

Transposable Elements Activity

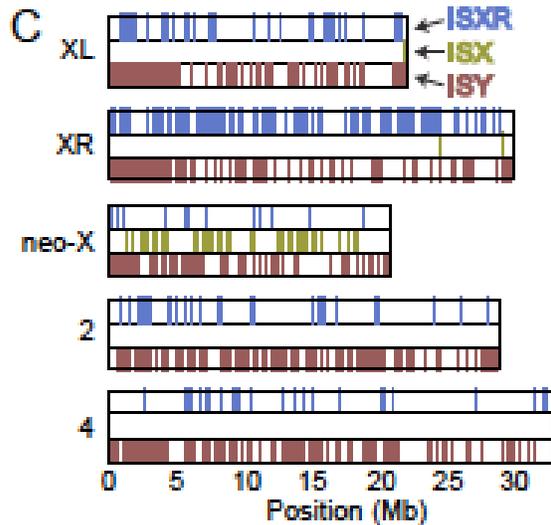
Drosophila miranda is a fruit fly species that is of interest to geneticists, since it contains three X chromosomes (more on that later in the class), which formed at different time points in the past. XL is an old X chromosome (over 60 million years old), XR is younger (15 MY old), and the neo-X is a very young X chromosomes (1 MY old). You analyze the genome of this species, and identify the following transposable element.

Use rebase to find out some information on this TE (<http://www.girinst.org/rebase/>).

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TCCTAAGGAAAAACGAGGGGGAACGTTGTGAGTTGCTGCGGAGACCGCAACTCTACAGTTATACCCGATACTAAGTCAGTATGGCTCTC
CTCCGGCAGACGCGCTAATATTAACGACACGACAAAAGAGAGAGACAGAAAAATCAGTCTGAGCGTGACGTCGGGTGCTGCCGTAGCCAG
TGCAAATGATTGTTTCTTTGGCTATAAAAATGATCTGATCTGATCCAGATTTCAGCAATCTGATATATATGATCATTATCTATGATT
CTGCGTTTTTAGTTTTCTCGTATCCTCAATATTTGGATGCAACAGATTTTCGTCCTTTGTGGGGCGGAAGGGGGTGGGGCGAAATTT
TGAGATATACGTTTTATAGTGAGATCTAACAGGAGTGGGATACTCTACTGGTTACTCTAGCCTTAATAGTCTCTGAGATTTGTGAATA
TCCCAGATTTTCATCCTTTGCGGGGGCGGAAGGGGGTGTGGGAAATTTGAAACAACTCGTCTCGGTCCGATATATTAGGAGTGTG
GATACCAAATTTGGTTGCTCTAGCTTTTGTAGTCTCTGAGATCTAGGCGCTAATGTTTTACTCTAAGCAAAGCCGGCTATGCTACGTGT
GTGTTAGAGAGAGACAGGGCGAGAAAAATGAAATTTGTTTTCTGATCTGGCTATAATAATTATACGATCTGGTTCAGATTTTGCACCT
CAAGAAGATATAGTCATCTTCTACGATTCTGCGTTTTTAGTTTTCTCGTATCGTCGAAATTTGTGGATGCCACAGATTTTCGCCCTTTGT
GGGACGATGTGGGCGGGCAAAGTTTTGAAATATTCTTTGATAGCAGTGACATATCACAGAAGTCTGGATCCAAAACATCGTTGCTCTA
GCTCTTATAGTCTTTGAGCACTAGGCGCTGAAGGGGACGGACAGACGGACGGACAGACAGACATGGCTCAATCGACT
CGGCTATTGATGCTGATCAAGAATATATGTATATACTTTATGGGGTCGGAACGATTTCCTTTTGGACGTTACACACATCCACTTTTACC
ACAAATCTAATATACCAAATACTCATTTTGTAGTATCGGGTATAA
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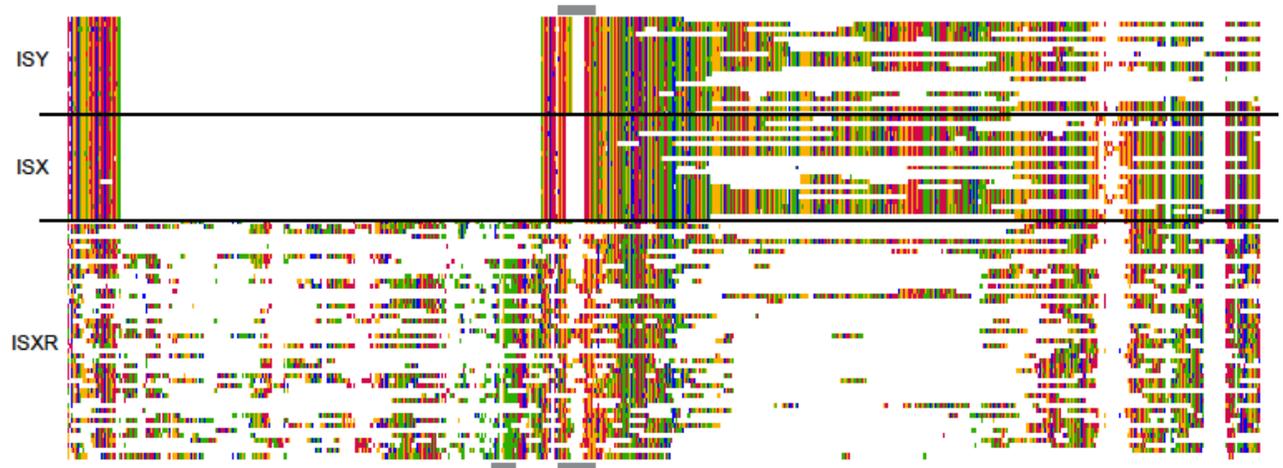
What type of transposon is it?
 What is unusual about that class of TEs?

You investigate the genomic distribution of this transposable element (which you named ISX), and that of two related transposons (ISY and ISXR). Each line represents an occurrence of a particular TE across the genome of *D. miranda*, for the 5 chromosomes of this species (the three X chromosomes, XL, XR, and the neo-X; and the two autosomes, chromosome 2 and chromosome 4).



Comment on the distribution of each transposon across the genome.
 What is unusual about the genomic distribution of ISX and ISXR?
 Can you provide any potential explanation for the observed distribution?

You perform an alignment of the three different transposable elements. Each base (A, G, T, C) is represented by a different color.



How can this alignment be used to make inferences on the age of the transposable element invasion?
 Which element is the oldest, and why?

Inspired by your findings, you more closely inspect your transposable elements and discover that the ISX element harbors a 10-bp deletion that creates a binding site for the dosage compensation complex in *Drosophila* (the P-values below show a computed probability score of how good a binding site for the dosage compensation complex a specific sequence is). ISXR turns out to similarly show a binding site for the dosage compensation complex.

		$P = 8.54 \times 10^{-7}$
ISY	CGACACGACAAGGAGTGCGTGCAGAGAGACAGAAAATCAG	
ISX	CGACACGACAAAG - - - - - AGAGAGACAGAAAATCAG	
	$P = 8.35 \times 10^{-10}$	

Can you come up with an evolutionary scenario for the observed genomic and age distribution of the ISX and ISXR element?
 Can you think of experiments on how to test your hypothesis?

