Packing the Standard Genetic Code in its box: 3-dimensional late Crick wobble

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Manuscript Source: https://www.biorxiv.org/content/10.1101/2021.01.18.427168v2
Manuscript Authors: Michael Yaru &Michael; Yarus

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Contact Information:

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All queries, feedback or suggestions are also very welcome.

Research Paper Sections:

The sections of the research paper input text parsed in this audit.

Section No.	Headings	Sentences
Section: 1	Abstract	14
Section: 2	Introduction and approach	13
N/A	--- --- --- --- --- --- ---	0
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Title	**Packing the Standard Genetic Code in its box: 3-dimensional late Crick wobble**

S1 [001] Abstract

S1 [002] Minimally-evolved codes are constructed with randomly chosen Standard Genetic Code (SGC) triplets, and completed with completely random triplet assignments.

> Minimally-evolved codes are constructed ...
>
> ... with randomly chosen Standard Genetic Code ...
>
> ... (SGC) ...
>
> ... triplets, ...
>
> ... and completed ...
>
> ... with completely random triplet assignments.

S1 [003] Such "genetic codes" have not evolved, but retain SGC qualities.

> Such "genetic codes" ...
>
> ... have not evolved, ...
>
> ... but retain SGC qualities.

S1 [004] Retained qualities are inescapable, part of the logic of code evolution.

> Retained qualities are inescapable, ...
>
> ... part ...
>
> ... of the logic ...
>
> ... of code evolution.

S1 [005] For example, sensitivity of coding to arbitrary assignments, which must be $<\approx 10\%$, is intrinsic.

> For example, ...
>
> ... sensitivity ...
>
> ... of coding ...
>
> ... to arbitrary assignments, ...
>
> ... which must be $<\approx 10\%$, ...
>
> ... is intrinsic.

S1 [006] Such sensitivity comes from elementary combinatorial properties of coding, and constrains any SGC evolution hypothesis.

> Such sensitivity comes ...
>
> ... from elementary combinatorial properties ...
>
> ... of coding, ...
>
> ... and constrains any SGC evolution hypothesis.

S1 [007] Similarly, evolution of last-evolved functions is difficult, due to late kinetic phenomena, likely common across codes.

Similarly, ...

... evolution ...

... of last-evolved functions is difficult, ...

... due to late kinetic phenomena, ...

... likely common ...

... across codes.

S1 [008]   Census of minimally-evolved code assignments shows that shape and size of wobble domains controls packing into a coding table, strongly shifting accuracy of codon assignments.

Census ...

... of minimally-evolved code assignments shows ...

... that shape ...

... and size ...

... of wobble domains controls packing ...

... into a coding table, ...

... strongly shifting accuracy ...

... of codon assignments.

S1 [009]   Access to the SGC therefore requires a plausible pathway to limited randomness, avoiding difficult completion while packing a highly ordered, degenerate code into a fixed three-dimensional space.

Access ...

... to the SGC therefore requires a plausible pathway ...

... to limited randomness, ...

... avoiding difficult completion ...

... while packing a highly ordered, ...

... degenerate code ...

... into a fixed three-dimensional space.

S1 [010]   Late Crick wobble in a 3-dimensional genetic code assembled by lateral transfer satisfies these varied, simultaneous requirements.

Late Crick wobble ...

... in a 3-dimensional genetic code assembled ...

... by lateral transfer satisfies these varied, ...

... simultaneous requirements.

S1 [011]   By allowing parallel evolution of SGC domains, it can yield shortened evolution to SGC-level order, and allow the code to arise in smaller populations.

By allowing parallel evolution ...

... of SGC domains, ...

... it can yield shortened evolution ...

... to SGC-level order, ...

... and allow the code ...

... to arise ...

... in smaller populations.

S1 [012]   It effectively yields full codes.

It effectively yields full codes.

S1 [013]   Less obviously, it unifies well-studied sources for order in amino acid coding, including a stereochemical minority of triplet-amino acid associations.

> Less obviously, ...
>
> ... it unifies well-studied sources ...
>
> ... for order ...
>
> ... in amino acid coding, ...
>
> ... including a stereochemical minority ...
>
> ... of triplet-amino acid associations.

S1 [014]   Finally, fusion of its intermediates into the definitive SGC is credible, mirroring broadly-accepted later cellular evolution.

> Finally, ...
>
> ... fusion ...
>
> ... of its intermediates ...
>
> ... into the definitive SGC is credible, ...
>
> ... mirroring broadly-accepted later cellular evolution.

S2 [015]   Introduction and approach

S2 [016]   The form of the Standard Genetic Code (SGC) offers authoritative information about its origin.

> The form ...
>
> ... of the Standard Genetic Code ...
>
> ... (SGC) ...
>
> ... offers authoritative information ...
>
> ... about its origin.

S2 [017]   By calculating evolved coding tables (Yarus 2021b), the SGC's implications can be investigated.

> By calculating evolved coding tables ...
>
> ... (Yarus 2021b), ...
>
> ... the SGC's implications can be investigated.

S2 [018]   Comparing coding tables evolved via different pathways, more frequent SGC-like results quantitatively signal superior explanations.

> Comparing coding tables evolved ...
>
> ... via different pathways, ...
>
> ... more frequent SGC-like results quantitatively signal superior explanations.

S2 [019]   Consequently, initial hypotheses about code descent can be improved.

> Consequently, ...
>
> ... initial hypotheses ...
>
> ... about code descent can be improved.

S2 [020] In fact, respecting Bayes' theorem, multiple successful explanations rapidly strengthen an accurate hypothesis by Bayesian convergence (Yarus et al. 2005).

> In fact, ...
>
> ... respecting Bayes' theorem, ...
>
> ... multiple successful explanations rapidly strengthen an accurate hypothesis ...
>
> ... by Bayesian convergence ...
>
> ... (Yarus et al. 2005).

S2 [021] The existing result is late Crick wobble (Yarus 2021a).

> The existing result is late Crick wobble ...
>
> ... (Yarus 2021a).

S2 [022] "Late" implies that wobble was deferred, being preceded by unique triplet pairing assignments.

> "Late" ...
>
> ... implies ...
>
> ... that wobble was deferred, ...
>
> ... being preceded ...
>
> ... by unique triplet pairing assignments.

S2 [023] Unique base pairing does not require support from a highly evolved allosteric ribosome (Moazed and Noller 1990; Ogle et al. 2001), or a specific, highly optimized tRNA anticodon loop-and-stem structure (Yarus 1982; Uhlenbeck and Schrader 2018), or control of isomerization in wobble-paired bases (Westhof et al. 2019).

> Unique base pairing does not require support ...
>
> ... from a highly evolved allosteric ribosome ...
>
> ... (Moazed ...
>
> ... and Noller 1990; ...
>
> ... Ogle et al. 2001), ...
>
> ... or a specific, ...
>
> ... highly optimized tRNA anticodon loop-and-stem structure ...
>
> ... (Yarus 1982; ...
>
> ... Uhlenbeck ...
>
> ... and Schrader 2018), ...
>
> ... or control ...
>
> ... of isomerization ...
>
> ... in wobble-paired bases ...
>
> ... (Westhof et al. 2019).

S2 [024] Accurate Crick wobble (Crick 1966) would therefore likely be a later, more modern code refinement.

> Accurate Crick wobble ...
>
> ... (Crick 1966) ...
>
> ... would therefore likely be a later, ...
>
> ... more modern code refinement.

End of Sample Audit