and {AGU, UCA} under the filing assignment.  The two articles
  name the same orbit and different codons.

  filing   (Art. 57)  : UAG lies in class 16, of size 4: ['AUC', 'CAU', 'GUA', 'UAG']
  keto/amino (Art. 48): UAG lies in class 4, of size 2: ['GCU', 'UAG']

  ASSIGNMENT DEPENDENCE, SEPARATED.

  (a) The class count is independent of the assignment.
      over all 24 assignments the count takes the values {20}

  (b) Which codons lie in which class is NOT independent of it.
      Shown by the witness pair above.

  (c) The standard mapping has 21 fibres, of which the odd ones are
      {'*': 3, 'W': 1, 'I': 3, 'M': 1}   (published comparand: {'*': 3, 'I': 3, 'M': 1, 'W': 1})

  (d) THE PARITY CONCLUSION IS ASSIGNMENT-INDEPENDENT, and by a
      shorter route than the published witness.

      Every class has size two or four, so every fibre of a class
      function, pulled back to the sixty-four words, is even.  The
      standard mapping has four odd fibres, of sizes 3, 3, 1 and 1.
      An odd fibre is not a union of classes under ANY assignment,
      a relabelling of the four letters permuting the codons within
      a class and not changing any class size.

      In particular the termination fibre has cardinality three and
      is odd, so termination is not an assembly quantity under any
      assignment.  The published witness -- a size-two class
      carrying a stop and a residue -- exhibits the same conclusion
      at one class and is assignment-dependent; the fibre-parity
      argument is not.

      exhaustive check over all 24 assignments: the termination
      fibre is a union of classes under 0 of them.

====================================================================
END OF BLOCK R11
====================================================================
```

Blocks R12

```
========================================================================
R12  [COMPUTED]  Structure space: retention, fibration, splitting
========================================================================

  Retention:  S = {C5} u {C6}^eta u arc(p,q)

   res   published (eta,p,q)   predicted set == retained set
   Ala   (0, None, None)       True
   Arg   (0, 0, 2)             True
   Asn   (0, 0, 0)             True
   Asp   (0, 0, 0)             True
   Cys   (0, None, None)       True
   Gln   (0, 0, 1)             True
   Glu   (0, 1, 0)             True
   Gly   None                  True
   His   (0, 0, 2)             True
   Ile   (1, 0, 1)             True
   Leu   (0, 1, 1)             True
   Lys   (0, 0, 2)             True
   Met   (0, 0, 1)             True
   Phe   (0, 4, 4)             True
   Pro   (0, 0, 1)             True
   Ser   (0, None, None)       True
   Thr   (0, 0, 0)             True
   Trp   (0, 2, 1)             False   extra retained: ['1', '2', '3', '4']
   Tyr   (0, 4, 4)             True
   Val   (1, 0, 0)             True
```

```
  structures fitting the classification exactly: 19 of 20
  exceptions: ['Trp']   (published comparand: ['Trp'])
  the exception retains, in addition, ['1', '2', '3', '4']
  which together with 4a and 12a is ring A entire: True

  The obvious repair fails: an arc reaching one fusion vertex
  carries its fused ring and an arc reaching the other does not.
    Glu has arc(1,0) = ['4a', '4b'], reaching the fusion vertex 4a,
    and retains ['4a', '4b', '5'] -- ring A is NOT carried.
    Trp has arc(2,1), reaching the fusion vertex 12a, and ring A IS.

======================================================================
  FIBRATION of the forgetful map (S, delta) -> S
======================================================================

  structures: 20    distinct retained subgraphs: 11   (comparand: 20 and 11)

    []                                        Gly
    ['5']                                     Ala, Cys, Ser         <-- shared
    ['4b', '5']                               Asn, Asp, Thr         <-- shared
    ['10b', '4b', '5']                        Gln, Met, Pro         <-- shared
    ['4a', '4b', '5']                         Glu
    ['4b', '5', '6']                          Val
    ['10b', '11', '4b', '5']                  Arg, His, Lys         <-- shared
    ['10b', '4a', '4b', '5']                  Leu
    ['10b', '4b', '5', '6']                   Ile
    ['10b', '11', '12', '12a', '4a', '4b', '5'] Phe, Tyr             <-- shared
    ['1', '10b', '12a', '2', '3', '4', '4a', '4b', '5'] Trp

  fibres carrying more than one structure: 5   (comparand: 5)
  structures they cover: 14   (comparand: 14)
  fibre sizes: [3, 3, 3, 3, 2]   (comparand: 3,3,3,3,2)

======================================================================
  SPLITTING RULE across the sixteen blocks
======================================================================

   block   n1 n2   rule says   mitochondrial   agree
    UU      U  U    True        True            OK
    CU      C  U    False       False           OK
    AU      A  U    True        True            OK
    GU      G  U    False       False           OK
    UC      U  C    False       False           OK
    CC      C  C    False       False           OK
    AC      A  C    False       False           OK
    GC      G  C    False       False           OK
    UA      U  A    True        True            OK
    CA      C  A    True        True            OK
    AA      A  A    True        True            OK
    GA      G  A    True        True            OK
    UG      U  G    True        True            OK
    CG      C  G    False       False           OK
    AG      A  G    True        True            OK
    GG      G  G    False       False           OK

  rule holds at 16 of 16 blocks   (published comparand: 16 of 16)

  The rule turns on the partition {A,U} | {C,G} at position one,
  which is the registry partition of the letter assignment -- and
  nothing in the derivation of the rule uses that assignment.

======================================================================
END OF BLOCK R12
======================================================================
```

Blocks R13

```
======================================================================
R13  [COMPUTED]  Slot arithmetic; the doubly-seeded structure
======================================================================

  (a) THE DOUBLY-SEEDED STRUCTURE.

  The source records one structure seeded at two slots, and infers
  that a single class may serve both, so that the demands number
  seventeen where the slots number eighteen.  The two slots are
  named in its verification record.

    UC all   codons ['UCA', 'UCC', 'UCG', 'UCU']   classes [4, 13, 17, 18]
    AG pyr   codons ['AGC', 'AGU']   classes [4, 17]
    classes meeting BOTH slots: [4, 17]
      class  4 = ['AGU', 'UCA']
      class 17 = ['AGC', 'CGU', 'GCA', 'UCG']

  So a single class does meet both slots, and the inference of
  the source is supported: on the reading in which a structure
  seeded twice imposes ONE demand, the demand count is
  seventeen and a single representative can discharge it.

  BUT THE TWO COUNTS ARE OF DIFFERENT OBJECTS.

  The source states the demand count as seventeen at one
  proposition and as eighteen at the next, and its matching block
  reports eighteen matched of eighteen.  These are consistent only
  if the object matched is the SLOT and not the demand:

    ground set = slots     : 18 elements, 18 matched, deficiency 0
    ground set = demands   : 17 elements, a structure seeded twice
                             counting once

  A matching on slots requires DISTINCT classes for the two slots
  of the doubly-seeded structure; a matching on demands does not.
  The two formulations can therefore differ in deficiency in
  general, and the corpus does not say which it intends.

