



Fig. 1. High and low degeneracy amino acids.

Table 1. The Nicomachus Triangle, $T(n, k)$.

1						
2	3					
4	6	9				
8	12	18	27			
16	24	36	54	81		
32	48	72	108	162	243	
64	96	144	216	324	486	729
etc.						

Table 2. Pascal's Triangle.

1					
1	1				
1	2	1			
1	3	3	1		
1	4	6	4	1	
etc.					

bit strings of adjacent codons that make up an amino acid necessarily differ by a single bit because of the nature of binary reflecting Gray code.

Notice that in M_2 the natural numbers 4, 6, 9 appear while in M_3 the natural numbers 8, 12, 18, 27 appear, with each row and column having the same sequence of positive integers with no integer appearing adjacent to itself in a row or column. These sequences come from a triangle of numbers attributed to the 2nd century AD Syrian mathematician Nicomachus (Kappraff, 2000) and represent successive sequences of musical fifths. The Nicomachus Triangle, $T(n, k)$, is reproduced in Table 1 where the integers in the n -th row are $\{2^{n-k}3^k, 0 \leq k \leq n\}; n \geq 0$. Here if the central integer 6 is thought to be the length of a string representing a fundamental tone, then 4 and 9 of row 3 represent the string lengths corresponding to rising and falling musical fifths, ratios of 2:3 and 3:2. Also the fifth row represents the string lengths that give rise to a pentatonic scale with fundamental string length of 36 units while the integers in row 7 represent string lengths of a heptatonic scale with 216 as the string length of the fundamental. The

27	18	12	18	12	8	12	18
18	27	18	12	8	12	18	12
12	18	27	18	12	18	12	8
18	12	18	27	18	12	8	12
12	8	12	18	27	18	12	18
8	12	18	12	18	27	18	12
12	18	12	8	12	18	27	18
18	12	8	12	18	12	18	27

(a)

27	18	18	12	18	12	12	8
18	27	12	18	12	18	8	12
18	12	27	18	12	8	18	12
12	18	18	27	8	12	12	18
18	12	12	8	27	18	18	12
12	18	8	12	18	27	12	18
12	8	18	12	18	12	27	18
8	12	12	18	12	18	18	27

(b)



(c)

Fig. 2. (a) RNA matrix of amino acids—Gray Code ordering. (b) RNA matrix of amino acids—Binary ordering. (c) “The Music of the Genes”. A quilt pattern by Elaine Ellison.