that all four meiotic products are included in the development of the embryo sac. If we work out the frequencies and types of endosperms and embryos from tetrasporic embryo sac development we find that we may expect dilute dotted nonshrunken endosperms associated with 4 $\underline{\alpha}$ $\underline{a}^m$: 1 $\underline{\alpha}$ $\underline{\alpha}$: 1 $\underline{a}^m$ $\underline{a}^m$: 3 $\underline{\alpha}$: 3 $\underline{a}^m$ embryos. This of course is not our expected 1:1:1 ratio; however, it was recognized that when the data were collected $\underline{\alpha}$ $\underline{\alpha}$ $\underline{a}^s$ or $\underline{a}^m$ $\underline{a}^m$ $\underline{a}^s$ trisomics would not be distinguished from $\underline{\alpha}$ $\underline{a}^s$ or $\underline{a}^m$ $\underline{a}^s$ parentals and would be classified as such in the tables. A recheck of the remaining test ears of the parental cases confirmed that some were indeed misclassified trisomics. By combining these groups we again have a 1:1:1 ratio. The data provide a good fit as shown by a χ^2 of .8000 and a P value of .68.

From this we conclude that when nondisjunction for chromosome 3 occurs in mitotic divisions of the germ line to produce a trisomic sector, this provides a condition where tetrasporic embryo sac formation occurs with the resulting production of tetrasomic endosperms and trisomic and noncorresponding parental type embryos.

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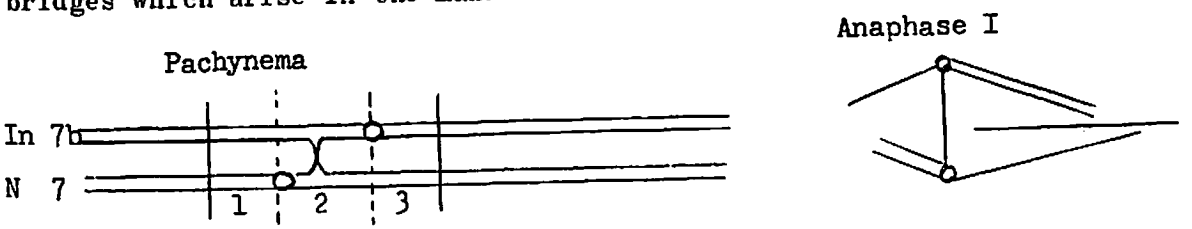
1. The detection of non-homologous crossing over.

In the 1961 News Letter it was suggested that the occurrence of non-homologous crossing over could be detected by the use of pericentric inversions which exhibit a high frequency of non-homologous pairing. Non-homologous crossing over may be detected by the observation of anaphase bridges which arise in the manner shown below:



A crossover in region 2 will lead to the formation of a bridge and a fragment at the first anaphase of meiosis. This is something not normally expected in a pericentric inversion heterozygote. Since anaphase bridges may also arise from short heterozygous paracentric inversions which may be present in the material and may be difficult to detect cytologically, it is necessary to examine normal sibs of the pericentric inversion heterozygotes and to determine if there are bridges present without the pericentric inversion. In Table 1 data are presented for In 7b (S.32-L.30).