  Here they do not differ: besides the 2 class(es) meeting both,
  the two slots reach 2 further classes between them,
  [13, 18], so distinct representatives exist either way.

======================================================================
  (b) COMPLEMENTARITY
======================================================================

  Arithmetic of the published counts:
    pairs from 18 slots : C(18,2) = 153   (published comparand: 153)
    pairs from 10 slots : C(10,2) = 45   (published comparand: 45)

  The three published complementary pairs, checked:
    UA pyr   ['UAC', 'UAU']         <-> AU pur   ['AUA', 'AUG']         sizes 2,2   complementary: True
    CC all   ['CCA', 'CCC', 'CCG', 'CCU'] <-> GG all   ['GGA', 'GGC', 'GGG', 'GGU'] sizes 4,4   complementary: True
    CG all   ['CGA', 'CGC', 'CGG', 'CGU'] <-> GC all   ['GCA', 'GCC', 'GCG', 'GCU'] sizes 4,4   complementary: True

  pairs with BOTH slots of size two: 1  [('UA pyr', 'AU pur')]
   (published comparand: exactly one, the first)

  NOTE ON SCOPE.  The denominators 153 and 45 are C(18,2) and
  C(10,2) and are checkable from the counts alone.  That there are
  exactly THREE complementary pairs among the eighteen slots, and
  exactly TEN slots of size two, requires the full slot list, which
  the published verification record does not print (block R4b).
  The three named pairs are verified above; their exhaustiveness is
  not.

======================================================================
END OF BLOCK R13
======================================================================
```

Blocks R14

```
======================================================================
R14  [COMPUTED]  The junction reading
======================================================================
```

```
  (a) ALTERNATING HEXAMERS: inversion equals a one-position shift

    h = AUAUAU   inv(h) = UAUAUA   shift_1(h) = UAUAUA   equal: True
    h = UAUAUA   inv(h) = AUAUAU   shift_1(h) = AUAUAU   equal: True
    h = CGCGCG   inv(h) = GCGCGC   shift_1(h) = GCGCGC   equal: True
    h = GCGCGC   inv(h) = CGCGCG   shift_1(h) = CGCGCG   equal: True

  all four alternating hexamers satisfy inv = shift_1: True

  (b) EVERY WINDOW OF AN ALTERNATING HEXAMER IS A PALINDROME

    h = AUAUAU   windows ['AUA', 'UAU', 'AUA', 'UAU']   all palindromic: True
    h = UAUAUA   windows ['UAU', 'AUA', 'UAU', 'AUA']   all palindromic: True
    h = CGCGCG   windows ['CGC', 'GCG', 'CGC', 'GCG']   all palindromic: True
    h = GCGCGC   windows ['GCG', 'CGC', 'GCG', 'CGC']   all palindromic: True

======================================================================
  (c) THE DISCRIMINATING CASE
======================================================================

  Junction bases fixed; the incoming codon is UA.h1 and the outgoing
  AU.h6, with h6 the complement of h1 by the outer-base hypothesis.

   h1  c_in    h6  c_out   inv(c_in)  rev(c_in)  comp(c_in)   which works
   A   UAA     U   AUU     AUU        AAU        UUA          ['inv']
   C   UAC     G   AUG     AUG        CAU        GUA          ['inv']
   G   UAG     C   AUC     AUC        GAU        CUA          ['inv']
   U   UAU     A   AUA     AUA        UAU        AUA          ['inv', 'comp']

  At an alternating hexamer every window is a palindrome, so the
  three operations cannot be told apart there.  The discriminating
  case is the pyrimidine C outside the incoming codon and the purine
  G outside the outgoing one:
    c_in = UAC   c_out = AUG
      face inversion  -> AUG   MATCHES
      order reversal  -> CAU   no
      composite       -> GUA   no

  and the outgoing codon at the discriminating case is the start.

======================================================================
  (d) THE SAME THREE AGAINST THE OBSERVED MAPPING
======================================================================

  codons of the first sulfur residue : ['UGC', 'UGU']
  codons of the second               : ['AUG']

   codon   inv -> residue    rev -> residue    composite -> residue
    UGC     ACG -> T          CGU -> R          GCA -> A
    UGU     ACA -> T          UGU -> C          ACA -> T

  any frame operation carrying a codon of the first to a codon of
  the second, in the observed mapping: False
  (published comparand: none does; the paper inherits the dilemma)

======================================================================
  (e) THE TWO JUNCTION SLOTS
======================================================================

  incoming, h1 a pyrimidine : ['UAC', 'UAU']   = slot 'UA pyr', size 2
  outgoing, h6 a purine     : ['AUA', 'AUG']   = slot 'AU pur', size 2
  position-wise complementary: True

  These are the two slots of the unique complementary pair with
  both slots of size two, computed at block R13 from the slot set.

  IMPORTANT FOR THE COORDINATING ACCOUNT.  The junction route and
```

```
  the forced-placement route of Section 12 reach the SAME pair of
  slots, and they are not independent of one another: the junction
  route DERIVES the complementarity that the placement route
  ASSUMES.  That is the promotion recorded as entry C5, and it is
  the explanation of the coincidence rather than a second
  coincidence.  Only the Con-admissibility mark of block R6 is
  independent of both.

======================================================================
END OF BLOCK R14
======================================================================
```

Blocks R4b and R13, recomputed on the full slot list

```
======================================================================
THE EIGHTEEN-SLOT LIST
======================================================================
#   slot       size  codons                str   classes meeting it
1   UU pyr     2     UUC UUU               Phe   1,11
2   UC all     4     UCA UCC UCG UCU       Ser   4,13,17,18
3   UA pyr     2     UAC UAU               Cys   3,15
4   UG pyr     2     UGC UGU               Tyr   12,13
5   UG pur     2     UGA UGG               Trp   2,14
6   CU all     4     CUA CUC CUG CUU       Leu   5,9,15,19
7   CC all     4     CCA CCC CCG CCU       Pro   8,14,18,20
8   CA pyr     2     CAC CAU               His   16,19
9   CG all     4     CGA CGC CGG CGU       Arg   6,12,17,20
10  AU pyr     2     AUC AUU               Ile   10,16
11  AU pur     2     AUA AUG               Met   3,15
12  AC all     4     ACA ACC ACG ACU       Thr   2,12,13,14
13  AA pyr     2     AAC AAU               Asn   9,10
14  AG pyr     2     AGC AGU               Ser   4,17
15  GU all     4     GUA GUC GUG GUU       Val   7,11,16,19
16  GC all     4     GCA GCC GCG GCU       Ala   6,12,17,20
17  GA pyr     2     GAC GAU               Asp   5,15
18  GG all     4     GGA GGC GGG GGU       Gly   8,14,18,20

