ence of movement in the opposite direction (condition iv), or by the presence of a "no movement" signal (condition ii), in the corresponding region of the retina of the other eye. Because both conditions involve differential disparity information over time, the binocular occlusion found by Pettigrew and coworkers might well be brought into play by a stimulus with stereoscopic depth movement, such as was used in my experiment.

The information for retinal position from the two eyes is processed into disparity information for elements of similar form on the two retinas (see model in Fig. 4). After this disparity stage, there is an interaction stage in which mutual inhibition between signals of different disparities occurs. The final stage in the model is a comparator responding to spatiotemporal differences in disparity, such as to detect depth movement.

A number of features in the model are implied by the present data. The frequency response of the inhibitory interactions must be approximately constant as a function of frequency in the frequency range examined in Fig. 1, otherwise the monocular and stereoscopic curves would have dissimilar forms. The model assumes that monocular as well as stereoscopic movement information is processed in a unitary pathway. If separate pathways were involved, separate mechanisms would be required for suppression of the monocular information in the stereoscopic stimulus and reduction of the stereoscopic sensitivity. A unitary model is therefore more parsimonious. In order to accommodate monocular movement sensitivity it must be assumed that the binocularly driven cells will fire with only monocular input, which is supported in the data of the above neurophysiological investigations, and that the disparity remains spatially coded up to the movement detection stage, so that lateral movements at a constant disparity can stimulate the movement detector.

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13. My thanks to T. Corwin for his suggestions. Supported by Foundations Fund for Research in Psychiatry grant 70-481.

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Growth Inhibition by Mechanical Stress

The report by Neel and Harris (*1*) on the motion-induced inhibition of growth in *Liquidambar* bears a close resemblance to our observations that *Cucurbita melopepo* plants subjected to daily measurements of petiole length and leaf area were smaller than undisturbed plants of the same age. A similar growth inhibition was reported for *Bryonia* (*2*) and collectively the results demonstrate a need for caution in the design and interpretation of experiments that involve any form of mechanical manipulation of growing plants.

We have now measured the effect of subjecting greenhouse-grown *C. melopepo* plants to daily handling during the month of August. Eighteen 10-day-old plants were selected and nine were chosen to be handled briefly at noon each day. The handling involved gently shaking the petioles, individually, for 30 seconds and lightly stroking the leaf blades with the fingers once across the upper surface. New leaves were similarly treated as they unfolded during the experimental period. Petioles were numbered 1 to 4 consecutively from the primary petiole. The remaining plants, as controls, were left undisturbed.

After 20 days of treatment the experiment was stopped and the petioles, shoots, leaf blades, hypocotyls, and roots of control and handled plants were compared. The lengths and fresh weights of the stems and petioles of the handled plants were significantly less than in controls (Table 1) but the handled petioles showed a significant increase in volume per unit length as measured by water displacement (Fig. 1) which indicates an increase in radial growth. The fresh weights of the leaf blades, roots, and hypocotyls were unchanged by treatment as were the leaf blade areas and hypocotyl lengths.

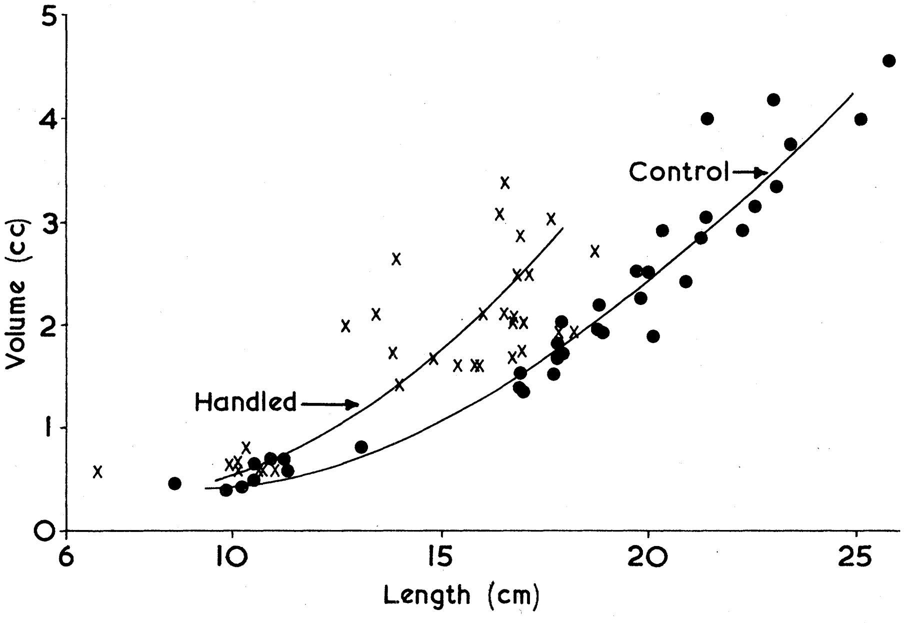

Fig. 1. Effect of handling on the ratio of length to volume of petioles of *Cucurbita melopepo.* Data for petioles 1 to 4 have been combined.

Table 1. Growth in length and fresh weight of petioles and shoots of control and handled plants. Data are presented as mean and standard error of mean. Significance of difference was evaluated by two-tailed *t*-test.

