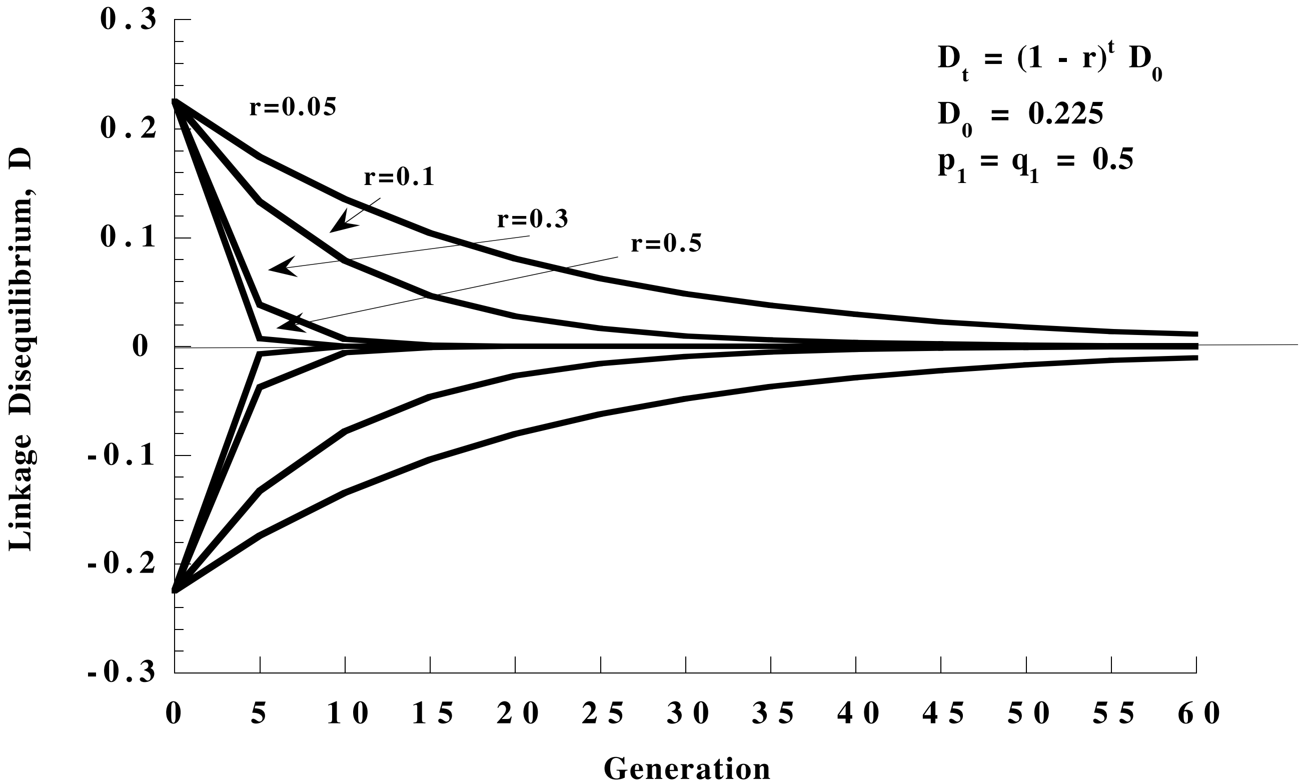
Frequency of Gametes with Two Diallelic Loci