======================================================================
R4b   THEOREM 5.31(ii), FULL SLOT SET
======================================================================
  |A|                       18
  rank_M(A)                 18
  deficiency |A| - rank     0
  Hall defect max|B|-|G(B)| 0
  A independent in M        True
  -> the assignment is admissible; Thm. 5.31(ii) verified on the
     ASSIGNMENT, not on a subset.  Clause (iii) agrees: 0 = 0.

  control, second kind of exchange (Cor. 5.32): relocate the demand at
  AG pyr to UA pur, a slot not in A.
    |A'| 18   rank 17   deficiency 1   Hall defect 1
    violating set: UA pyr, CU all, CA pyr, AU pyr, AU pur, AA pyr, GA pyr, UA pur
    reaching classes: [3, 5, 9, 10, 15, 16, 19]

======================================================================
R13   THEOREM 12.10, EXHAUSTIVE
======================================================================
  slots                                  18
  unordered pairs  C(18,2)               153
  complementary pairs, EXHAUSTIVE        3
      UA pyr    <-> AU pur      sizes 2,2
      CC all    <-> GG all      sizes 4,4
      CG all    <-> GC all      sizes 4,4
  slots of size two                      10
  pairs among them C(10,2)               45
  complementary with BOTH slots of size 2  1
      UA pyr <-> AU pur
```

```
  THEOREM 12.10 AS PUBLISHED: 3 of 153, one with both of size two,
  ten slots of size two giving 45 pairs.   VERIFIED: True

[written: slot-table.tex]

======================================================================
REFEREE POINT (d): IS THE MATCHED OBJECT THE SLOT OR THE DEMAND?
======================================================================
  structures seeded at more than one slot: {'Ser': ['UC all', 'AG pyr']}

  SLOT READING   : each slot is matched separately.  |A| = 18.
                   rank = 18, deficiency 0 (computed above).

  DEMAND READING : a structure seeded at several slots is ONE demand,
                   served by one class meeting all of them.
                   Ser needs a class meeting ['UC all', 'AG pyr'] -> classes [4, 17]
                   |D| = 17 demands.

  BOTH READINGS ARE SATISFIABLE for this assignment, so the ruling does
  not change admissibility.  It changes the COUNT (18 against 17) and it
  changes what Thm. 5.31 is a theorem about.

  RECOMMENDED RULING: the matched object is the SLOT.  Thm. 5.31(i) says
  the incidence is determined by A = s(D) and that the occupying structure
  is not an argument of Gamma; a demand reading reintroduces the structure
  into the matching through the identity of what is seeded twice, which is
  exactly what clause (i) denies.  The demand count remains reportable as
  a derived quantity.
```

Blocks R15

```
======================================================================
R15  [COMPUTED]  Audit of the eighteen-slot list
======================================================================

  (a) ADJACENCY against the eight rows the corpus prints (V3).

    UA pyr    computed [3, 15]               published [3, 15]               OK
    CU all    computed [5, 9, 15, 19]        published [5, 9, 15, 19]        OK
    CA pyr    computed [16, 19]              published [16, 19]              OK
    AU pur    computed [3, 15]               published [3, 15]               OK
    AA pyr    computed [9, 10]               published [9, 10]               OK
    GA pyr    computed [5, 15]               published [5, 15]               OK
    AU pyr    computed [10, 16]              published [10, 16]              OK
    UA pur    computed [10, 16]              published [10, 16]              OK   (relocation target, not a slot)

    all eight agree: True
    -- the slot list reproduces every adjacency the corpus prints,
       including the one slot that is NOT in it.

  (b) STRUCTURAL FACTS the corpus states about the assignment.

    slots                                  18   (published 18)  OK
    distinct structures seeded             17   (published 17)  OK
    structures seeded at two slots         {'Ser': ['UC all', 'AG pyr']}
    -- published: one structure seeded at two slots.  OK
    the row the witness table omits: Ile at AU pyr, class 16 in its
    neighbourhood [10, 16]   OK

  (c) WHICH ASSIGNMENT is this?  The seeded slots are checked
      against the standard mapping at the exchanged blocks.

    UA pyr    standard Tyr       here Cys
    UG pyr    standard Cys       here Tyr
    AU pur    standard Ile/Met   here Met

    -- Cys and Tyr are interchanged with respect to the standard
       mapping, so this is the assignment structural consistency
       selects and not the published witness.  Expected.

  (d) THE COUNT OF SPARE CLASSES -- a value this ruling changes.
```

```
    SLOT reading   : 18 slots matched to 18 distinct classes,
                     leaving 2 of the twenty spare.
    DEMAND reading : 17 demands, the doubly-seeded structure served
                     by one class of [4, 17], leaving 3 spare.

    THE CORPUS STATES: seventeen demands and THREE spare classes.
    That is a DEMAND-reading pair.  Under the recommended SLOT
    ruling the spare count becomes TWO.

    Both readings are admissible and the ruling does not change
    that.  What it changes is a published count, and the ruling
    must therefore carry the restatement with it: the corpus's
    'three spare classes' is a demand-reading quantity and reads
    two under the ruling.  Neither number is wrong; they count
    different things.

  (e) COMPLEMENTARITY, independently recomputed.

    complementary pairs  3   size-two slots 10   both-size-two 1
    published            3                  10                 1
    agrees: True
    the unique pair: UA pyr <-> AU pur, carrying Cys and Met

    -- the two structures of the exogenous pair, at the unique
       complementary pair of size-two slots.  Theorem 12.17 stands.

======================================================================
END OF BLOCK R15
======================================================================
```

Blocks R16

```
======================================================================
R16  [COMPUTED]  Null computation for the marks on one block
======================================================================

  THE MARKS, as the paper reports them

    irregular under the standard mapping      ['UG', 'AU']
    the forced complementary pair of slots    ['UA', 'AU']
    blocks the two exchanges touch            ['UA', 'UG', 'AA', 'CA']
    blocks at which non-release occurs        ['AG', 'UA', 'UG']

    the start codon lies in block             AU
    intersection of the first two             ['AU']

======================================================================
  NULL 1.  The two irregular blocks fall uniformly at random.
======================================================================

    blocks 16, irregular 2, placement blocks 2

    P(at least one irregular block is in the placement pair)
      = 1 - C(14,2)/C(16,2) = 1 - 91/120 = 0.242

    P(the block AU specifically is irregular)
      = 1 - C(15,2)/C(16,2) = 0.125

    Neither is small.  A coincidence at this rate is what an arc
    with sixteen blocks produces by arithmetic.

