On Ac induced chromosome dissociation

Barbara McClintock was able to identify the presence of the activator, Ac, by its action of chromosome dissociation, Ds. Although the events involved in the mobility the Ds transposon are clear, I know of no studies on Ac breakage of the chromosome. Three possible events come to mind. Breakage can result from Ds mobility if the two broken ends do not join to produce an eight base direct repeat (1). It may result from a single break at the 5' end that contains the nearby AAACGG binding site of the transposase (2). The last event (3) is breakage at the 3' end. The fusion of the two complimentary strands of DNA at a break point that must occur to give rise to McClintock's breakage–fusion-bridge cycle, affords a simple way to distinguish between these three possible events

Ds1 terminal sequences of about 40 bases were duplicated and pasted end to end, either at the 5' or at the 3' termini, and used as query in BLASTs of the sequenced genome of B73. The BLASTs were searched for hits that extended across the paste point. According to (1), no such hits would be expected when either the duplicate 5'-5' or 3'-3' terminal sequences were used as query, since the fusion would join the flank sequences and not Ds1. According to (2) hits that extend across the paste point should be detected only with the duplicate 5-5' used as query and not with the duplicate 3'-3' query. The opposite should result according to event (3) with the extended hits detected only when the query is the duplicated 3'3' sequence.

Tests with a number of Ds transposons clearly showed that event (2) is correct. In BLASTs with duplicate 5'-5' pasted termini as query, multiple cases were detected with hits that extended for as long as 20 bases on both sides of the paste point. No such cases were detected with the duplicated 3'-3' pasted queries.

The AAACGG transposase binding site is very close to the terminus, starting at position 9. Proximity is not required for the cleavage that occurs at both the termini in the case of Ac/Ds transposon mobility where the 5' and 3' termini are separated by as many as 4500 bases, but it may be a factor in breakage at only one end that gives rise to a breakage-fusion-bridge cycle. In order to check if a close by transposase binding site at the 3'end would give a positive result, a test was performed using Ds transposons with terminal sequences that had an AAAGGG sequence close to both the 5' and 3' ends. The test results were clearly positive showing that the breakage could occur at either the 5' or 3' termini.

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