

ORTHOGONAL REVIEW RECORD

*Why Three and Why Twenty: The Capacity of a  
Chrysene Cluster, the Base-Four Intermediary, and  
the Production Operator  $\Delta$*

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REVIEW SCOPE

This file is the review record of Article 48. It is not a section of the paper. The object reviewed, in order, was the concept outline, the drafted text of nine sections and three appendices, and the supplementary verification script. The architecture

is [Sch26b, §4.3]. Admissibility is  $F_{\text{adm}} = M \cap C \cap H$  [Sch26b, Def. 2]. There is no author-reply section.

### Scope of Review

The manuscript extends the framework and falls under [Sch26b, §4.5]. It is short on mathematics and long on inheritance. Its arguments are elementary — orbit counting under a four-element group, a parity observation, an arithmetic inequality — and essentially all of its risk lies in what it takes from two predecessors and what it declines to take. Concordance was therefore expected to produce the majority of the items, and did. Fourteen of the sixteen items were raised against the concept outline.

### Compiled disposition

Sixteen criticisms were raised and all sixteen are fully accepted. All carry verification explicit. Nine arose at concordance, six at mathematics, one at chemistry. Seven numerical checks pass. Three items made the manuscript claim more rather than less, each by making an assumption explicit. Three chemical statements are referred to the domain pass without disposition and are not counted among the sixteen. Seven Targets remain open, three of them load-bearing.

### Referred, not disposed

Three chemical statements await a ruling this review cannot give. That the reacting unit is six alternating units, established without reference to codons or to the alphabet size. That each interface produces one nucleobase. And that the amino-acid pathway does not involve the initiator, which decides between a ceiling of twenty and one of thirty-two and is the manuscript's central empirical commitment. A reader declining initiator independence should read the result as a theorem about thirty-two.

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## 1. THE THREE QUESTIONS

*M*: Is each numbered statement valid at the strength claimed? A correct computation offered as establishing more than it establishes fails the test.

*C*: Does the manuscript contradict a prior statement, or silently weaken a structure a prior statement relies on, including register, naming, and provenance discipline?

*H*: Is the molecular interpretation admissible, and is every such claim confined to a remark entering no proof?

2. STAGE *M* — MATHEMATICAL REVIEW**Stage *M* — mathematics only**

Six items. Claims stated at the wrong strength, a measure conflated with a count, and one violation of proof discipline. The capacity result is a ceiling, not a count of exactly twenty. Parity forbids the operator from producing the stop sites.

Strength of claim (items 1, 4, 7). The outline presented the capacity result as “exactly twenty.” It is a ceiling: a product satisfying the two standing hypotheses factors through the twenty classes and therefore takes at most twenty values. The constant map, carrying every class to one amino acid, shows that the passage to a count is carried entirely by totality and injectivity. The theorem is written in two clauses. The abstract says ceiling before it says count. The witness is a numbered non-implication. The outline also had the operator producing the twenty amino acids and the stop sites. Every class has size two or four, so every fibre of an assembly-level map is even, while two codons of one class carry a stop and an amino acid respectively. The phrasing is removed. Termination is derived to be a reading-level datum. A section displaying two worked discriminations was framed as a method. Two are not twenty, and twenty independent determinations would test injectivity rather than establish it. The section is labelled an illustration, and its three limits are stated together.

A measure conflated with a count (items 6, 14). Six bits carried by a cluster, of which the class carries 4.25 and the reading 1.75. The figures are correct under the uniform measure on marker strings, but  $\log_2 20 = 4.32$ , and the two decompositions answer different questions. The remark was cut rather than repaired.

Proof discipline (item 16). The corollary deriving the triplet codon used the empirical claim that each catalyst–substrate interface produces one nucleobase. An empirical instantiation claim enters no proof. The two chemical facts are registered as realization hypotheses, with their molecular reading confined to a remark. The corollary now proves from the hypotheses. The capacity theorem is instantiated at  $N = 3$  under a hypothesis rather than arithmetically.

3. STAGE *C* — CONCORDANCE REVIEW**Stage *C* — concordance only**

Nine items, the largest group. Four changed the manuscript’s structure. The two of largest consequence were found by asking what a predecessor’s table caption and a predecessor’s definition actually assert. Neither is a defect of proof.

A load-bearing claim resting on a table caption (item 13). That a frame class is a physical cluster and not an equivalence class of descriptions appears in [Sch26e] only in the caption of Table 1. Theorem 3.3(iii) states something adjacent but weaker: any quantity attributable to the assembly is a function on the class set, which presupposes the attribution. A caption cannot carry a hypothesis register. The statement is proved here from [Sch26d, Props. 3.4, 3.19, 6.5, 6.7], as a bijection between clusters and classes. Nothing in the predecessor is contradicted.