======================================================================
  NULL 2.  How much of the block set is marked at all?
======================================================================

    union of all four marked sets: ['AA', 'AG', 'AU', 'CA', 'UA', 'UG']
    6 of 16 blocks carry at least one mark  (38%)

    pair 1,2 intersect: ['AU']
    pair 1,3 intersect: ['UG']
    pair 1,4 intersect: ['UG']
```

```
    pair 2,3 intersect: ['UA']
    pair 2,4 intersect: ['UA']
    pair 3,4 intersect: ['UA', 'UG']

    6 of the 6 pairs of marked sets intersect.
    With over a third of blocks marked, pairwise coincidence is
    the expected condition and not an observation.

======================================================================
  NULL 3.  A permutation test, holding the sizes fixed.
======================================================================

    exhaustive over all C(16,2) = 120 placements of the two
    irregular blocks: 29 intersect the placement pair.
    rate = 0.2417

    Observed: an intersection.  Expected under the null at rate
    0.24.  The observation is NOT improbable and carries no
    evidential weight.

======================================================================
  VERDICT
======================================================================

  The target asked whether the marks on the block carrying the
  start codon have a common source, or whether the arc is too
  narrow for marks to fall apart.

  ANSWER: the second, on this evidence.  One coincidence among
  sixteen blocks, at a null rate of roughly one in four, is not a
  finding.  The observation is to be DEMOTED: it may be recorded
  as a fact about where the marks fall and must not be reported
  as a convergence.

  What is unaffected: the agreement of the placement route with
  the junction route, which is not a coincidence at all but the
  promotion of entry C5 -- one route deriving what the other
  assumes.  That was already corrected and is not a null question.

======================================================================
END OF BLOCK R16
======================================================================
```

Blocks R17

```
======================================================================
R17  [COMPUTED]  The decoration record, audited and applied
======================================================================

  (a) PER-ATOM VALENCE AUDIT

  Each retained vertex must be valence-complete: the bonds it
  keeps to other retained vertices, plus the transannular bond at
  the base point, plus any inserted heteroatom, plus its terminal
  types, must total four for an sp3 carbon and three sigma for an
  aromatic one.

   str   vertex  retained-nbrs  transann  insert  delta  total  ok
   (only failures are printed)

   every retained vertex valence-complete: True

   NOTE.  Proline passes only because its closure onto the
   backbone nitrogen is supplied here from CLOSURE, a field that
   Definition 6.6 does not have.  Without it C10b totals three
   where four is required.  See (d).
```

```
========================================================================
  (a2) THE TWO KINDS OF INSERTION
========================================================================

   Definition 6.6 admits heteroatoms inserted INTO EDGES of the
   retained set.  The record contains insertions of a second kind:
   between two retained vertices that are NOT adjacent in the
   vessel graph, so that the heteroatom creates a bond rather than
   interrupting one.

   str   pair          edge of X?   kind
   Met   4b-10b:S      yes          into an edge
   His   4b-11:NH      NO           CREATES a bond
   His   11-10b:N      yes          into an edge
   Arg   10b-11:NH     yes          into an edge
   Trp   10b-12a:NH    NO           CREATES a bond

   The second kind is outside Definition 6.6 as stated.

========================================================================
  (b) DELTA AGAINST THE RESIDUAL COUNT OF TABLE 14.7
========================================================================

   The two counts differ and both are correct.  Table 14.7 counts
   bonds LOST TO THE FRAMEWORK.  delta counts substituents PRESENT
   IN THE PRODUCT.  They differ by the hydrogen an aromatic vertex
   already carried and by the change of hybridisation.

   str   lost to framework   delta entries   insertions
   Ala                   1               3            0
   Arg                   3               8            1
   Asn                   2               4            0
   Asp                   2               4            0
   Cys                   1               3            0
   Gln                   3               6            0
   Glu                   3               6            0
   Gly                   0               0            0
   His                   3               4            2
   Ile                   3               9            0
   Leu                   4               9            0
   Lys                   3               9            0
   Met                   3               7            1
   Phe                   3               7            0
   Pro                   3               6            0
   Ser                   1               3            0
   Thr                   2               5            0
   Trp                   3               7            1
   Tyr                   3               7            0
   Val                   2               7            0

   Neither is the other and Section 14 must not conflate them.

========================================================================
  (c) THE DEMAND FUNCTIONAL, DERIVED FROM THE RECORD
========================================================================

  CONVENTIONS, stated because the result depends on them:
    omega counts bond order to more electronegative partners less
    bond order to less electronegative ones; C-C contributes 0;
    C-H is -1; C-O is +1 per order; C-N is +1 per order; C-S is
    taken as 0 at the carbon, the corpus carrying sulfur at the
    sulfur.  The aromatic framework carbon is taken at omega 0
    where its neighbours are carbons and -1 where it bore an H.

   str   omega(initial)  omega(final)  sigma+eta   parity
   Ala              -1            -3         -2   even
   Arg              -2            -2          0   even
```

```
    Asn              -1             1           2   even
    Asp              -1             1           2   even
    Cys              -1            -2          -1   ODD
    Gln              -1            -1           0   even
    Glu              -1            -1           0   even
    Gly               0             0           0   even
    His              -2            -2           0   even
    Ile              -2            -9          -7   ODD
    Leu              -1            -9          -8   even
    Lys              -2            -7          -5   ODD
    Met              -1            -7          -6   even
    Phe              -3            -7          -4   even
    Pro              -1            -6          -5   ODD
    Ser              -1            -1           0   even
    Thr              -1            -3          -2   even
    Trp              -5            -6          -1   ODD
    Tyr              -3            -5          -2   even
    Val              -2            -7          -5   ODD

    totals with odd parity: ['Cys', 'Ile', 'Lys', 'Pro', 'Trp', 'Val']

    WHAT THIS IS, AND WHAT IT IS NOT.

    The column above is the RETAINED-SET term of the balance: the
    index change over the vertices the structure keeps.  It is NOT
    nu_x(k), and the parity column is the proof that it is not.

    Six of twenty totals are odd.  A complete balance over a cell
    cannot be odd, electrons being transferred in pairs, and the
    corpus records an odd total as the signature of exactly this
    error.  The retained-set term is therefore a proper part of the
    balance and the remainder is missing.

    WHAT IS MISSING, precisely.  Every bond severed at the boundary
    leaves a FRAMEWORK carbon needing a substituent, and every
    vertex removed entire departs as a fragment whose valences must
    also be filled.  Those atoms lie outside the retained set, so
    delta does not describe them, and their contribution is the
    remnant term of Proposition 14.4.

    CONSEQUENCE FOR SECTION 14.  Supplying delta closes one of the
    two inputs of Proposition 14.4 and not both.  The decomposition
    is proved; the skeletal input is Table 14.7; the decoration
    input is now the table above; the remnant accounting is not yet
    available and nu_x(k) is therefore still not evaluable.
    Section 14 remains a target, on a materially narrower gap.

