The number of times the centromere of each bivalent is found stuck to the centromere of another pair is recorded in Table 2. In order to perform an analysis of the observed frequencies of associations, the expected frequency for each class was calculated on the basis of the total length of the 10 chromosomes at the pachytene stage. The chi-square test indicates a non-random distribution of the centromere adhesion for the total of the 10 chromosomes, but a closer inspection of Table 2 shows that the only significant individual chi-square value is for chromosome 5; for all others the value is not significant. If one excludes chromosome 5, the remaining 9 classes give a total chi-square of 14.56 which is not significant. One can conclude that the association of centromere regions of non-homologous chromosomes in corn is a random affair, according to the relative lengths of the chromosomes, with the exception of chromosome 5.

Table 2. Comparisons of the observed frequencies of centromere adhesions with the expected frequencies calculated on basis of chromosome length.

Normal KYS				Homozygous 4-10 translocation			
Chrom.	ob.	exp.	X^2	Chrom.	ob.	exp.	X^2
1	87	105.3	3.18	1	81	96.2	2.37
2	69	83.3	2.45	2	64	78.6	2.71
3	71	74.3	0.15	3	59	69.9	1.70
4	75	70.5	0.29	4^{10}	44	38.2	0.88
5	112	74.3	19.13	5	100	67.4	15.77
6	50	59.1	1.40	6	45	51.6	0.84
7	67	54.5	2.87	7	56	51.1	0.50
8	63	56.7	0.68	8	52	49.6	0.12
9	43	50.8	1.98	9	37	41.8	0.55
10	35	43.2	1.56	10^4	70	63.6	0.64
Σ	672	672.0	33.69	Σ	608	608.0	26.08

In order to check the hypothesis that the frequency of centromere adhesion of non-homologous chromosomes is proportional to chromosome length, the author planned to analyze several homozygous translocations where the length of certain chromosomes is drastically changed. At present adequate data are available only for a homozygous 4-10 translocation. In this translocation the breakage points are near the centromere in 4L and in the middle of the long arm of chromosome 10 (for the length and arm ratio, see Table 1). The 4^{10} chromosome with a centromere from chromosome 4 is now the shortest member of the complement while the 10^4 with a 10 centromere is the second longest chromosome. If the frequency of centromere adhesions is a function of relative chromosome length then the 4^{10} chromosome should have a reduced frequency while that of 10^4 should be increased. This is precisely what was found. Again it should be noted that chromosome 5 is involved more often than expected on the basis of its relative length. The chi-squares are given in the second part of Table 2. The chi-square for the total is significant, but chromosome 5 is responsible for this. If this value is eliminated, the remaining total chi-square is not significant.

In conclusion, it was shown that the number of centromere adhesions is a function of relative chromosome length for all the chromosomes with the exception of chromosome 5, which is more frequently involved than expected.

Table 3. Combinations of bivalents involved inn non-homologous knob associations and their frequencies.

Normal KYS			Homoz. 4-10 transl.		
Knob combin.	No. of adhesions	% of adhesions	Knob combin.	No. of adhesions	% of adhesions
5-6	8	11.3	5-6	4	10.0
5-7	32	45.0	5-7	15	37.5
5-9	15	21.1	5-9	10	25.0
6-7	3	4.2	6-7	2	5.0
6-9	0	0.0	6-9	1	2.5
7-9	13	18.4	7-9	8	20.0
Σ	71	100.0	Σ	40	100.0

In considering knob adhesions, it must be remembered that KYS has a large knob on chromosome 5 and 7, a small one in 6L and a small terminal knob on 9S. Table 3 gives the frequencies and percentages of the six possible types of knob association for the 4 knobs in the normal KYS and in the homozygous 4-10 translocation strains. If knob adhesion occurs at random., one would expect to find that each combination would occur in 1/6 of the total number of knob fusions. The data in Table 3 show that the frequencies of different knob associations deviate markedly from a random association. The larger knobs on chromosomes 5 and 7 are most frequently involved and the smaller knobs on 6 and 9 are less frequently involved. Although the knobs on 6 and 9 are of the same approximate size the terminal knob on 9 is more frequently involved in knob adhesion than is the interstitial knob in 6L. Our data on knob adhesions are in close agreement with those of Peterson.

José do Amaral Gurgel
(Rockefeller Fellow at the Univ. of Illinois; permanent address is Univ. of Sáo Paulo, Piracicaba, Brazil)