Response by the author

Dear Editor,

Prof. R. Berríos kindly read and performed an exhaustive study of my recent article (Valenzuela, 2013) and indicated that the central column of the mutational matrix does not add up to 1, as any stochastic matrix should. I revised it with the construction algorithm and indeed it has errors. This letter corrects these errors and teaches any reader to generate and revise these matrices with the construction and correction algorithms.

The column describes the probability of transformation of a population with 4 bacteria of generation I, where 2 are A and 2 are B (AABB) into a population of 4 bacteria in the next generation J, with the 5 possible alternatives: BBBB, ABBB, AABB, AAAB and AAAA. This transformation occurs after a round of duplication to 8 bacteria and reduction to 4 bacteria by random death, only by recurrent forward (A to B) and backward (B to A) mutation. Both mutation rates (and probability of mutation) are m [non-mutation then occurs with probability (1-m)].

I. AABB is transformed into BBBB in only one way, if both A mutate (independently) to B (m^2) and both B remain un-mutated [$(1-m)^2$]; the total probability is [$m^2(1-m)^2$].
II. AABB is transformed into ABBB in two ways: 1) one of the two A mutates to B, with probability $2m^1$, and the other three bacteria (ABB) remain un-mutated with probability $(1-m)^3$, whose total probability is [$2m^1(1-m)^3$]; 2) the two A mutate to B with probability m^2 and one of the two B mutates to A (2m) and the other B remains unchanged $(1-m)^1$, with probability $2m^1(1-m)^1$, whose total probability is [$2m^3(1-m)^1$].
III. AABB is transformed into AABB in three ways: 1) the four bacteria remain unchanged with probability $(1-m)^4$ and there is no mutation with probability m^0; total probability is [$m^0(1-m)^4$]; 2) one A mutates to B with probability 2m and one B mutates to A with probability 2m and two bacteria (one A and one B) remain unchanged with probability $(1-m)^2$; total probability [$4m^2(1-m)^2$]; 3) the two A mutate to B with probability m^2 and the two B to A with probability m^2, and no bacteria remain unchanged with probability $(1-m)^0$; total probability is [$m^4(1-m)^0$].
IV. AABB is transformed into AAAB in two ways: 1) one A mutates to B and the two B mutate to A with total probability [$2m^3(1-m)^1$] ; 2) one B mutates to A with probability $2m^1$ and the other three bacteria remain unchanged $(1-m)^3$ and total probability [$2m^1(1-m)^3$].
V. AABB changes to AAAA in only one way. Two B mutate to A and both A remain unchanged with total probability [$m^2(1-m)^2$].

Table I shows the correction. Controls for the columns of these matrices are: 1) the exponents of a term must add up 4; 2) the addition of the terms of a column must add up 1 (it is a stochastic matrix), because the columns display the binomial $[m + (1-m)]^n = 1$, where n is the number of bacteria. In this case this display is $m^0(1-m)^4 + 4m^1(1-m)^3 + 6m^2(1-m)^2 + 4m^3(1-m)^1 + m^4(1-m)^0 = 1$, that agrees with the columns of the matrix (Valenzuela, 2013).

TABLE 1

Third column of the mutation stochastic matrix (Valenzuela, 2013)

	Corrected Column	Erroneous Column
Input Pop	**AABB**	**AABB**
Output Pop	**Probability**	**Probability**
BBBB	$m^2(1-m)^2$	$m^2(1-m)^2$
ABBB	$2m^1(1-m)^3 + 2m^3(1-m)^1$	$2m(1-m)^3 + m^2(1-m)^2$
AABB	$m^0(1-m)^4 + 4m^2(1-m)^2 + m^4(1-m)^0$	$m^0(1-m)^4 + 4m^2(1-m)^2 + m^4(1-m)^0$
AAAB	$2m^3(1-m)^1 + 2m^1(1-m)^3$	$2m(1-m)^3 + m^2(1-m)^2$
AAAA	$m^2(1-m)^2$	$m^2(1-m)^2$

Pop = Population

REFERENCE

VALENZUELA CY (2013) Foundational errors in the Neutral and Nearly-Neutral theories of evolution in relation to the Synthetic Theory. Is a new evolutionary paradigm necessary?. Biol Res 46: 101-119.

I thank Prof. Berríos for his critical reading of my article.

Carlos Y Valenzuela
Programa de Genética Humana ICBM
Facultad de Medicina
Universidad de Chile