========================================================================
  (d) A GAP IN DEFINITION 6.6, FOUND BY PRINTING THE RECORD
========================================================================

  Definition 6.6 gives a structure a retained set S, a terminal
  type at each vertex of S, and heteroatom insertions into EDGES
  OF S.  The structure's one attachment to the backbone is the
  transannular bond at the base point, which is structural and is
  not a value of delta.

  Proline has a SECOND attachment: the retained set closes onto
  the backbone nitrogen.  That bond runs from a retained vertex to
  an atom outside S, so it is neither a terminal type nor an
  insertion into an edge of S, and Definition 6.6 cannot express
  it.  Proline is the only structure with the datum and the only
  one whose amine is secondary; the two facts are one fact.

  REQUIRED: a third field on delta, a set of closures from
  retained vertices to the backbone, empty at nineteen of twenty.
  This is a gap in a definition and not a missing transcription.
```

```
======================================================================
END OF BLOCK R17
======================================================================
```

C The precedence and audit ledger

C.1 Scope and method

Every entry records a pair of statements of the corpus that speak to one object, its disposition under Definition 2.7, and any audit item arising. The ledger corrects no result of the corpus. It states, for statements whose scope was not stated, what that scope is.

Entries are grouped by the object they concern and not by article. Where an entry rests on a computation, the verification block is named.

C.2 Localisation and cell parity

C1. Vessel-localisation at even count. *Earlier*: a vessel-localised pathway can distinguish a vessel only for odd vessel count, and only the central one; a designation of any other vessel is reversed by a change of reading direction (Article 48). *Later*: a cell of six vessels has no central vessel; its centre is an interface, its central pair the two facing units, and it yields two residues rather than one (Article 59). *Disposition*: Re-scoped. The earlier statement is true of localisation at a vessel and is silent on localisation at an edge. Both are instances of the fixed-locus theorem of Section 5.2, which yields one product at odd count and two at even.

Audit Item C.1. [A] Article 48 opens a target asking whether a cluster of four catalyst–substrate interfaces carries a product alphabet bounded by seventy-two, and observes that such a cluster admits no vessel-localised pathway, so that a negative result would bear on its localisation target as well. Under the fixed-locus theorem a cluster of four vessels admits an *edge*-localised pathway at the central pair, yielding two products. The observation is therefore outside its scope as stated, and the target is to be re-examined: what it excludes is a pathway localised at a vessel, not a localised pathway.

C.3 Parity, termination, and the level at which punctuation lives

C2. Parity against the start and stop account. *Earlier*: every class has even size, so every fibre of an assembly-level map is even; the standard code has two fibres of size one, methionine and tryptophan; hence no assembly-level operator produces it, and termination is supplied by the reading and not by the cluster (Article 48). *Later*: a purine at one position terminates the incoming reading and withholds the outgoing start in one event, and termination is the failure of a reaction to complete (Article 59). *Disposition*: Consistent. The earlier statement is an allocation — punctuation must live at the reading level — and the later supplies a mechanism at that level. No audit item arises. The appearance of conflict is worth meeting explicitly because the earlier statement names methionine as one of the two singleton fibres and the later reaches the start codon, and a reader may take the first to forbid the second. It does not: what it forbids is an assembly-level operator producing that assignment, and the junction account places the assignment nowhere near the assembly level.

C3. Whether the second register governs release. *Earlier*: among codons at which non-release occurs, the two mappings differ exactly when the second register is one specified value (Article 57, Proposition 10.13). *Later, within the same article*: the bounding test returns negative against the published translation tables, which release at the pair the proposition finds fixed; what survives is the weaker claim that the register governs what is released rather than whether (Article 57, Remark 10.13 and Proposition 10.12). *Disposition*: Re-scoped, the article having scoped its own statement. Recorded here because the scope is easily lost in citation: the proposition holds for the two mappings it is stated for and for no others.

C.4 The sulfur pair

C4. Single unit against junction. *Earlier*: both sulfur residues form on a single chrysene unit, which forces an amendment to the structure series, a pyramidalisation of a ring carbon before the bridge can close, and two asymmetries whose relation is left open (Article 58). *Later*: the two residues form at a junction, one on each facing unit, using the published rows unamended, with the bridge closing across the stack undistorted and three asymmetries agreeing (Article 59). *Disposition*: Re-scoped, on five items, the

later article itself listing them. The amended retained set and the corrections following from it, the cut list of the first residue, the pyramidalisation, and the two asymmetries are all properties of the single-unit premise and not of the corpus.

Remark C.2 (Why this entry is not Superseded)**. [A]** The later article declines to rank itself against the earlier: the two describe different cells, one occurring where a strand is regular and one where two strands meet, and it states that nothing forbids both and that neither is evidence against the other. By Remark 2.9 this paper does not override that refusal.
The asymmetry of premises is nonetheless real and is recorded rather than resolved. The junction account buys its five advantages with an assumption about how carriers assemble that no paper of the corpus supplies; the single-unit account assumes nothing of the kind. A reader is entitled to judge the exchange either way, and this paper cites the junction account where the object is a junction and the single-unit account where it is not.

Audit Item C.3. [A] Three statements of Article 58 do not descend from its single-unit premise and are unaffected by entry C4: that the exogenous proposition of Article 57 requires an index by species, nitrogen being demanded by six structures; that the scarcity premise there is comparative rather than general; and that the α-nitrogen is not a decoration. These concern the whole structure series. They are recorded here so that a reader of the ledger does not take C4 to reach them, and they are not audit items in the sense of Definition 2.8.

C.5 Paired delivery

C5. A premise that becomes a consequence. *Earlier*: the two structures requiring an element the carrier cannot supply are seeded at complementary slots, so that one delivery serves both; this is stated as a hypothesis, said to be an argument about the medium rather than about the cluster, and an independent ground is asked for (Article 57, Hypothesis 9.4). *Later*: at a junction the two strands are related by face inversion, face inversion is position-wise complementation, so the two codons of a junction are complementary of necessity; and one delivery serves both because the two sites are one bond apart across the stack (Article 59, Corollary 7.15 and Scholium 7.16). *Disposition*: Promoted. The earlier hypothesis is unamended and its conditional statements remain correct; what changes is that at a junction the condition is discharged.

Remark C.4 (The discharge inherits premises)**. [A]** Two bounds, both stated by the later article and both to be carried wherever this promotion is cited. The identity holds in the assignment that structural consistency selects, which is where the earlier theorem also lives, so the ground reaches no further than that theorem does. And it requires the premise that the two outer bases of a junction are complementary, without which the two codons are not complementary at all. A promotion is a discharge of one condition by the assumption of others, and it is not a removal of conditionality.

C.6 Independence from the observed code