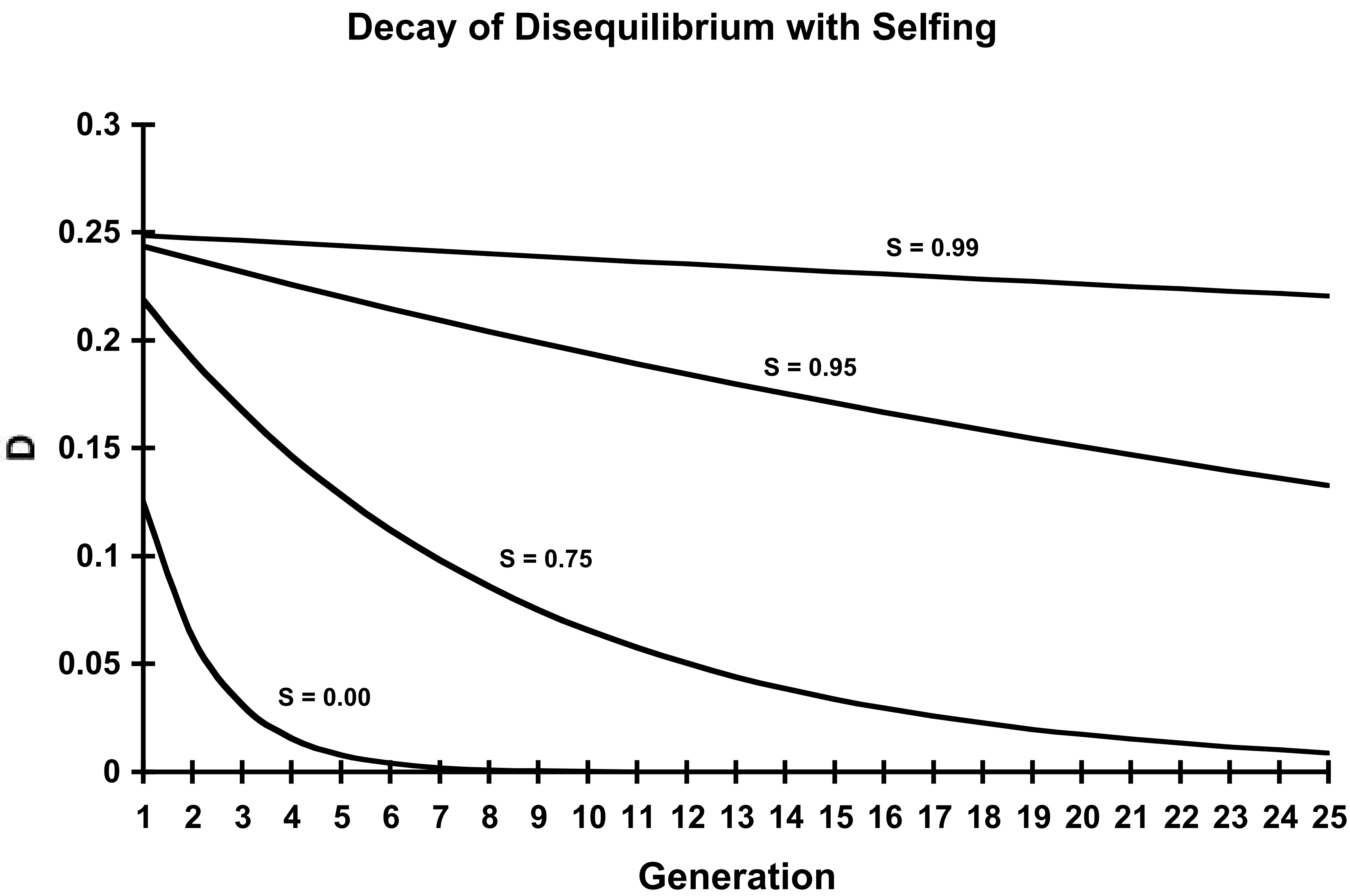
		Gamete Pool			
Genotype	Frequency	A_1B_1	A_1B_2	A_2B_1	A_2B_2
A_1B_1/A_1B_1	P_{11}^2	P_{11}^2	—	—	—
A_1B_1/A_1B_2	$2P_{11}P_{12}$	$P_{11}P_{12}$	$P_{11}P_{12}$	—	—
A_1B_2/A_1B_2	P_{12}^2	—	P_{12}^2	—	—
A_1B_1/A_2B_1	$2P_{11}P_{21}$	$P_{11}P_{21}$	—	$P_{11}P_{21}$	—
A_1B_1/A_2B_2	$2P_{11}P_{22}$	$(1-r)P_{11}P_{22}$	$rP_{11}P_{22}$	$rP_{11}P_{22}$	$(1-r)P_{11}P_{22}$
A_1B_2/A_2B_1	$2P_{12}P_{21}$	$rP_{12}P_{21}$	$(1-r)P_{12}P_{21}$	$(1-r)P_{12}P_{21}$	$rP_{12}P_{21}$
A_1B_2/A_2B_2	$2P_{12}P_{22}$	—	$P_{12}P_{22}$	—	$P_{12}P_{22}$
A_2B_1/A_2B_1	P_{21}^2	—	—	P_{21}^2	—
A_2B_1/A_2B_2	$2P_{21}P_{22}$	—	—	$P_{21}P_{22}$	$P_{21}P_{22}$
A_2B_2/A_2B_2	P_{22}^2	—	—	—	P_{22}^2
		P_{11}'	P_{12}'	P_{21}'	P_{22}'



