predicted results occurred. For the normal words too few errors occurred for any conclusions about the shapes of the error functions—although fewer overall errors did appear on the right. However, Anderson and Crosland (*9*) have previously obtained for nonsense words more nearly symmetrical error functions on the left of fixation than on the right.

Our study tests the hypotheses of Heron (*3*) by determining the distributions of errors within normally oriented, meaningful words presented tachistoscopically to the right or left of fixation. Predictions are the same as those of Finkel and Harcum (*8*) for words printed in the normal manner.

Forty different eight-letter English words were printed in black ink on white cards. Twenty words appeared one at a time on either side of fixation in different exposures. After the 0.05-second exposure, the observers, not knowing the exposure side beforehand because of the haphazard presentation sequence, attempted to report the word verbally, and then to write down as many letters as they could. Failures to reproduce letters correctly within one letter position were scored as errors. Although no instructions were given to this effect, all 20 observers reproduced the words from left to right.

Figure 1 shows fewer overall errors to the right of fixation ($P < .002$). A generally increasing function of errors rightward from fixation, and about equality for opposite halves of the words on the left, was obtained. Thus, the difference between right and left halves of words was greater for the words to the right of fixation ($P = .01$). Therefore, a greater inferred conflict between incipient eye movements, and also a poorer perception of words, occur to the left of fixation. This confirms both hypotheses (*10*).

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Pachytene and Diakinesis Behavior of the Isochromosomes 6 of Maize

Abstract. Complementary isochromosomes which shared homologies only for the centromere region and one or two adjacent chromomeres were rarely found associated at pachytene. It is therefore questioned whether the centromere plays an important specific role in the initiation of synapsis. It is also questioned whether centromere repulsion is a cause of diplotene separation and terminalization since the isochromosome univalent foldbacks assumed shapes typical of bivalents with chiasmata at diplotene and diakinesis.

An unusual type of sectorial aberration was found in microsporocytes from several tassel branches of an otherwise apparently normal corn plant grown from seed which had been irradiated at 12,000 r. The abnormality can be interpreted as a translocation in which breaks occurred in both chromosomes 6 (the nucleolus organizer chromosome) at or near the centromere: in one chromosome on the short arm side of the centromere and in the other on the long arm side. From cytological evidence (Fig. 1, *A* and *B*) it appears that at least one and possibly both breaks were separated from the centromere by one chromomere. Reunion is thought to have occurred in one of the three ways diagramed in Fig. 2 which are cytologically indistinguishable. If the original breaks and reunions occurred at the chromatid level, the two exchange chromatids must have been distributed at anaphase to the same pole to establish a sector in which all of the chromosome material was present but in the new arrangement for chromosome 6. Note that each of the rearranged chromosomes is an isochromosome except for one or two chromomeres for which the synaptic partners are found in the other chromosome. Homologies between the two chromosomes are therefore limited to their centromeres and one or two chromomeres. The other chromosomes of the complement appeared normal and formed nine completely synapsed bivalents.

At pachytene the two isochromosomes 6 usually each synapsed internally to form two separate foldbacks which gave the appearance of 11 bivalent chromosome pairs per cell. In 4/158 of these cells the isochromosome of the short arm (carrying the nucleolus organizer) was open as in Fig. 1*C*. Rarely (in 6/164 or about 4 percent of pachytene cells) the two chromosome 6 fragments were paired in the centric region. Since centromeric associations occurred in this material on the average

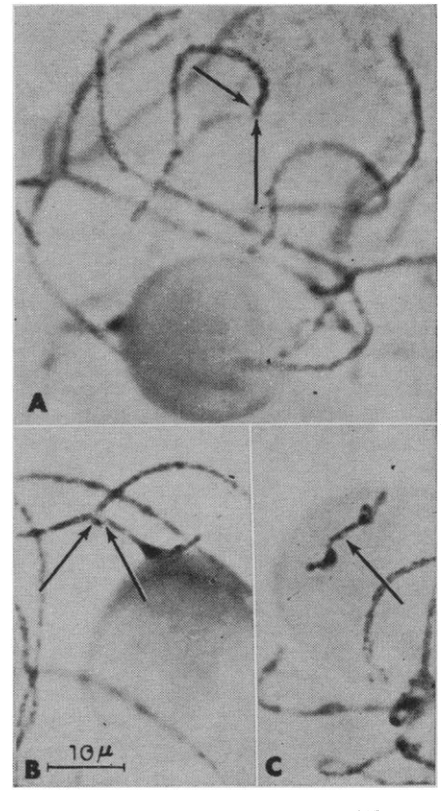

Fig. 1 (right). *A*, Chromosome 6 long arm isochromosome in a univalent foldback configuration (above nucleolus, shaped like a reversed question mark). Arrows point to centromere and to an adjacent chromomere. The chromosome 6 short arm isochromosome can be seen extending to the left from the nucleolus, out of focus except for the darkly staining nucleolus organizer region. *B*, Chromosome 6 short arm isochromosome in a univalent foldback configuration (attached to the nucleolus and extending above and to its left). Arrows point to its centromere and to an adjacent chromomere. Its centromere is associated with that of another chromosome. *C*, Chromosome 6 short arm isochromosome in an open univalent configuration. The arrow points to its centromere. The two large darkly staining regions are the two nucleolus organizers.

about one per cell, if such associations were randomly distributed among the chromosomes (and no striking departure from such randomness appeared) about 2 percent of cells would be expected to show an association involving the two chromosome 6 centromeres. Thus very little if any synapsis occurred between the homologous centromeres and adjacent chromomeres which the two fragments of chromosome 6 carried in common. Any important specific role of the centromere in the initiation of synapsis is therefore questioned. The opposite situation in which regions devoid of centromeres successfully synapse is a common occurrence in structural heterozygotes.