C6. What is independent of the codon table, and over what range. *Earlier*: the standard genetic code enters no hypothesis and no construction; the class count, the capacity theorem and the derivation of the triplet are independent of it and of the nucleobase alphabet (Article 48). *Later*: the demand is read through a consistency relation whose hypotheses were abstracted from a series worked against the observed mappings, so the reading is mediated rather than direct and is not thereby independent (Article 57, Section 3(vi) and (v)). *Disposition*: Re-scoped. The earlier claim is true of the capacity theorem and of the statements Article 48 proves. It does not extend along the arc, and a coordinating paper is at particular risk of letting it, the independence of the first stage being the corpus's most quotable methodological feature.

Audit Item C.5. [A] Any statement of this paper describing the arc as independent of the observed code is to be checked against C6 before it stands. The independence holds through Section 9 of this paper and fails from Section 11 onward, the consistency relation entering there.

C.7 The seeded witness

C7. A table short of a row. *Earlier*: the published witness table prints sixteen rows and three spare classes (Article 50). *Later*: the assignment occupies eighteen slots and seeds seventeen distinct structures, one structure being seeded at two slots; the source's

own count of seventeen demands and three spares is correct and its table omits a line, the missing row being identified with a named class (Article 57, Scholium 8.6 and block V8). *Disposition*: Superseded, on the table only. The counts of the earlier article stand; its printed table does not.

Audit Item C.6. [A] Statements of the corpus citing the printed witness table row by row are to be re-examined against the eighteen-slot list. This paper's own Section 5.4 is affected: the full slot list is not printed in any published verification record, only the eight-slot subset carrying the Hall violation, and the rank computation there is completed only when the list is supplied from the supplementary script of Article 57 (Appendix B, block R4b).

C.8 Stereochemistry

C8. Selection against naming. *Earlier and later, within one article*: an oriented cage condition excluding one approach branch gives a determinate configuration at the α carbon; the identification of that configuration with the intended L-series assignment is made only after the complete substituent ordering and the applicable convention are specified, and no universal identification is assumed (Article 54). *Disposition*: Re-scoped by the article itself, and recorded here because the arc invites the loss. Section 5.3 of this paper states the scope structurally: the cage supplies a section of a torsor, and a torsor supplies no canonical naming of its own elements.

Audit Item C.7. [A] Any statement of this paper or of a later article asserting that the architecture produces the L-series is to be checked against C8. What is available is that it produces one configuration rather than a mixture.

C.9 An open conflict, carried and not resolved

C9. Engagement or escape. *One article* fixes the direction of the conditional refinement from the code data and concludes that the limiting step is engagement and not escape (Article 56). *Another* distinguishes two failure modes by whether the carrier is consumed, the non-releasing mode being the one in which it is (Article 57, Proposition 7.8). *Disposition*: none. The conflict is open, is recorded as such by the later article, and is its Target 11.2. No disposition of Definition 2.7 applies, the two statements being neither compatible on a common instance nor resolvable by scope.

Remark C.8 (Why this is entered without a disposition)**. [A]** Definition 2.7 classifies pairs that this paper can place. It cannot place this one, and inventing a fifth disposition to absorb it would conceal that. The entry exists so that a reader meeting the two statements has the conflict named, and so that the ledger cannot be read as complete.

C.10 An item arising in this paper

C10. The start-codon block. *Arising here*: the consistency relation, stated as a factorization in Section 5.5, forces regularity on every assignment admitting it, so the standard mapping lies outside Con-admissibility at its two irregular blocks. Those two blocks are not the two at which the exchanges of Article 57 act; the two sets meet in one block only, and the block AU is irregular and is touched by neither exchange. Its irregularity is the disagreement of its purine-third pair, which is the start codon. *Disposition*: none; this is not a pair of statements of the corpus but an item this paper contributes to the ledger.

Audit Item C.9. [A] The corpus offers no account of the block AU as the standard mapping fills it. Article 57 exhibits two exchanges and neither reaches it; Article 59 reaches the start codon by a route that does not pass through Con-admissibility at all. Whether the two marks on that block — irregularity under the consistency relation, and the frame relation at a junction — have a common source is not determined here and is carried to Section 15 and to the target inventory.

C.11 The cut list of the first sulfur residue

C11. Two readings of one row. *One article*: three rows of the structure series record two vertices as removed entire and record no severed edge, under a stated convention — a vertex removed entire loses every edge, which is how a structure terminating on a vertex flanked by framework vertices is freed (Article 57, Table 3 and its conventions). *Another*: the same structure is given a boundary cut

list of two edges at the base point, and its remnant is reported as one piece of seventeen carbons (Article 59, Definition 5.2 and block K6) — which is the other reading, and which that article's own re-scoping appendix attributes to the single-unit account while stating that at a junction the corpus's row stands. *Disposition*: superseded by entry C13, which rules the row in favour of the series. The two readings give different remnants, of three pieces and of one, and Article 59 asserts one reading in its definition and the other in its appendix; both fragmentations are computed at Appendix B, block R8. This entry is retained as the record of the discrepancy and C13 carries the ruling.

Audit Item C.10. [A] See Section 14.4 for the three statements affected: the fragmentation clause of the three-asymmetry theorem, the constant term of the junction balance, and the claim that both rows are used unamended. The second junction residue is unaffected, the two readings coinciding where no vertex is removed entire, so the sulfur sites, the bridge geometry and the reading results of Article 59 do not depend on the resolution.

C.12 Two rulings, and what each carries

C12. The matched object. *At issue*: the corpus states the demand count as seventeen at one proposition and as eighteen at the next, the two being consistent only if the matched object is the slot. *Ruling*: the matched object is the slot, on the ground that the incidence is determined by the slot set and the occupying structure is not an argument of it, so that a demand reading reintroduces the structure into the matching. *Disposition*: Restated. Both readings are admissible for this assignment and neither is in error; the ruling fixes which the corpus uses.

Remark C.11 (One published quantity moves)**. [A]** The corpus records seventeen demands and three spare classes. That pair is a demand-reading pair. Under the ruling the eighteen slots take eighteen distinct classes and the spare count is two.
Both are correct and they count different things. Any statement of the corpus citing three spare classes is to carry the demand reading with it, or to be restated as two. Appendix B, block R15(d).

C13. The disputed row. *At issue*: three rows of the structure series record two vertices removed entire and no severed edge; the junction development exhibits for the same structure a cut list of two edges at the base point, and its fragmentation block follows the latter. *Ruling*: two vertices removed entire. A vertex removed entire loses every edge, which is how a structure terminating on a vertex flanked by framework vertices is freed. *Disposition*: Superseded, on the junction development's Definition and fragmentation block only. This supersedes entry C11, which recorded the discrepancy without disposing it.

Audit Item C.12. [A] Three statements of the junction development are incorrect as printed under C13 and are to be corrected: its cut list for the first residue; its fragmentation block, which reports one remnant of seventeen carbons where the ruling gives three, of fifteen, one and one; and its claim that both rows are used unamended, which is true of the series' rows and not of the cut list it exhibits.
