Topic C
Dynamic DNA - Mobile DNA

Simple sequences (minisatellite)
Unique DNA (<5% in eukaryotes)
Gene family (globin)
Tandem genes (rRNA..)

9.3 Mobile DNA moderately repeated

Mostly in Eukaryotes
Process of moving - Transposition
“molecular parasites” Selfish DNA
Very slow process for elimination
9.3 Mobile DNA

First found in corn (1940, B. MaClintock)
Weak similarity to bacterial elements

Transposition is in 2 modes:
DNA only
RNA intermediate

9.3 The two classes of mobile elements

![Diagram showing the two classes of mobile elements]

Figure 9-10
9.3 Mobile elements may move as DNA or RNA

**Table 9.3: Major Types of Mobile DNA Elements**

<table>
<thead>
<tr>
<th>Type</th>
<th>Structural Features</th>
<th>Mechanism of Movement</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DNA-MEDIATED TRANSPORT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacterial insertion sequences (IS elements)</td>
<td>50-bp inverted repeats flanking region encoding transposase and, in some, restriction</td>
<td>Excision or copying of DNA and its insertion at target site</td>
<td>IS2, IS10</td>
</tr>
<tr>
<td>Bacterial transposons</td>
<td>Central antibiotic-resistance gene flanked by IS elements</td>
<td>Coping of DNA and its insertion at target site</td>
<td>Tn9</td>
</tr>
<tr>
<td>Eukaryotic transposons</td>
<td>Inverted repeats flanking coding region with introns</td>
<td>Excision of DNA and its insertion at target site</td>
<td>F elements (Drosophila) A and Ds elements (corn)</td>
</tr>
<tr>
<td><strong>RNA-MEDIATED TRANSPORT</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Viral retrotransposons</td>
<td>≤240- to 690-bp direct terminal repeats (LTRs) flanking region encoding reverse transcriptase, integration, and retroviral-like gag protein</td>
<td>Transcription into RNA from promoter in left LTR by RNA polymerase II followed by reverse transcription and insertion at target site</td>
<td>Ty elements (yeast) Copia elements (Drosophila)</td>
</tr>
<tr>
<td>Nonviral retrotransposons</td>
<td>Of variable length with a 3' A/T-rich region; full-length copy encodes a reverse transcriptase</td>
<td>Transcription into RNA from internal promoter; folding of transcript to provide primer for reverse transcription followed by insertion at target site</td>
<td>F and G elements (Drosophila) LINE and SINE elements (mammals) Alu sequences (humans)</td>
</tr>
</tbody>
</table>

9.3 General structure of bacterial IS elements

![IS element diagram](image)

Transposase: excision and insertion
20 types in E. coli, seen in heteroduplex view

Figure 9-11
9.3 General structure of bacterial IS elements

Frequency of transposition:
1/1000-1/10000 per generation
In specific site - $10^{-5}$ - $10^{-7}$
Reversion $10^{-6}$ - $10^{-10}$

Transposition is random site
In lysogenic virus - insertion to new cell
9.3 General structure of bacterial transposons

Transposon (2600 bp)

3' ← 750 bp - 1100 bp - 750 bp → 3'

IS1 Chloramphenicol-resistance gene IS1 5-bp direct repeat

Target selection
- random
- hotspots
- AAAATT
- hotspots
- NGCTAGCN
- hotspots
- random

Overall length
- IS1: 9 bp
- IS2: 11 bp
- IS4: 13 bp
- IS5: 16 bp
- IS5R: 16 bp
- IS6R: 8 bp
- IS6S: 8 bp

Target site
- ATGCA
- TACGT

Host DNA: 123456789
Transposase gene: 087654321

Figure 9-13

Figure 15.1 Overview: transposons have inverted terminal repeats and generate direct repeats of flanking DNA at the target site. In this example, the target is a 5 bp sequence. The ends of the transposon consist of inverted repeats of 9 bp, where the numbers 1 through 6 indicate a sequence of base pairs.
**Transposon - bacterial**

9.3 bacterial transposons - valuable tools

Easily selected (antibiotic resistant)
Act as a one site mutagen
Can be inserted into plasmid, viral etc
9.3 Eukaryotic transposons - valuable tools

In corn
In fly
(50% of spontaneous mutation are mobile DNA)

Drosophila - P element, non replicative mechanism
mode to introduce mutations

Figure 9-13

Transposon - Creating a new one
See you in few weeks….

Enjoy