It is also of interest that the isochromosomes formed chiasma bearing O or ∞ shaped configurations at diakinesis. Since these foldback chromosomes were presumably univalent for the centromere region, it seems unlikely that it could have functioned as a center of repulsion for diplotene separation and terminalization (*1*). Yet this separation apparently operated normally. Objections to the theory of terminalization by centromere repulsion have also been raised recently by Godward (*2*).

If the ear from the plant carrying the abnormality described above includes the aberrant sector, progeny may be produced which contain a normal chromosome 6 and the two isochromosomes 6. It is of interest in such plants to what extent and frequency each of the isochromosomes will foldback to synapse with itself at meiosis and to what extent it will pair with the homologous region of the normal chromosome or remain unpaired (*3*).

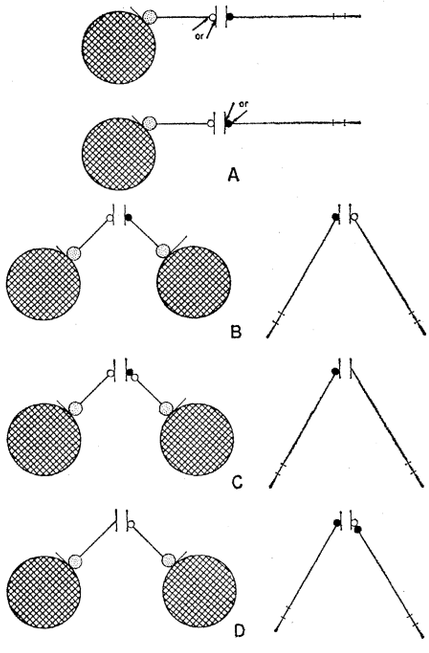

Fig. 2. *A*, Semidiagrammatic representation of normal chromosome 6 homologues. Possible positions of the x-ray induced breaks which led to the formation of isochromosomes are indicated by arrows. The centromeres are the blank regions set off by cross bars. Only the chromomeres adjacent to the centromeres are shown, and these are represented differently on the short arm and long arm sides so that they can be distinguished in *B*, *C*, and *D* (the chromomere on the short arm side is an open circle, on the long arm side, a black circle). The large crosshatched circles represent the nucleolus, the smaller stippled circles are the nucleolus organizer and crosslines near the end of the long arm are small knobs. *B*, Reunion chromatids in the case in which both breaks are separated from the centromere by one chromomere. *C* and *D*, The two cases of reunion chromatids in which one break is immediately adjacent to the centromere and the other break is separated from it by one chromomere.

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Communication with Queen Honey Bees by Substrate Sound

Abstract. A caged queen honey bee, installed in an observation hive which already contained a virgin queen, piped in response to artificial piping which was played to it through the substrate. The experiments which followed this observation provide the first direct quantitative evidence that sound, at least in the range of 600 to 2000 cycles per second, is perceived by honey bees and that information is transmitted through sound from one bee to another.

Whether or not honey bees (*Apis mellifera* Linnaeus) perceive sound and use this sound in communication is a question which has long been a matter of dispute. Although there is some indirect evidence that honey bees receive sound (*1*), the statement of Snodgrass in 1910 ". . . that no one has yet produced any actual evidence that bees perceive sound" (*2*) has remained essentially unchallenged. At least, there is no existing evidence that there is exchange of information between bees by means of sound. The recent suggestion that foraging bees use sound in communicating distance of a food source to other workers in the hive increases the value of an answer to this question (*1*, *3*). The following experiments show how an artificially produced substrate sound, patterned after that produced by a free virgin queen, elicited a response from a caged virgin. The response, in turn, was similar to that produced by a virgin forcibly contained in her cell by worker bees.

A honey bee colony in a one-frame observation hive raised its own queen from an egg. Five days after emergence of the first virgin queen, another virgin (obtained by mail from northern California) was installed in the observation hive without having been removed from the standard wooden mailing cage. Sound was generated by a Hewlett-Packard oscillator, amplified, and played to the bees through a converted pillow speaker, Calrad PS-10, which had been removed from its plastic case. This speaker was securely fastened to the outside of the hive at the end of the top bar of the frame which contained the honey comb. Thus the speaker was 5 to 10 cm from the queen, which was in a cage on the top bar of the frame.

Queen piping, which had been recorded 3 months earlier from a 5-day-old virgin, was analyzed on a Sonagraph (Kay Electric Company model 662-A). The analysis is shown in part *A* of Fig. 1, where frequency is displayed on the ordinate and time on the abscissa; the relative intensity within one tracing is indicated by the darkness of tracing. When the pattern was imitated by means of a telegraph key connected between the amplifier and transducer, a response was obtained from the caged bee. A record of a successful stimulus and the bee's response to it are shown in the parts *B* and *C* of Fig. 1, respectively. The intensity of the stimulus was approximately equal to that of loud queen piping. The caged queen in the hive usually piped within 5 seconds after the artificial piping ceased.

To eliminate the possibility of coincidence, my assistant listened to the caged queen for a 10-second period each minute, on the minute, for a total of 1 hour. For 30 of these observations, at random, I imitated a queen piping just before the 10-second listening period. The assistant then tallied +