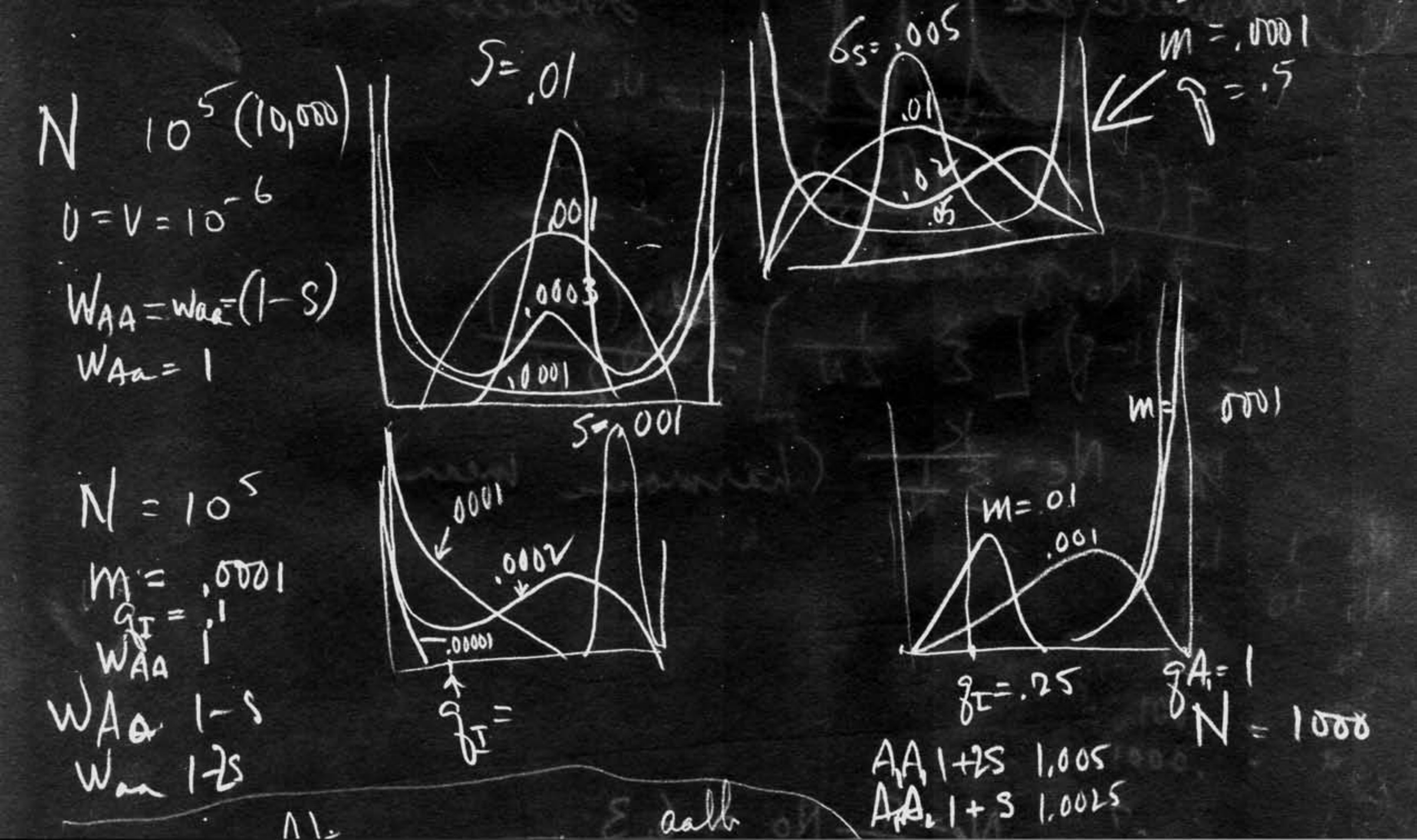

SEWALL WRIGHT TAUGHT ME

1. EVOLUTION

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LONDON
2007

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Euston Grove Press
44 Highgate Hill, London N19 5NQ United Kingdom
www.eustongrove.com

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British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

ISBN: 978-1-906267-02-5 (pbk)

38

Δq tends to approach 0 for all q

Random Fluctuations.

Negligible in a large random breeding population.

$\frac{1}{2N}$

Unique Processes

Fixation dependent on $\frac{1}{2N}$, rate of fixation / generation in population size N, ~~rate~~ steady state reached.

for small N use $\frac{1}{2N+1}$ (still an approx)

AA	$1+2s$	a selective advantage of s for a mutant
Aa	$1+s$	gene A may not insure fixation in a pop.
aa	1	fixed for aa. The random fluctuation

at the ends (0 or 1 freq) may tend to eliminate it.

chance of fixation here is about 2s irrespective of pop. size (Haldane) actually $\frac{2s}{e^{4ns}-1}$ (deleterious)

$\frac{2s}{1-e^{-4ns}}$ (advantageous)

$\frac{1}{2N}$ non advantageous & delet.

