5.3 Eukaryotic MicroRNA and RNAi

Eukaryotic Cell

Chromosomes (46 in humans)

Translation

Nucleus

RNA Modifications + Export

Cytoplasm

Human Genome: 2 x 22 + 2 = 46 Chromosomes (diploid)

Length (haploid): ~ $3 \times 10^9$ bp

# Genes: ~ 20-25K (coverage ~ 2%), lid 98% transcribed

(For comparison: E.coli: genome 1 circular genome, 1.6 x 10^6 bp,
~ 4400 genes, ~ 95% coverage)

Three RNA Polymerases

POL I: rRNA Transcription

POL II: mRNA, miRNA

POL III: tRNA, 5S Small RNA

Gene Structure

Promoter + Regulatory Region

Inteons | Exons

Primary RNA Transcript

5' Capping

Splicing
3' Polyadenylation

cMP

UFOREXPOZT (Exons Only!)

Translation
CAP: 5' to 5' TRIPHOSPHATE BRIDGE  G-ADA-CH$_3$

SPLICING REMOVES INTRON SEQUENCES (SPlicOSOME)
RNA-PROCESSING ENZYMES GENERATE 3' END

MICRORNA BIOGENESIS

MICRORNA ARE TRANSCRIBED FROM POLII PROMOTERS (CAP+polyA)
~1000 miRNA
~ INDEPENDENT GEN TRANSCRIPTIONAL UNITS OR INTRONS TO PROTEIN CODING GENES

BASIC CASE

\[ \text{miRNA GENE} \]
\[ \downarrow \text{TRANSCRIPTION} \]

\[ \text{IMPERFECT STEM} \]
\[ \text{AAA} \]

\[ \text{PRIMARY miRNA} \]

PRIMARY miRNA: NON-CODING BUT SIMILAR TO mRNA CONTAINS IMPERFECT HAIRPIN
ii) **Hairpin Cleavage by Drosha/Dgcr8**

![Diagram of hairpin cleavage by Drosha/Dgcr8]

**Drosha**: Endonuclease  
**Dgcr8**: RNA Binding

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Hairpin Cleavage
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~20bp
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Pre-miRNA

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iii) **Pre-miRNA Export**

![Diagram of pre-miRNA export]

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Export by Exportins
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iv) **Dicer Cleavage**

![Diagram of Dicer cleavage]

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Dicer: dsRNA Endonuclease
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```
~20bp
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Dicer Cleavage