$D_t = (1 - r)^t D_0$
$D_0 = 0.225$
$p_1 = q_1 = 0.5$
r=0.05
r=0.1
r=0.3
r=0.5
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
Linkage Disequilibrium, D
0
5
10
15
20
25
30
35
40
45
50
55
60
Generation

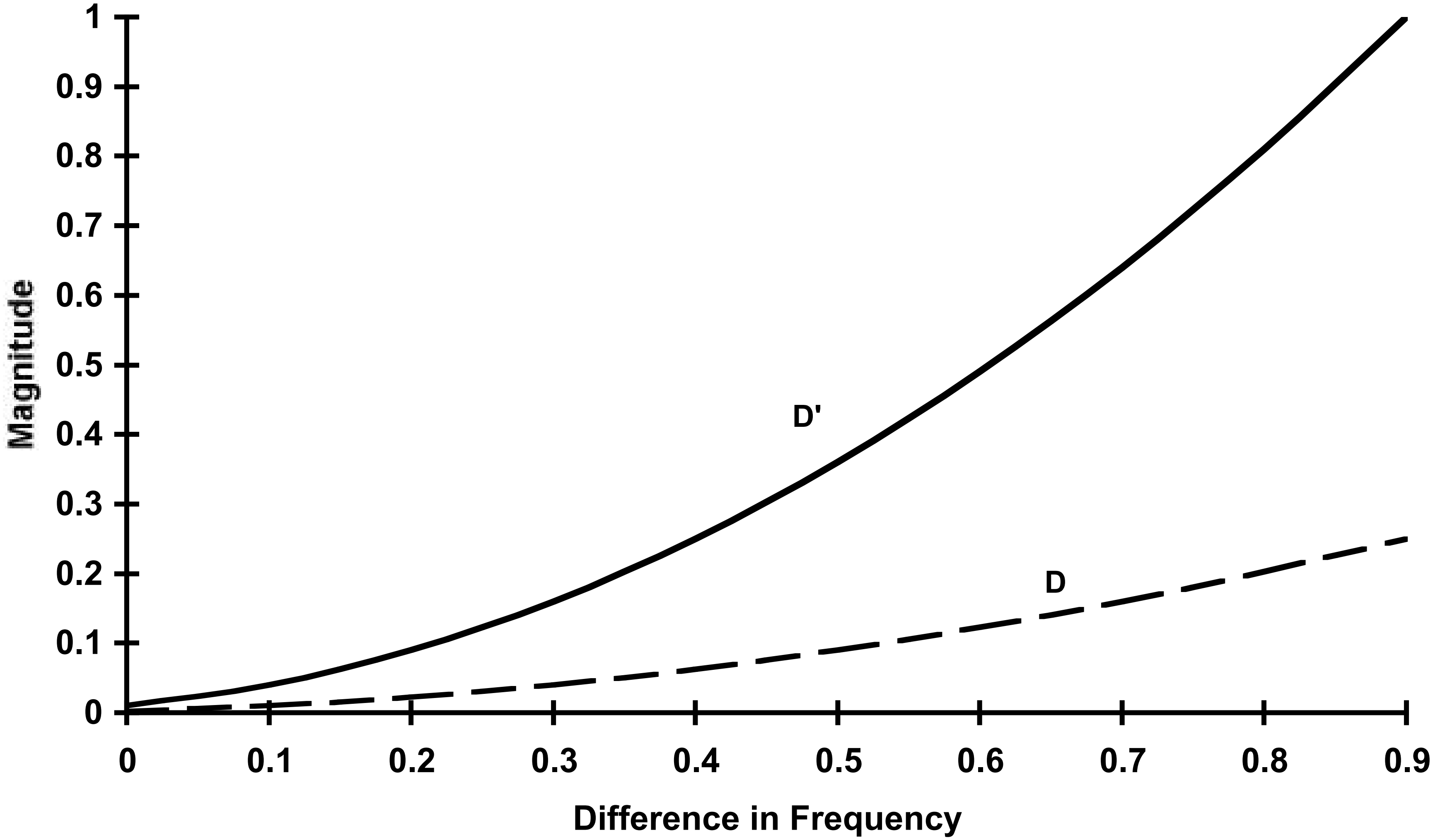
Gametic Disequilibrium Due to Mutation