Two consequences are bounded. The three-asymmetry theorem survives, the two units differing under either reading; only its fragmentation clause is restated. And the balance survives in form, the affine dependence on the remnant level being unaffected; its constant term is to be recomputed.

C.13 Completeness of the ledger

Remark C.13 (What the ledger does not contain)**. [A]** Three classes of item are deliberately absent.
Withdrawals internal to a single article are carried in that article's own record and are not repeated here, except where a reader is likely to cite the withdrawn form; entry C3 is the one such exception.
Statements of the corpus that this paper does not use are not examined for precedence. The seeding and refinement apparatus beyond what Section 12 requires, the variational criterion, the margin geometry and the survival programme are cited in the concordance of Appendix D and are not disposed here.
And no entry disposes a statement against a source outside the corpus. Where a claim of the corpus is bounded by published translation tables, the bounding is recorded in the article that carries it and is a statement about scope, not a precedence relation.

D Statement-level concordance

Appendix C disposes pairs of statements that speak to one object. This appendix is the wider list: for every prior statement of the corpus that this paper touches, whether it is preserved, extended, restated, noted, or not applicable. It corrects nothing and establishes nothing.

prior statement	**disposition here**
The classification and capacity layer	
The orbit count of the frame group	Preserved; restated at Theorem 5.8 as the dimension of an algebra of invariants, with Recovery 5.11
That the orbit map is the registry sequence	Preserved and made structural: it is the coboundary, and the factorization through it is the content of Theorem 5.8
The stabiliser refinement, and the three derived scalars	Preserved; Proposition 5.10 derives the distinguished coordinate as the unique ρ-fixed index rather than recording it
That a class is a cluster	Preserved and placed at the front (Proposition 6.5); it is the hinge and a coordinating paper should show it as one
The capacity theorem, in two clauses	Preserved, both clauses, with the ceiling stated before the count everywhere in this paper
That a vessel-localised pathway requires odd count	Re-scoped; see Appendix C, C1. True of localisation at a vessel, silent on localisation at an edge
Parity, and the exclusion of the standard mapping	Preserved; the conclusion restated by fibre parity, which makes it independent of the letter assignment (Corollary 9.13)
The termination corollary's named witness	Re-scoped and flagged; assignment-dependent, Appendix C
The four-interface target	Preserved; one supporting clause entered as an audit item
The origins-transition layer	
The retention classification and its exception	Preserved; recomputed at R12, and the failed repair given explicit witnesses at Remark 11.11
The fibration of the forgetful map	Preserved; recomputed, and its relation to the split of the demand functional stated at Scholium 11.13
The splitting rule, and the recovered partition	Preserved; recomputed at sixteen of sixteen. The partition remains unexplained and is carried as an open problem
Accommodation and gating	Restated at Section 5.5 as a monotonicity and a factorization, with Recovery 5.49. No clause weakened or strengthened; one consequence added (forced regularity)
The two failure modes	Preserved; used at Section 15.9 to state the contrast with the null excision
That the demand graph depends on the slot set alone	Preserved; restated as the ground set of a transversal matroid, with the exchange criterion added
The complementarity count	Preserved; denominators verified, the three pairs verified, their exhaustiveness not (R13)
Paired delivery, and the forced placement	Preserved; promoted at a junction, Appendix C, C5
The demand count	Noted: stated as seventeen and as eighteen in adjacent propositions. This paper takes the slot set as the ground set and enters the convention in Appendix C
The published witness table	Superseded on the table only; the counts stand
The carrier layer	
The reference transformation and the canonical word	Preserved; restated in the settled locant notation
Reaction-word nonuniqueness	Preserved and carried: the freedom of the category is a methodological choice this paper does not smooth over
The stereochemical apparatus	Preserved; restated at Proposition 10.12 as a section of a torsor, which separates selection from naming without weakening either
Local transformation invariance	Preserved; the unevenness of its reach — exact chemically, conditional at the cage level — stated at Remark 10.16
The locant convention for the arm carbons	Restated under the ruling of Notation 10.7
The sulfur-pair layer	
The junction cell and its vessel parity	Preserved; derived as the even case of one statement rather than as a cell outside a rule
That both rows are used unamended	Noted, subject to Appendix C, C11: the cut list exhibited for the first residue is not the row as printed in the series

The three asymmetries	Preserved; the fragmentation clause subject to C11
The balance, affine in the remnant level	Preserved in form; the constant subject to C11 and to the restatement of Remark 10.9
The bridge, and the forced sense of the internal sulfur	Preserved
The frame relation and the start	Preserved; recomputed at R14, including the case at which two operations agree and which is therefore not discriminating
The single-unit development	Re-scoped, on five items, by the junction development's own list; three further statements of it are unaffected

E The documentary layer

E.1 Purpose

Every statement in this appendix is imported from the filings and is worked in no article of the corpus. They are collected here so that a reader auditing the arc's dependence on documents finds the whole of it in one place, and so that the body of the paper may cite this appendix rather than distributing them.

Two of the five are load-bearing and three are not. The distinction is made explicitly below because a reader is otherwise entitled to assume that anything in an appendix of this kind is decorative.

E.2 Load-bearing

Remark E.1 (The letter assignment)**. [C]** $FF = A$, $FB = C$, $BF = G$, $BB = U$, carrying the registry partition to $\{A, U\} \mid \{C, G\}$. Read off the filing, which gives coding rules and synthesis mechanisms for the four registry states.
Without it the arc has four vessel states and no names for them, and Sections 12 onward have no codons. The class count is unaffected, being invariant under all twenty-four assignments. That the same partition is recovered from block structure alone in Section 11, by an argument using nothing from here, is a result of that section and is not adduced as support for the import.

Remark E.2 (The asymmetry of the two arms)**. [C]** In the exhibited integrated product the two arms of the marked vessel are not symmetric: one is anchored to the base and one is not.
This is the datum that selects a representative of the involution orbit at Proposition 11.4, and it is the one place where the documentary layer enters a construction. If the exhibited product had symmetric arms, the marking would be undetermined and the structure space would be defined only up to the involution.

E.3 Not load-bearing

Remark E.3 (The exhibited integrated product)**. [C]** After transformation the filing exhibits RNA intercalated with tethered chrysene: a disubstituted remnant on adenine at the 6-position, a remnant anchoring a phospholipid bilayer, and a coding strand departing from the anchored poly-*A* tail.
Apart from the arm asymmetry of Remark E.2, no numbered statement of this paper uses it. It is the exhibit that makes the arc an account of origins rather than of a carrier, and a reader who declines it loses that reading and no result.

Remark E.4 (The identity of the departing strand)**. [E]** The filings claim that the initiator beginning the subsequent sequence determines whether the coding strand that departs is ribonucleic or deoxyribonucleic.
Recorded and not used. No article of the corpus addresses it. Its relation to the initiator-independence hypothesis requires clarification rather than resolution: the initiator is excluded from the cluster and the product pathway is assumed blind to it, so a claim that the initiator selects between two classes of strand is a claim about the nucleobase branch and not about the branch the capacity theorem bounds. Whether that separation survives examination is not determined here.

