Transposons (Ac-Ds system)

- Transposable elements were discovered by Barbara McClintock through an analysis of genetic instability in maize.
- She discovered a phenomenon of genetic instability which was recognizable by the appearance of a spotted phenotype in a somatic cell tissue by using the 'breakage–fusion–bridge' strains to map genes.
- She identified two loci-*Dissociator* (*Ds*) and *Activator* (*Ac*), which change positions on the chromosome.
- She observed frequent chromosome break occurring at the *Ds* locus on chromosome-9 in *Ac* dependent manner.
- *Ds* element could move in the genome even to different chromosomes. Or the *Ds* locus seemed to regulate the expression of neighbouring genes.
- The change in position of the *Ds* element correlated with the expression of the *C* gene, and resulted in variegation of the kernel colour.
- *Ac* and *Ds* were 'controlling elements' that regulated the expression of other genes.

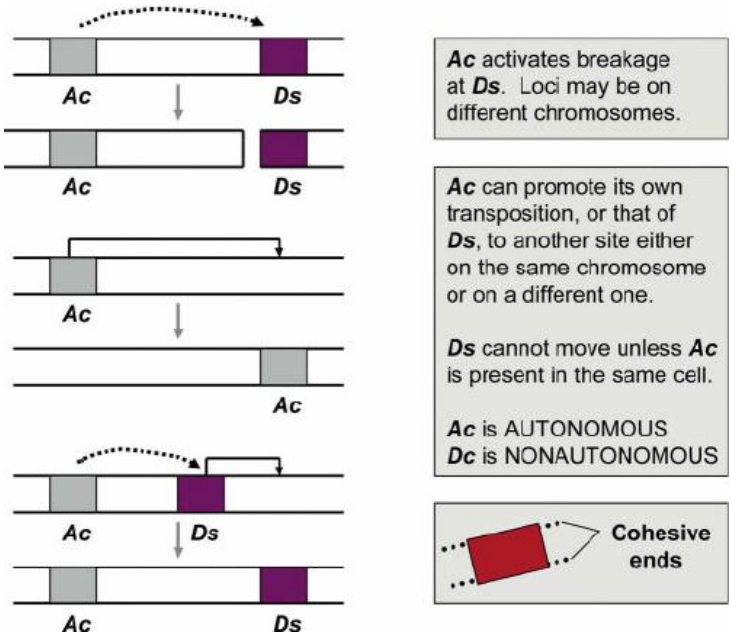
Transposable elements are repetitive genomic sequences that are able to move or transpose from one chromosomal location to another. These mobile elements have been variously called jumping genes, mobile elements, insertion sequences and transposons. The term transposon was coined by Hedges and Jacob in 1974 for a DNA segment which could move from one DNA molecule to other and usually disrupts genetic function.

Transposable Elements in Maize

The transposable elements in maize were discovered by Marcus Rhoades and Barbara McClintock. These genetic elements in maize were found to be responsible for turning the expression of genes 'on' or 'off' hence the name 'controlling elements'. These controlling elements when located on maize chromosomes represented specific sites for breakage and reunion of chromosomes leading to gross changes in chromosome structure. Some of the most popular controlling elements found in maize are *activator-dissociation* (*Ac-Ds*) system and *suppressor-mutator* (*spm*) system. The number, type and location of these elements are characteristic of each maize strain.

***Activator-Dissociation* (*Ac-Ds*) system**

Ac-Ds system is the most popular system and was discovered in 1950 by Barbara McClintock, when she found the presence of a genetic factor *Ds* (*dissociation*) caused high tendency towards chromosome breakage at the location, where it appears. These breaks could be located either cytologically at pachytene or genetically by uncovering of recessive alleles in a heterozygote. This property of *Ds* was dependent on another unlinked genetic factor *Ac* (*Activator*). Thus, in presence of *Ac*, *Ds* may undergo transposition or may cause chromosome breaks and an increase in the number of *Ac* element in the genome decreases the frequency of transposition or chromosome breaks by *Ds*.



Significance of transposable elements

Transposons seem to play a role in evolution and biology by promoting rearrangement and restructuring of genes. Transposition may directly cause both deletion and inversion mutagenesis. They cause mutations by insertion into genes and affect the regulation of genes by inserting near promoters. They also provide substrates for genetic rearrangements and thus act as agents of genome evolution.