0 ——— 1

$q_A = 1$

$P = (1-2s)^{2NVt}$ ← /gen ← rate / representative (as used before)

(Probability of loss of all mut. at rate v during t

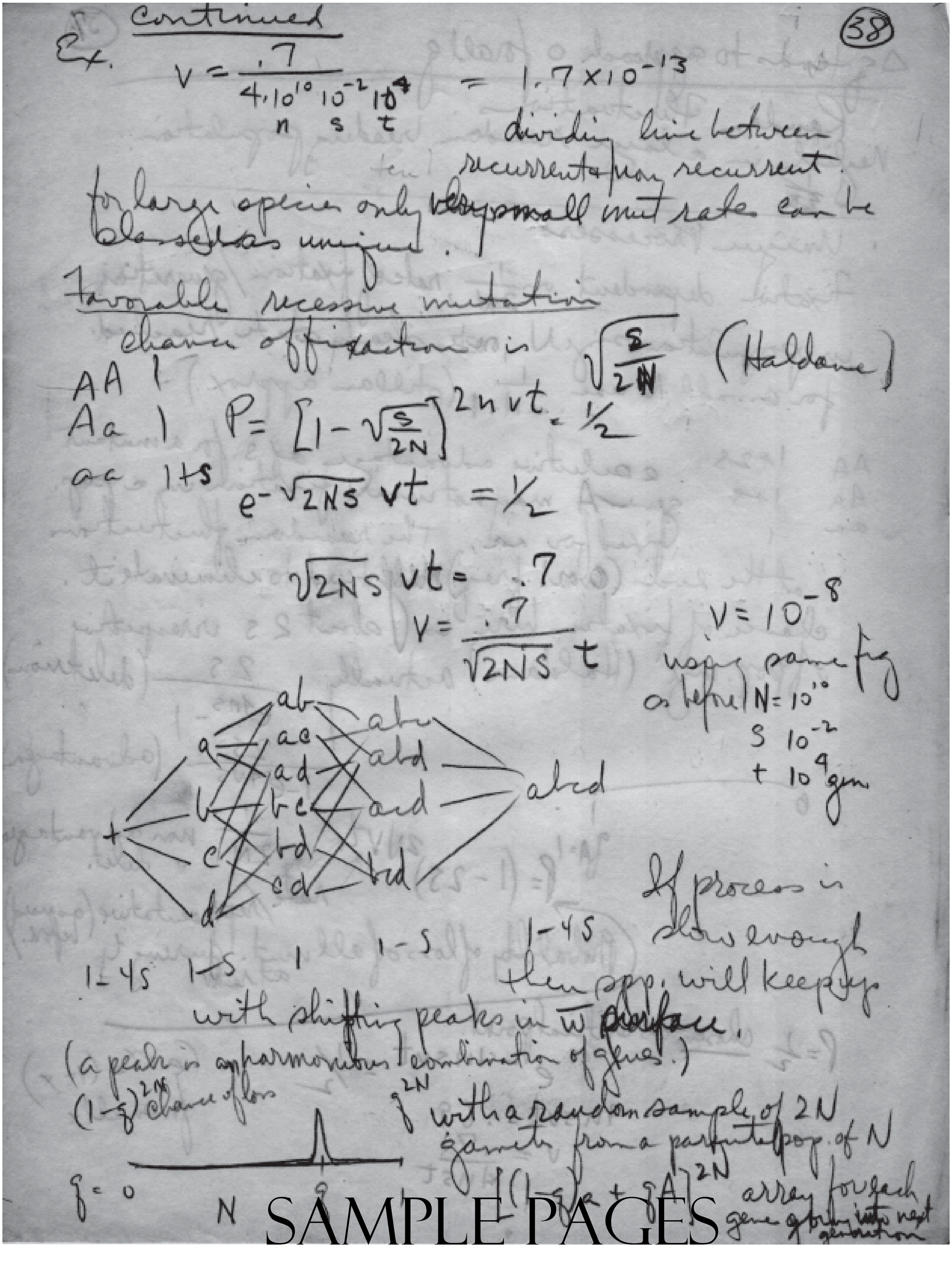
$P = \frac{1}{2}$ chosen as critical point.

$$e^{-4nsvt} = \tfrac{1}{2} \qquad (e^{-x} = (1-x) \text{ for small } x)$$

$$4nsvt = .69$$

$$v = \frac{.7}{4nst}$$

SAMPLE PAGES



Continued (38)

Ex. $V = \frac{.7}{4 \cdot 10^{10}\ 10^{-2}\ 10^{4}} = 1.7 \times 10^{-13}$

n s t

dividing line between recurrent & non recurrent.

for large species only very small mut rate can be classed as unique.

Favorable recessive mutation

chance of fixation is $\sqrt{\frac{s}{2N}}$ (Haldane)

AA 1

Aa 1 $P = \left[1 - \sqrt{\frac{s}{2N}}\right]^{2nvt} = \frac{1}{2}$

aa 1+s

$e^{-\sqrt{2Ns}\,vt} = \frac{1}{2}$

$\sqrt{2Ns}\,vt = .7$

$v = \frac{.7}{\sqrt{2Ns}\,t}$

$v = 10^{-8}$ using same fig as before

$N = 10^{10}$

$s\ 10^{-2}$

$t\ 10^{4}$ gen

+ a b c d ab ac ad bc bd cd abc abd acd bcd abcd

1-4s 1-s 1 1-s 1-4s

If process is slow enough then pop. will keep up with shifting peaks in $\overline{w}$ ~~surface~~.

