Interaktionen von RNAs und Proteinen

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DNA-DNA Interactions: Nuclear Organization

A. Interphase nucleus

- chromosome territory
- euchromatin
- heterochromatin
- nuclear pore
- nucleoli

B. Prometaphase nucleus

- chromosome
- nuclear membrane
Nuclear Bodies Associated and Their Function

- Nucleolus
  - rDNA
  - Pol I
  - Interaktionen von RNAs und Proteinen
  - Pol I Transcription
  - Post-Translational Modifications

- Cajal Body
  - Pre-snRNA
  - snRNP Biogenesis
  - 5' -> 3'

- Nuclear Speckle
  - Exon
  - RNA Splicing
  - Unknown Function

- Nuclear Stress Body
  - Stress
  - HS Gene
  - Set III DNA
  - Pol II
  - Stress Response

- Gemini of Cajal Body
  - SMN Complex
  - Unknown Function

- Histone Locus Body
  - Histone pre-mRNA
  - 5' -> HCC -> 3'
  - Histone Gene Synthesis

- Transcription Factory
  - Gene
  - RNA Pol
  - Transcription
  - Chromosome Territories
  - Nuclear Lamina
  - Nuclear Pore Complex

- Paraspeckle
  - 5'
  - A to I Edited RNA
Organization of Nuclear Bodies by Long Noncoding RNAs

arcRNAs: architectural long noncoding RNAs

- nascent arcRNA serve as scaffold for RNA binding proteins
- results in strong local enrichment of specific factors
Chromosome Territories
Attachment of Chromatin to Nuclear Membrane

- S/MARs: Scaffold/Membrane attachment regions
A Special Territory: X Chromosome Inactivation

- problem: dosage compensation
- default state inactivation of X, Cix responsible for counting
- random X-inactivation $X_i$ (inactive), $X_a$ (active)
- IncRNA $\text{Xist}$ (X-inactive specific transcript) expressed from inactive X chromosome is responsible for silencing the X in cis $\rightarrow X_i$ (inactive)
- IncRNA $\text{Tsix}$ (antisense of Xist) expressed from active X chromosome is responsible for silencing Xist (in cis $\rightarrow X_a$ (active)
The Xist Gene Locus on Chromosome X

- **Xist**: X-inactivation specific transcript
- **Tsix**: antisense of Xist
- **Tsx**: testis-specific X-linked gene
- **Xite**: X-inactivation intergenic transcription element
- **RepA**
- **Jpx**, also known as Enox (Expressed Neighbor of Xist)
Measuring Chromatin Interactions

Chromosome Conformation Capture Hi-C

Crosslink DNA
Cut with restriction enzyme
Fill ends and mark with biotin
Ligate
Purify and shear DNA; pull down biotin
Sequence using paired-ends
Topologically Associated Domains (TADs)

Structure of TADs

-Inactive TAD 1
-Active TAD
-Inactive TAD 2

Subdomains

Boundary Interactions
CTCF motifs
H3K36me3
H3K27me3
Interactions
Enhancers
Genes

Current Opinion in Genetics & Development
Topologically Associated Domains (TADs)

Functional/Regulatory Relevance