

Nucleosome positioning

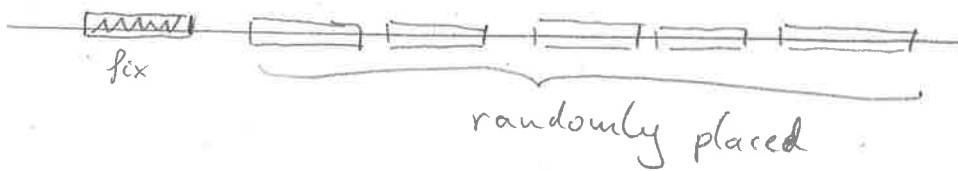
①

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Statistical positioning of nucleosomes

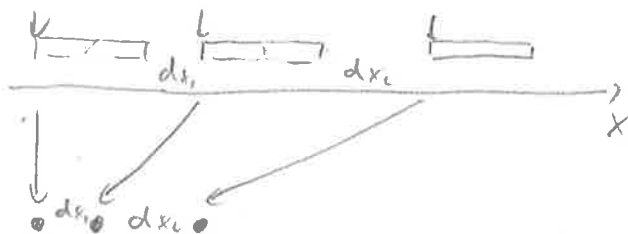
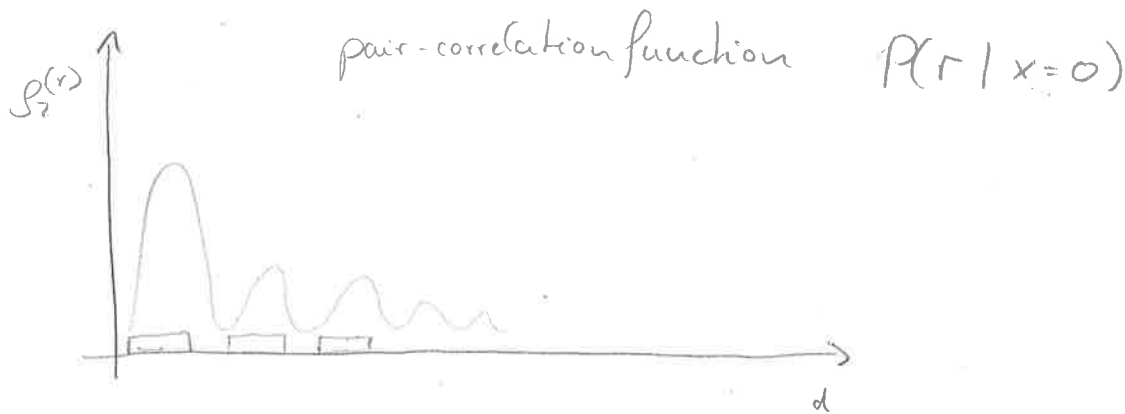
- not every nucleosome needs to be explicitly placed
- "barrier nucleosome model"
- "nucleosome free regions"

simple model: gas of non-interacting particles of width b



⇒ what kind of pattern should we expect?

is there evidence that there is positioning beyond this?



remove width of nucleosomes

→ gas of points

→ simple statistics

- non-interacting points \Rightarrow randomly placed with density ρ
- distribution of distance between $\frac{1}{\rho} e^{-\rho r}$
- Points are distributed as a Poisson point process with density ρ . The probability of an empty seg of length r is $e^{-\rho r}$
- express the 2-point function as

$$g_2(r) = \sum_{k=1}^{\infty} P_k(r) \quad \text{with } P_k(r) \text{ being the distribution of the } k\text{th nucleosome}$$

$$P_1(r) = \rho e^{-\rho r}$$

$$P_2(r) = \int_0^r dr_1 \rho^2 e^{-\rho r_1} e^{-\rho(r-r_1)} = \rho^2 e^{-\rho r} \int_0^r dr_1 = \rho^2 r e^{-\rho r}$$

$$P_3(r) = \int_0^r dr_1 \int_0^{r-r_1} dr_2 \rho^3 e^{-\rho r_1} e^{-\rho r_2} e^{-\rho(r-r_1-r_2)} = \rho^3 e^{-\rho r} \frac{r^2}{2}$$

$$P_k(r) = \rho^k \frac{r^{k-1}}{(k-1)!} e^{-\rho r}$$

\rightarrow put back the extra blocks

$$g_k(r) = P_k(r - kb) \Theta(r - kb)$$

$$g(r) = \sum_k g_k(r)$$

• at very large distances

$$g(r) = \rho e^{-\rho g} \sum_{h=0}^{\infty} \frac{r^h \rho^h}{h!} = \rho$$

• at short distances, only a few terms contribute

• model quantitatively describes data