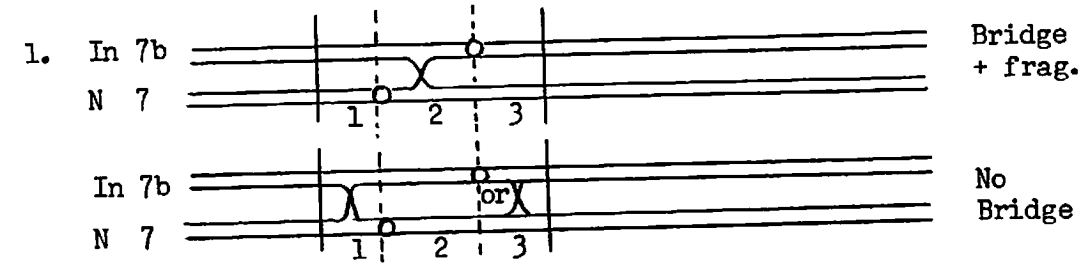
Table 1

Anaphase Configurations of In/N and N/N Plants

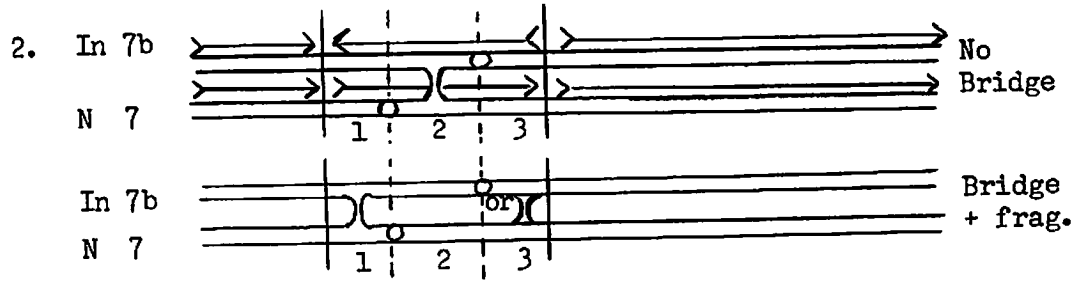
In/N Plant no.	Number of cells			N/N Plant no.	Number of cells		
	No Bridge	Bridge + frag.	Bridge, no frag.		No Bridge	Bridge + frag.	Bridge, no frag.
- 3	532	3	1	- 4	478	0	0
- 9	515	4	0	-16	538	0	0
-10	628	6	1	-18	401	0	1
-13	576	1	1				
Total	2251	14	3	Total	1417	0	1

There were 14 cases of bridge and fragment formation out of a total of 2,268 cells examined or 0.62%. There were no cases in the controls. When a bridge is found without a fragment it is possible that these are not true bridges but rather they may represent chiasmata which have not been resolved. Consequently, they will be disregarded.

These results are fairly good evidence for the occurrence of non-homologous crossing over. How the non-homologous crossing over takes place is not clearly established as there are three hypotheses which could explain it. The first has been suggested in the diagram on the preceding page; it is the simplest--namely that crossing over proceeds as it does with homologous paired segments.

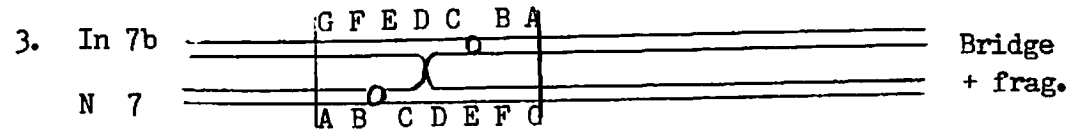


The second hypothesis takes note of the possibility that the chromosomes may be polarized and therefore crossing over may take place in the manner shown below.



The third hypothesis is based on the fact that in the middle of the non-homologously paired segment there is a site perhaps which is homologous. Crossing over could take place at this site. It would be then actually homologous crossing over. What this site where the

homology meets (coming in opposite directions) consists of is a matter of some interest as it would cast some light on the nature of the pairing code. It may be a pair of chromomeres or a pair of nucleotides.



Which hypothesis is correct is difficult to determine. In case of hypotheses #1 and #3, the fragment is always the same size--it consists of the equivalent of one chromatid. On the contrary, under hypothesis #2, the size of the fragment would be variable, sometimes very small from a crossover in region 1 and sometimes larger than a one chromatid equivalent from a crossover in region 3. The observed fragments were uniformly large, so hypothesis #2 is probably not correct.

The use of other pericentric inversions is planned. If anaphase bridges are found in inversion heterozygotes where the two break points are equidistant from the centromere, then hypothesis #2 may be valid. Or if one break point is close to the centromere and there are a considerable number of anaphase bridges formed, this would tend to invalidate hypothesis #2.

Also, it is possible to isolate and examine some of the products of non-homologous crossing over if they do not cause inviability or if they do, a trisomic culture can be used.

The occurrence of non-homologous crossing over is relevant to a number of cytogenetic problems--such as whether the translocations found in the progeny of monoploids arise solely from crossing over in duplicated segments and how chromosomal aberrations are formed under natural conditions.

G. G. Doyle

2. <u>The formation of duplications by the induction of translocations between homologous chromosomes and by the transposition of chromosome segments to non-homologous chromosomes</u>.

Translocations between homologous chromosomes will produce chromosomes with duplicated segments in tandem (and concurrently--chromosomes with deficiencies), as shown in the diagram below.