A hypothesis that was not one (item 10). Frame-invariance of the product, registered as the load-bearing hypothesis, is not a hypothesis: a function of the cluster is automatically constant on the class. What is actually assumed is that the product depends on the cluster’s marker assignment alone, and not on temperature, concentration, neighbouring clusters, or reaction history. That locality hypothesis was absent. A four-clause register replaces the two-clause form: locality, initiator independence, totality, injectivity. Frame-invariance becomes a corollary.

A predecessor’s definition breaking the symmetry (item 11). [Sch26d, Def. 6.1] states that the origin, the direction sign, and the projection reference are all three supplied by the initiator, and [Sch26d, Def. 9.1] places the initiator at a distinguished end of the stack. An assembly taken with its initiator has a determined reading direction. Reversal is not a re-description of it. The acting group is generated by the projection reference alone, and the class count is thirty-two, not twenty. The resolution is chemical: the initiator supplies the frame for reading a codon, while the amino-acid pathway proceeds within the six units and does not involve it. Initiator independence is registered and identified as the central empirical commitment. The sensitivity table is rewritten as a conditional. The manuscript states in three places that a reader declining the hypothesis should read it as a theorem about thirty-two.

Circularity in the cluster length (items 2, 12). The outline justified the six-unit cluster by “three interfaces, three bases.” That reaches for the codon being a triplet. The cluster length is registered as a chemical statement about the architecture, prior to and independent of codons. The triplet then becomes a consequence rather than an input.

Inheritance and naming (items 3, 5, 8, 15). The frame-group decomposition of [Sch26d, Prop. 6.7] is proved for the letter and was being used for the product. It is restated in the open. Every occurrence of the number twenty passes through it. The partition result of the companion paper depends on the letter assignment and on the standard codon table, and is disclosed as a posteriori, contrasted with the capacity, which depends on neither. The renaming of the operator and of two

hypothesis clauses is recorded as a concordance substitution; no clause is weakened or strengthened. The two worked discriminations take their candidate pairs from the companion paper, hence from the standard code. The distinction between order of exposition and order of proof is disclosed.

A collision recorded after compilation. The production operator was set as  $\chi$  and has been changed to  $\Delta$ . That collides with the localized cipher involution  $\Delta_{\mathbf{k}}$  of [Sch26d, §2.2]. The production operator is never subscripted and never localized; the involution is always both; no statement of the manuscript uses the involution. The two never occur in one argument. This postdates the ledger.

#### 4. STAGE *H* — CHEMISTRY AND DOMAIN REVIEW

##### Stage *H* — one item disposed

One item disposed, and three statements referred without disposition. The manuscript’s mathematical content uses no molecular datum. Its chemical content is confined to two registered hypotheses and one illustrative section whose synthesis steps are deferred. Nothing in the four mathematical sections is conditional on the deferred treatise, and nothing in the manuscript is offered for chemical review.

Nomenclature (item 9). A four-letter alphabet in a paper about the genetic code will be read as  $\{A, C, G, U\}$ . The intermediary is the vessel alphabet, whose letters are orientational states of a catalyst–substrate pair. A remark fixes the reading. The capacity is proved over the intermediary and is independent of the letter assignment, verified over all twenty-four assignments. That independence is a strengthening rather than a clarification.

#### 5. TARGETED VERIFICATION

##### Targeted verification

Each of the sixteen entries was located and the repair confirmed present. Withdrawn language does not survive outside the ledger: the information-theoretic remark, “exactly twenty,” the stop sites in the operator’s image, and the derivation language for the cluster length. Codon-table macros of the companion paper are left undefined, so a stray codon table fails the compile. Seven numerical checks pass. The script imports nothing from the manuscript’s tables.

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| Check | Object verified |
|-------|-----------------|
|-------|-----------------|

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|    |                                                                                                                                           |
|----|-------------------------------------------------------------------------------------------------------------------------------------------|
| V1 | Orbits on the sixty-four marker assignments under every subgroup of the frame group: 64, 32, 36, 36, 20. Only the full group gives twenty |
| V2 | Class count under all twenty-four letter assignments: twenty in every case                                                                |

| Check | Object verified                                                                                                                                                          |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| V3    | Count at $N = 1, \dots, 8$ against $4^N$ , and the ratio $\frac{1}{4} + 2^{-(N+1)} < 1$ ; closed formula against direct enumeration                                      |
| V4    | Every class has even size, eight of size two and twelve of size four; the standard codon table has exactly two singleton fibres. The only check that reads a codon table |
| V5    | Twenty classes with registry class, weight, size, stabiliser type and central entry; weight fibres 1, 3, 6, 6, 3, 1; size two iff the registry is palindromic            |
| V6    | Reversal fixes a vessel iff the cluster length is odd; at three vessels the fixed vessel is the middle one                                                               |
| V7    | Four classes of the illustrative section, with weights, sizes and vessel registries                                                                                      |

## 6. META-REVIEW

### Meta-review of the controlling text

All sixteen criticisms fully accepted. None partially resolved, unresolved, or no longer applicable. Concordance produced nine, mathematics six, chemistry one. Three items made the manuscript claim more. The comparison with the companion paper is a comparison of two records, not a result.