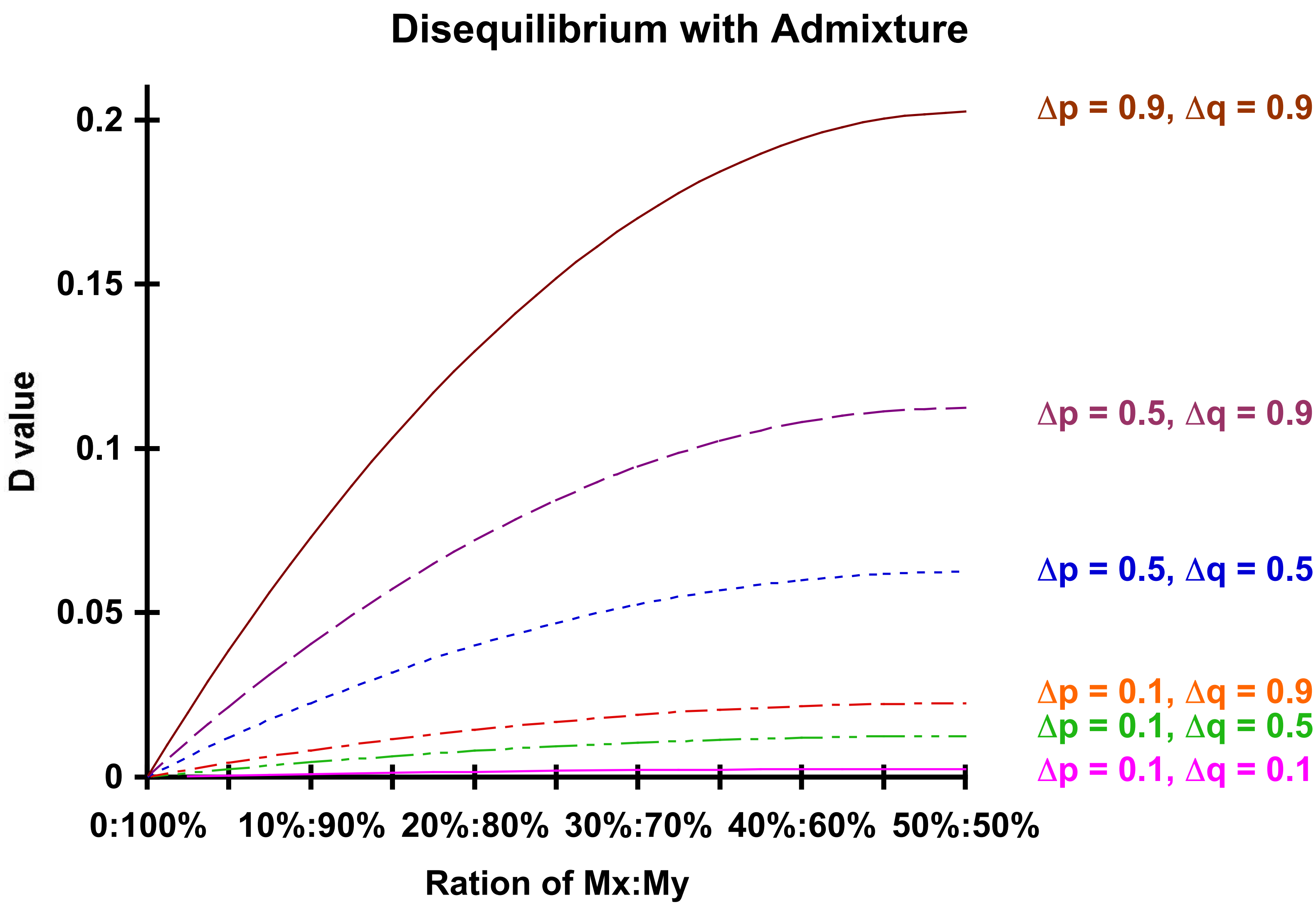
	Gametic Frequencies				
	A_1B_1	A_1B_2	A_2B_1	A_2B_2	D
Before mutation:	q_1	q_2	0.0	0.0	0.0
After Mutation:					
if with B_1	$q_1 - \frac{1}{2N}$	q_2	$\frac{1}{2N}$	0.0	$-\frac{q_2}{2N}$
if with B_2	q_1	$q_2 - \frac{1}{2N}$	0.0	$\frac{1}{2N}$	$\frac{q_1}{2N}$


