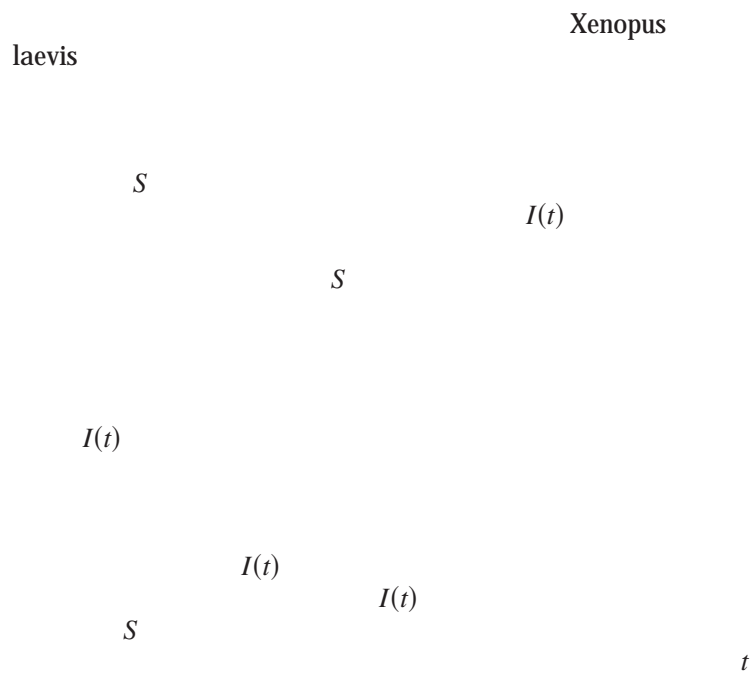


Control of DNA Replication by Anomalous Reaction-Diffusion Kinetics

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Xenopus

—



Δ

$f(t)$

$$f(t) = 1 - S(t) = 1 - e^{-2vh(t)},$$

$I(t)$ v

Diffusion-based search.—

$I(t)$

S

Xenopus

S

S

$G1$

one one

t_r

$(t_s + t_r)$

t_r

N_s

$$I(t) = \frac{N_s(t)}{L[1 - f(t)][t_s(t) + t_r]} = \frac{N_s(t)e^{2vh(t)}}{L[t_s(t) + t_r]}$$

$f(t)$

$$N_s = N_s(t)$$

S

κ_s

$$N_s(t) = \kappa_s t$$

$$\begin{aligned} \frac{I(t)}{v/L^2} &= \frac{\frac{L}{v} \kappa_s t e^{2vh(t)}}{(\frac{\ell_0}{\lambda})^{1/\alpha} [2e^{2vh(t)} - 1]^{1/\alpha} \tau + t_r} \\ &= \frac{I_0 t e^{2vh(t)}}{\mathcal{T}_0 [2e^{2vh(t)} - 1]^{1/\alpha} + 1} = \frac{I(t)}{\mathcal{T}(t) + 1} \end{aligned}$$

L

$$\begin{aligned} v & \alpha I_0 = \kappa_s L / v t_r & \mathcal{T}_0 &= (\ell_0 / \lambda)^{1/\alpha} \times \\ (\tau / t_r) & \frac{I(t)}{\mathcal{T}(t)} & & \\ & t_s(t) / t_r & & I(t) \end{aligned}$$

$$\begin{aligned} \mathcal{T}(t) \ll 1 & & I(t) &= d^2 h(t) / dt^2 \\ h(t) & & h(0) &= \dot{h}(0) = 0 \end{aligned}$$

$t \rightarrow \infty$

$$\begin{aligned} I(t) \sim \exp[2vh(t)(1 - 1/\alpha)] & & I \geq 0 & \\ h > 0 & & I \rightarrow 0 & \\ & & \alpha < 1 & \\ & & I \rightarrow & \\ 0 & & & \end{aligned}$$

$I(t)$ S

et al. 277
 et al. 320
 12
 275
 et al. 300
 et al. 3

1

both

71
 71

73

98

117

$\alpha \approx 1/2$

$\alpha \approx 2/3$

112

94

36

$I(t)$

et al. 96
 32

95

96

93

S

in vitro

v

et al. 87

37

$I(t)$ $N_s(t)$

12
 195
 1

$\kappa_s - \gamma N_s(t)$ γ
 κ_s/γ

$\dot{N}_s(t) =$
 $N_s \rightarrow$
 S

κ_s

1 $L = 3.07 \times 10^6$ kb $v = 0.6$ kb/min $L/(vt_{\text{rep}}) \gg$
 $\mathcal{O}(10^5)$ t_{rep} $L/(vt_{\text{rep}}) =$

21

78

et al.

316

Principles of Nuclear Structure and Function

92

6

279

38

59