(a peak is a harmonious combination of genes.)

$(1-q)^{2N}$ chance of loss

q = 0 N q

q^{2N} with a random sample of 2N gametes from a parental pop. of N

$[(1-q)a + qA]^{2N}$ array for each gene going into next generation

SAMPLE PAGES

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q of next generation is close to q of q

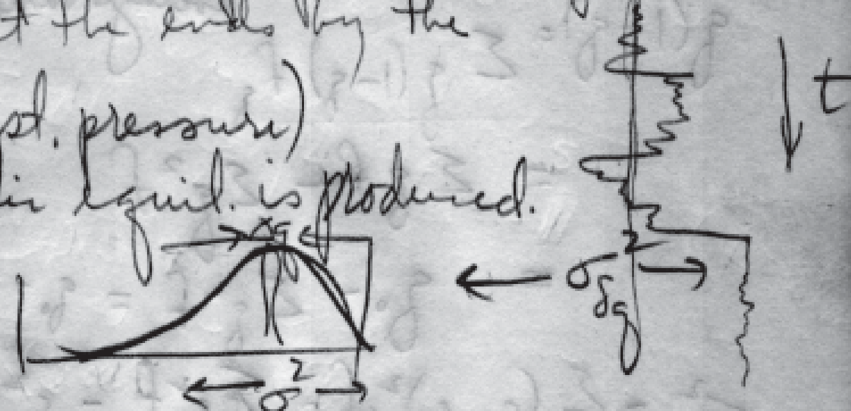
$\sigma^2_{\delta q} = \frac{q(1-q)}{2N}$ → Δq ←

array of possible population for 2nd generation

$\sigma^2_{\delta q_2} \cong \sigma^2_{\delta q_2} + \sigma^2_{\delta q_1}$ $\sigma^2_{\delta q_n} = n\sigma^2_{\delta q}$

variance of possible populations spreads out until damped at the ends by the

with a Δq (syst. pressure) added ~~a~~ dynamic equil. is produced.



Wednesday 25 July

$[(1-q)a + qA]^{2N}$ distribution of sample of gametes from pop of size N

# of gametes to form a zygote # of zygotes to maintain popn.

Prob. come out to be $(1-q)^{2N}a^{2N}$ + + probability of drawing 2N a's

$\sigma^2_{\delta q} = \frac{q(1-q)}{2N}$ ~~deviation~~ variance of q from the mean (mode ??)

the q of last generation

damping effect due to approach of q to 1 or 0

$\sigma^2_{\delta q_n} \neq$ but $\cong n\sigma^2_{\delta q}$ less so as ↗ occurs.

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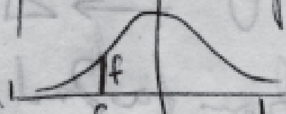
1 locus in 1 pop many gen. 40

same prob 1 many pop 1 1 gen

many 1 pop 1 gen.

Constant N for each pop.

distribution of q



q_0 initial gene freq $= \bar{q}$ nth generation

$$\sigma^2_{q_n} = \sigma^2_{q_{n-1}} + \frac{\overline{q(1-q)}}{2N}$$

average variance in late generation.

$$\overline{q(1-q)} = \sum q(1-q) f_q \qquad \boxed{\sum f = 1} \text{ assumpt.}$$

$$= \sum qf - \sum q^2 f$$

$$= \rightarrow q_0 - \sum q^2 f = q_0 - q_0^2 - \sigma^2_{q_{n-1}} = q_0(1-q_0) - \sigma^2_{q_{n-1}}$$

$$\left(\sum qf = q_0\right)$$

$$\sigma^2_{q_{n-1}} = \sum (q-q_0)^2 f = \sum q^2 f - q_0^2$$

$$\sum q^2 f = \sigma^2_{q_{n-1}} + q_0^2$$

$$\sigma^2_{q_n} = \sigma^2_{q_{n-1}} + \frac{1}{2N}\left[q_0(1-q_0) - \sigma^2_{q_{n-1}}\right]$$

$$= \sigma^2_{q_{n-1}}\left(1-\frac{1}{2N}\right) + \frac{1}{2N} q_0(1-q_0)$$

$$\sigma^2_{q_1} = \frac{1}{2N} q_0(1-q_0) = q_0(1-q_0)\left[1-\left(1-\frac{1}{2N}\right)\right]$$

$$\sigma^2_{q_2} = \frac{1}{2N} q_0(1-q_0)\left(1-\frac{1}{2N}\right) + \frac{1}{2N} q_0(1-q_0)$$

$$= q_0(1-q_0)\left[\frac{2}{2N} - \left(\frac{1}{2N}\right)^2\right] = q_0(1-q_0)\left[1-\left(1-\frac{1}{2N}\right)^2\right]$$

SAMPLE PAGES

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