Decay of Disequilibrium with Selfing
0.3
0.25
0.2
0.15
0.1
0.05
0
D
S = 0.99
S = 0.95
S = 0.75
S = 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Generation

Gene Flow and Disequilibrium

$m_x = m_y = 0.5$




Disequilibrium with Admixture
D value
0.2
0.15
0.1
0.05
0
0:100%
10%:90%
20%:80%
30%:70%
40%:60%
50%:50%
Ration of Mx:My
Δp = 0.9, Δq = 0.9
Δp = 0.5, Δq = 0.9
Δp = 0.5, Δq = 0.5
Δp = 0.1, Δq = 0.9
Δp = 0.1, Δq = 0.5
Δp = 0.1, Δq = 0.1

Linkage Disequilibrum
from Admixture

Gamete	Frequency	Population 1	Population 2	Mix
A_1B_1	P_{11}	0.0025	0.9025	0.4525
A_1B_2	P_{12}	0.0475	0.0475	0.0475
A_2B_1	P_{21}	0.0475	0.0475	0.0475
A_2B_2	P_{22}	0.9025	0.0025	0.4525
	D	0.0	0.0	0.2025
	D’	0.0	0.0	0.8100

$$D = P_{11}P_{22} - P_{12}P_{21}$$

$$D' = \frac{D}{D_{max}}$$

Cytonuclear Disequilibrium

			Nuclear locus	
Type	**Frequency**	A_1A_1	A_1A_2	A_2A_2
M_1	m_1	m_1p^2	m_12pq	m_1q^2
M_2	m_2	M_2p^2	M_22pq	M_2q^2
	1.0	p^2	$2pq$	q^2

Cytoplasmic Locus (rows M_1, M_2)

$D_1 = M_1A_1A_1 - m_1p^2$

$D_2 = M_1A_1A_2 - m_1\,2pq$

$D_3 = M_1A_2A_2 - m_1q^2$

Cytonuclear Disequilibrium

(from Lamb and Avise 1986)

	Type	Frequency	Nuclear locus A_cA_c	A_cA_g	A_gA_g
Cytoplasmic Locus	M_c	0.274	0.162	0.077	0.035
	M_g	0.725	0.141	0.380	0.204
		1.0	0.304	0.457	0.239

$D_1 = 0.162 - (0.274)(0.303) = 0.079$

$D_2 = 0.077 - (0.457)(0.274) = – 0.048$

$D_3 = 0.035 - (0.239)(0.274) = – 0.03$

From this we can say:

1) There is a cytonuclear disequilibrium (D values are nonzero)

2) The $M_cA_cA_c$ and $M_gA_gA_g$ types is in excess (D_1 is positive and D_3 is negative)

3) *Hyla cinera* males are mating with *H. gratiosa* females (i.e., D_2 is negative indicating too few $M_cA_cA_g$ types).