Reconstructing DNA replication kinetics from small DNA fragments

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I r r , DNA r *in vitro* r
DNA r . Fr r
r r r ,
DNA r r , r r DNA r . r
, r , DNA r r ,
r r r . H r , r

, [13]. T

. H r , r r . r
r - .

B. Distribution of edge domains

T , r r . , r
r x' . T r
r . r r
x x'. I r x' ,
r r : x' 1, r .
x'.
r r . DNA, r .
, r x $2/x'$. T
r 2 r , r *two* . T ,
r . , r , r
x $(2/x')$ $x'=2$.

I , r x' r r 1
. T r . r
x r r r , 2,
r . F ,
r x r
$x'>x$. T r r ,
r x:

$$n_e(x) = 2\int_x^\infty (x')dx'. \quad (3)$$

N r E . (3) r . r .
$_e(x)$.

T r r r r .
$_f(\ell)$, . II A, E . (3)
$_f(\ell)$ r r ℓ. A , r r x
x. T ,

$$n_e'(x) = 2\int_x^\infty {}_f(\ell)d\ell\int_x^\infty (x')dx', \quad (4)$$

r $'_e(x)$ r r $n_e'(x)$.

C. Distribution of oversized domains

T r r . r
r r
r . T , r r -
, r ,
r r r r r
(F . 3).

A r - , - r r

FIG. 3. A r r -
. ( ) r ; ( ) r r . ( ) ( )
r r r . r r -
. r r
.

$$n_o'(x) = {}_f(x)\int_x^\infty (x' \quad x) (x')dx'. \quad (5)$$

E (5) r r E . (2) r
$_f()$ $()$ r r r
ℓ' x'. T r - ,
$_f$ δ , r L. T

$$n_o(x) = \delta(x \quad 1)\int_1^\infty (x' \quad 1) (x')dx'. \quad (6)$$

A r . (x) -
DNA r r r -
r . DNA. T I r
r r r
r - r - .

D. Example

F , r r (F . 4).
L r r . r 0
100 , DNA r r
r . 50 150 . T $x=X/100$,
r r- r r

$$n_i(x) = \begin{cases} 1 \quad x, & 0 \quad x \quad 0.5, \\ (9/8) \quad (3/2)x + (1/2)x^2, & 0.5 < x \quad 1; \end{cases} \quad (7)$$

TABLE I. r r r r .
r r . , r . r - r - . T 1 r x
<1 0 r $x>1$.

	Fr r .	
	r - r	G r - r
I r r	$n_i(x)=(x)(1 \quad x)(1 \quad x)$	$n_i'(x)=(x)\int_x^\infty(\ell \quad x)\ {}_f(\ell)d\ell$
E	$n_e(x)=2(1 \quad x)\int_x^\infty(x')dx'$	$n_e'(x)=2\int_x^\infty {}_f(\ell)d\ell\int_x^\infty(x')dx'$
r	$n_o(x)=\delta(x \quad 1)\int_1^\infty(x' \quad 1)(x')dx'$	$n_o'(x)={}_f(x)\int_x^\infty(x' \quad x)(x')dx'$

$$n_e(x) = \begin{cases} 2(1 \quad x), & 0 \quad x \quad 0.5, \\ 2[(3/2) \quad x](1 \quad x), & 0.5 < x \quad 1; \end{cases} \tag{8}$$

$$n_o(x) = \begin{cases} 0, & 0 \quad x \quad 0.5, \\ (1/2) \quad x + (1/2)x^2, & 0.5 < x \quad 1. \end{cases} \tag{9}$$

T n_i, n_e, n_o $x > 1$. M [13].

III. UNBIASED ESTIMATORS OF AVERAGE DOMAIN SIZES

I . II DNA : , . , (x). I , : $n_i(x)$, $n_e(x)$, $n_o(x)$, (x)? I , E . (2), $f(\ell)$ $n_i(x)$ (x); , (x) [13]. I , , DNA . T $\langle x \rangle \equiv \int_0^\infty x' \ (x')dx'$. I , . I , *interior* : $\overline{x}_i \equiv \Sigma_{j=1}^{n}(x_i)_j/n$, $(x_i)_j$ j *interior*

$$x_i^{tot} = \int_0^1 x\ \ (x)dx \quad \int_0^1 x^2\ \ (x)dx,$$

$$x_e^{tot} = \int_1^\infty \ (x)dx + \int_0^1 x^2\ \ (x)dx. \qquad (12)$$

B , x_o^{tot} $= n_o$, E . (10). $x_i^{tot} + x_e^{tot} + x_o^{tot}$ $= \langle x \rangle$. I ,

$$\bar{x}_2 = \frac{\bar{X}_2}{L} = \frac{X_i^{tot} + X_e^{tot} + X_o^{tot}}{N_i + N_e/2}, \qquad (13)$$

X_i^{tot} , X_e^{tot} X_o^{tot}. I , , , , . D $(N_i + N_e/2)$ -

A , L

$\langle L \rangle$ E . (13) 91 .T 96 52 06.981 . II C,

x_i^{tot} =71/3836270.333 915 11971 = 915 11971 = 11971 = 11971 , 1 139 .-356II-250C,-356 7584

DNA’ -
. A
. I ,

. A -
- -
[10].

DNA
,

$$= \int_0^\infty dx\, x\ (x)\int_x^\infty d\ell\ \ {}_f(\ell) + \int_0^\infty dx\ \ (x)\int_0^x d\ell\ \ell\ \ {}_f(\ell), \tag{A4}$$

ɾ ɾ ɾ , $\int_0^\infty dx\ \ (x) = 1$.
A ɾ ɾ E . (A4) ɾ , E . (A1) (A4)

$$n_i' + n_e'/2 = \int_0^\infty dx\ \ (x)\left[\int_0^x d\ell\ \ell\ \ {}_f(\ell) + \int_x^\infty d\ell\ \ell\ \ {}_f(\ell)\right]$$

$$= \int_0^\infty dx\ \ (x) = 1, \tag{A5}$$

$\langle \ell \rangle = 1$ ɾ .
, ɾ ɾ E . (5) ɾ ɾ
ɾ

$$n_o' = \int_0^\infty d\ell\ \ {}_f(\ell)\int_\ell^\infty dx\, x\ (x)\quad \int_0^\infty d\ell\ \ell\ \ {}_f(\ell)\int_\ell^\infty dx\ \ (x) \tag{A6}$$

$$= \int_0^\infty dx\, x\ (x)\int_0^x d\ell\ \ {}_f(\ell)\quad \int_0^\infty dx\ \ (x)\int_0^x d\ell\ell\ \ {}_f(\ell). \tag{A7}$$

T

$n_o' + n_e'$