	Length			Fresh weight			Days handled (No.)
	Control (cm)	Handled (cm)	Difference (%)	Control (g)	Handled (g)	Difference* (%)	
				Petiole			
No. 1	10.7 ± 0.4	10.0 ± 0.4	N.S.	0.58 ± 0.05	0.61 ± 0.03	N.S.	20
No. 2	17.9 ± 0.3	16.5 ± 0.3	8	1.79 ± 0.11	1.72 ± 0.06	N.S.	13
No. 3	20.0 ± 0.5	15.9 ± 0.5	21	2.32 ± 0.19	1.94 ± 0.10	16	10
No. 4	22.9 ± 0.6	15.8 ± 0.7	31	3.70 ± 0.24	2.69 ± 0.15	27	7
				Shoot			
	10.5 ± 0.5	6.6 ± 0.4	37	3.85 ± 0.35	2.66 ± 0.28	31	

* Percentage differences are significant at the 0.05 level of probability except where denoted by N.S.

The greatest inhibition of petiole growth occurred among those leaves last to unfold and which were therefore handled least. This suggests that the leaves were at their most sensitive stage before unfolding and that the effect of physical contact was felt by all sensitive regions of the plant, not only by those handled directly.

It is possible that changes in growth pattern induced by handling are responses to ethylene produced as a result of mechanical stress. Ethylene causes a reduction in longitudinal growth but an increase in radial expansion in pea epicotyls (*3*), and is involved in the growth inhibition of etiolated pea epicotyls caused by mechanical resistance (*3*). Ethylene is also involved in the coiling of pea tendrils following contact stimulation (*4*). Mechanical irritation of *Bryonia* shoots decreases the auxin concentration (*5*) which is a well-known ethylene response (*6*).

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Arctic Paleo-Oceanography in Late Cenozoic Time

A recent report by Herman (*1*) describing four Arctic Ocean cores is open to serious criticism in two crucial areas. First, the chronology of the four cores, a prerequisite to any climatic interpretation, is apparently in error. The cores are claimed by Herman to exceed 6 million years in age. Three of the cores (T-3/67-9, 67-11, and 67-12) were also studied by us. Our analysis of magnetic reversals in these *same* cores indicates that they do not exceed 3 million years in age. The results were reported at the Symposium on Late Cenozoic Glacial Ages at Yale University in December 1969 (*2*). The paleomagnetic data are subjected to some scatter but indicate that the cores do not penetrate beyond the Gauss Normal Epoch (3.3 million years ago).

Herman attempted to establish a chronology by correlation with a suite of five cores taken nearby and reported with paleomagnetic data by Steuerwald *et al.* (*3*). Although Herman's longest core was only 3.8 m long, particular emphasis was placed by her on correlation with Steuerwald's core 224, which was 5.6 m in length. The only paleontological or sedimentary information reported by Steuerwald *et al.* for core 224 is the presence of a sharp break between glacial marine and brown lutite sediment at a depth of 4.78 m. This lithologic change is correlated by Herman with a change in her cores which occurs at depths ranging from 1.85 to 2.85 m. Since these cores contain many lithologic changes, the correlation is a tenuous one. A much more acceptable correlation, and one which agrees with our paleomagnetic findings, can be made with the other four cores of Steuerwald *et al.*, for which sedimentary and paleontologic data are reported. These four cores average 2.8 m in length, and their microfaunal fluctuations in abundance correlate reasonably well with Herman's cores. In the upper 1 to 2 m of the cores, the abundance of planktonic foraminiferal tests varies widely. Below a sharp cutoff, whose age was estimated by Steuerwald *et al.* to be about 700,000 years, the cores are nearly barren of planktonic Foraminifera. Steuerwald's four cores are all less than 3 million years in age, which would indicate a similar age for Herman's cores.

The second point in question is the presence of so-called "low-latitude and temperate" species of planktonic Foraminifera in cores raised from the Arctic Ocean. Temperate species (*Globorotalia crassaformis, G. inflata,* and *Globigerinoides* sp.) were first reported by Herman (*4*) in Arctic cores, and subsequently she recognized such low-latitude species as *Globorotalia menardii, G. tumida, Globigerinoides ruber, Globigerinoides* sp., *Sphaeroidinella dehiscens,* and *Globoquadrina dutertrei* (*1, 5*). The last group is known to live predominantly in tropical and subtropical waters. Her drawings (*5*) of *Globigerinoides* sp., cf. *G. sacculifer Globigerinoides* sp., cf. *G. ruber*, and *Globorotalia crassaformis* are not diagnostic, and none of the other "tropical" species have been figured. We have searched at Lamont for such species at the indicated levels in the *same* Arctic cores. The only two species of planktonic Foraminifera identified by us were *Globigerina pachyderma* and *G. quinqueloba*, which are polar and subpolar species, respectively. It should be noted that neither Ericson *et al.* (*6*) nor Steuerwald *et al.* (*3*) have found any tropical or subtropical species in their Arctic cores.

Any warming trend in the Arctic Ocean that would lead to the purported appearance of tropical species should have been accompanied by a series of successions of foraminiferal assemblages. A progressive displacement of the polar species by a subpolar assemblage (dominated by *Globigerina bulloides*), by a temperate assemblage (dominated by *Globorotalia inflata*), which in turn should have been replaced by a subtropical assemblage (with mainly *Globorotalia truncatulinoides, G. hirsuta,* and so forth) should have occurred before the appearance of a tropical assemblage (*Globorotalia menardii, Sphaeroidinella dehiscens,* and so forth). We have found no such successions, as *Globigerina pachyderma* has been the dominant species during the last 2.5 million years. There have been only slight invasions of subpolar waters, as indicated by small percentages of *G. quinqueloba* and right-