|                                           | Count |
|-------------------------------------------|-------|
| Criticisms raised                         | 16    |
| fully accepted                            | 16    |
| By stage: concordance                     | 9     |
| mathematical                              | 6     |
| chemistry and domain                      | 1     |
| Raised before drafting                    | 14    |
| Raised during drafting                    | 2     |
| Verification explicit                     | 16    |
| Verification none                         | 0     |
| Items that made the manuscript claim more | 3     |
| Numerical checks, all passing             | 7     |

The distribution inverts that of the companion paper. There, mathematical review produced twenty-two of thirty-four items and concordance seven. Here concordance produces nine of sixteen. The companion paper builds an adjacency and selects among matchings; this manuscript proves three short things and inherits everything else. That the architecture detects the risk where the risk lies is a second instance of the differentiation [Sch26b, Rem. 1] reports. It is not evidence about the architecture in general.

The pass improved the result. In both preceding manuscripts every accepted item narrowed a claim. Here three did the opposite. Turning a caption into a proposition gave the central structural result. Turning frame-invariance into a corollary removed a hypothesis and exposed the real one. Refusing the circular justification of the cluster length turned an assumption into a derived corollary, so that the paper answers why three as well as why twenty.

Largest consequences were not defects of proof. Items 10 and 11 changed what the manuscript assumes more than anything else. A stage asked only whether the mathematics is valid would have passed both. The corpus now has four instances of this.

The dependence is concentrated. Every occurrence of the number twenty passes through [Sch26d, Prop. 6.7] and through initiator independence. A single chemical finding moves the result from twenty to thirty-two. The alternative value is stated in three places, and the corresponding Target is named load-bearing.

**What the review does not certify.** Seven Targets are open, three load-bearing: whether the product depends on the cluster alone, whether the pathway involves the initiator, and whether the twenty classes produce twenty distinct amino acids. Four hypotheses are registered and undischarged, and the capacity theorem’s second clause stands on two of them. Two further hypotheses are chemical and are before the domain pass. No synthesis is reported. One Target is of a kind the corpus has not carried: a cluster of four catalyst–substrate interfaces whose products exceeded seventy-two would refute the capacity theorem outright.

**Limitation.** Targeted verification re-runs the mathematical stage. By [Sch26b, §9.4], every entry marked verification explicit inherits that limitation. Concordance and chemistry are not affected. The seven numerical verifications are not subject to it. This report is a single-manuscript record.

#### LEDGER

| # | St       | criticism                                                                       | disposition / verification                                    |
|---|----------|---------------------------------------------------------------------------------|---------------------------------------------------------------|
| 1 | <i>M</i> | “Exactly twenty” presented as the theorem                                       | Split into ceiling and saturation; witness supplied. Explicit |
| 2 | <i>C</i> | Cluster length justified from the codon being a triplet                         | Superseded by item 12. Explicit                               |
| 3 | <i>C</i> | Frame-group decomposition proved for the letter, used for the product           | Restated in the open. Explicit                                |
| 4 | <i>M</i> | Operator said to produce the twenty and the stop sites                          | Parity forbids it; termination is reading-level. Explicit     |
| 5 | <i>C</i> | Partition result presented as intrinsic                                         | Disclosed as letter-dependent and a posteriori. Explicit      |
| 6 | <i>M</i> | Entropy conflated with the count                                                | Remark cut. Explicit                                          |
| 7 | <i>M</i> | One worked case offered as a method                                             | Labelled an illustration; three limits stated. Explicit       |
| 8 | <i>C</i> | Naming against the companion paper’s coarsening, and renamed hypothesis clauses | Renamed; substitutions recorded as restatements. Explicit     |

| #  | St       | criticism                                                                    | disposition / verification                                                  |
|----|----------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 9  | <i>H</i> | Intermediary read as a nucleobase                                            | Remark added; capacity independent of the letter assignment. Explicit       |
| 10 | <i>C</i> | Frame-invariance registered as a hypothesis; the real assumption was missing | Four-clause register; locality introduced; invariance a corollary. Explicit |
| 11 | <i>C</i> | Initiator breaks the reversal symmetry, giving thirty-two                    | Initiator independence registered; sensitivity table conditional. Explicit  |
| 12 | <i>C</i> | Cluster length still justified from the code                                 | Registered as prior to codons; the triplet is a consequence. Explicit       |
| 13 | <i>C</i> | Load-bearing claim cited to a table caption                                  | Proved from four prior propositions. Explicit                               |
| 14 | <i>M</i> | Entropy remark needs its measure named                                       | Cut; the thesis is a count. Explicit                                        |
| 15 | <i>C</i> | Worked cases take candidate pairs from the companion paper                   | Exposition against proof; disclosed. Explicit                               |
| 16 | <i>M</i> | Empirical claim used inside the proof of the triplet corollary               | Registered as two realization hypotheses. Explicit                          |

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## REVISION HISTORY

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|---------|------------|------------------------------------------|
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