Nei-Gojobori dN/dS estimate (NG86)

- For each codon `C` we define `ES(C)` and `EN(C)` - the numbers of synonymous and non-synonymous *sites* of a codon

  - e.g., `ES(GAA) = 1/3, EN(GAA) = 8/3.`

- May also define them as fractions of substitutions that do not lead to stop codons,

  - e.g., `ES(GAA) = 1/3, EN(GAA) = 7/3.`

- The sum of `ES` and `EN` over all codons in a sequence gives an estimate of expected synonymous and non-synonymous **sites** in a sequence.

- For two sequences (the target of the original method), we average `ES(C)` and `EN(C)` at each site.

- `EN/ES` is thus the *expected ratio of non-synonymous to synonymous substitutions counts* under neutral evolution

NG86 example

	Seq1	**ACA**	**ATA**	**ATC**	**TTT**	**AAT**	**CAA**
	Syn	1	2/3	2/3	1/3	1/3	1/3
	NonSyn	2	7/3	7/3	8/3	8/3	7/3
	Seq2	**ACA**	**ATA**	**ACC**	**TTT**	**AAC**	**CAA**
	Syn	1	2/3	1	1/3	1/3	1/3
	NonSyn	2	7/3	2	8/3	8/3	7/3
Mean	Syn	**1**	**2/3**	**5/6**	**1/3**	**1/3**	**1/3**
	NonSyn	**2**	**7/3**	**13/6**	**8/3**	**8/3**	**7/3**

$ES = 3½$, $EN = 14\frac{1}{6}$: under neutrality, we **<u>expect</u>** the ratio of non-synonymous to synonymous substitutions of $EN/ES \sim 4.05$