Remark E.5 (Concurrent provision of bilayer material)**. [E]** The filings claim that the architecture provides, concurrently with the coding material, the phospholipid material of a bilayer, and the exhibited product carries a remnant anchoring one.
No article of the corpus works this: there is no structure series for it, no consistency relation, no registry count and no falsification register. The corpus has developed one branch of a fork and has not developed the other.
Two observations about the shape of the claim, neither of which is an argument that it is correct and neither of which is used. Its shape is the same as the arc's own — one architecture said to supply two classes of material whose co-occurrence is otherwise unexplained, which is structurally the argument Section 13 makes about one delivery serving two residues. And it is claimed in the same documents that supply the letter assignment and the exhibited product, both of which are load-bearing here.
Entered as Target 8.15.

E.4 Sources

Remark E.6 (The two filings)**. [C]** The parent and its divisional, cited in full in the references. The first specifies the substituted chrysene family as encoding material; the second supplies the tether, the exhibited integrated product, and the stacking separation used at Proposition 13.15. Grant dates carry CONFIRM markers inherited from the corpus and are to be resolved before this paper goes to press.

F The record

F.1 Withdrawn in preparing this paper

withdrawn	replaced by, and how it was found
The demand functional as a theorem of this paper, affine in the remnant level at every structure of the series	Demoted to Target 14.13. The decomposition is proved and the skeletal input computed for all twenty structures; the decoration input is held in a supplementary record and is not in the published corpus. Found by attempting the computation rather than by planning it, and the contingency had been registered in advance
A clause presenting the set of readings an alternating hexamer leaves indistinguishable as a torsor under a group of order two	Demoted to a definition and Target 5.30. Face inversion has order two and a phase shift generates a group of order three, so the element acting trivially has order six, which does not name "one position". Found by computing the order of the composite before writing the statement
A statement that three marks on the block carrying the start codon are independent of one another	Corrected at Remark 12.21 and again at Remark 13.29: two of the three agree because the junction route derives the complementarity that the placement route assumes, which is the promotion of entry C5. Only the admissibility mark is independent. Found by computing the identity of the two pairs of slots at R14, after the claim had been made
A premise count of twelve	Eighteen, atomised, in Appendix A, which is now the authority and which the concluding section cites rather than duplicating. Found by building the register, the prose count having grouped premises that are refutable one at a time
An open question whether the blocks at which the standard mapping leaves admissibility are the blocks at which the two exchanges act	Reported negative at Proposition 5.47. They share one block and no more. Found by running the comparison the draft had undertaken to run whichever way it fell
A statement that the demand functional needs one further input, the decoration record	Narrowed, not discharged. The record was supplied and audited, and it closes the decoration term; parity then showed a third term missing, the remnant accounting. Found by computing the retained-set term and reading its parity, which is the test the corpus itself records
A definition of a structure with two fields, a retained set and a decoration of terminal types and edge insertions	Amended to three (Remark 11.7): two bridges of the series join non-adjacent retained vertices and create a bond rather than interrupting an edge, and one structure closes onto the backbone at a second point. Found by printing the record and checking each vertex for valence completeness
A record that the exhaustiveness of the complementarity count was not verified, and that the matroid rank was computed on an eight-slot subset	Withdrawn on the slot list being supplied. Both are now computed on the assignment and both come out as published, so no statement resting on them required restatement. Found by a referee asking for the record rather than by any computation in this paper

A statement that this paper does not decide between the two readings of the disputed row	Replaced by the ruling of entry C13, two vertices removed entire, on a valence ground. The ruling converts a recorded discrepancy into three corrections owed to the junction development
A record that the exhaustiveness of the complementarity count was not verified, and that the matroid rank was computed on an eight-slot subset	Withdrawn on the slot list being supplied. Both are now computed on the assignment and both come out as published, so no statement resting on them required restatement. Found by a referee asking for the record rather than by any computation in this paper
A statement that this paper does not decide between the two readings of the disputed row	Replaced by the ruling of entry C13, two vertices removed entire, on a valence ground. The ruling converts a recorded discrepancy into three corrections owed to the junction development
An audit item recording that a statement naming the phosphate-bearing carbon is inconsistent under either locant convention	Resolved to a restatement at Remark 10.9 by the ruling that the arm carbons are C6α and C6β. So read, the statement is correct and unambiguous

F.2 What catches what

Scholium F.1 (Three kinds, and the remedy differs)**.** The entries fall into three kinds and the distinction is worth preserving.
Caught by computing before asserting. The phase-torsor clause and the demand functional. Both were plausible, both were planned, and both failed on a computation that took minutes. The remedy is ordering: the computation before the sentence, not after it.
Caught by computing after asserting. The three-marks claim. It was written, it read well, and it was false — and it was caught only because a later block computed the identity of two objects the claim had treated as unrelated. The remedy is that the verification blocks were written to compute more than the statements strictly required.
Caught by building an instrument. The premise count, and the negative result on the two pairs of blocks. Neither was in doubt; neither was checked; both changed when a register and a comparison were built. The remedy is the instrument itself, which is the argument of Scholium 1.1.
The second kind is the one that should worry a reader, because it is the one that survived a plausible-sounding sentence. This paper's apparatus caught it once. Whether it would catch it every time is not something the apparatus can certify about itself.

F.3 Owed

Remark F.2 (What this paper leaves undone)**. [A]**

(a) *Supplied.* The slot list, printed at Table 4. The rank computation is now carried out on the assignment and the complementarity count is exhaustive; both come out as published, so nothing resting on them required restatement.

(b) *Ruled.* The disputed row: two vertices removed entire, entry C13. Three corrections are owed to the junction development in consequence.

(c) *Ruled.* The matched object is the slot, entry C12. One published quantity moves with it: three spare classes is a demand-reading count and reads two under the ruling.

(d) *Supplied.* The decoration record, printed at Table 5 and audited by formula and by valence at every retained vertex. It closed two of the three inputs of the demand functional and amended the definition of a structure in two respects.

(e) *Outstanding.* The remnant accounting, which is the third input. Parity shows it to be missing: six of twenty partial totals are odd and a complete balance cannot be. This is the only item still open and the only one that would restore a result.

(f) *Outstanding.* The CONFIRM markers on pagination and grant dates, and the unfilled source for the sulfur–sulfur bond length, both inherited from the corpus.

Items (a) to (c) were matters of record rather than of research, which is why Remark 17.2 separated them from the targets. Two were settled by ruling and one by supplying the record; the fourth is of the same kind and is not yet supplied.

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