terminated before the exodus, so we do not know whether the pintail hen used the call in enticing her young to leave the nest. The fact that the Colliases heard ground-nesting hens (*Aythya valisineria* and *Anas discors*) vocalize as they led their young from the nest (*5*), leads me to believe that in nature auditory stimulation is a typical component of the stimulative complex which at the very least *initiates* imprinting in ground-nesting as well as in hole-nesting species of ducklings (*6*).

Elsewhere I have put forth the notion that in ground-nesting species auditory stimulation may serve an attention-directing or activating function, while in hole-nesting species such stimulation not only serves an activating role but also plays a major role in the ducklings' recognition of their parent (*7*). The main purpose of my present report is to draw attention to the fact that in nature "imprinting" does not appear to be rooted on visual factors, due to the primacy (in time) of auditory factors. Much laboratory research has been based on the premise that the learning of parental characteristics by nidifugous birds is rooted solely or largely on visual factors, and little attention has been given to the role of auditory stimulation in the imprinting process (*8*). It is a matter of some interest that, at the mammalian level, the departure of young opossums from the den is also initiated by the mother's call (*9, 10*).

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10. The naturalistic studies were supported by the Chapman Fund of the American Museum of Natural History, the North Carolina Hospitals Board of Control, and research grant M-6039 from the National Institutes of Health. Objective naturalistic observations are difficult and tedious to arrange, record, and analyze. I am grateful to the following persons for help at one stage or another: Dr. J. R. Hester, Dr. Eugene Hester, Jack Dermid, Nora Gottlieb, Frank Lane, Carter Doran, Linda Green, John Whalen.

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Heritability of Variations in Oil Content of Individual Corn Kernels

Abstract. *Nuclear magnetic resonance spectroscopy was used to determine oil content of individual corn kernels in order to evaluate this technique as an aid in the development of strains having greater oil content. This method is rapid and does not impair viability. Individual kernels from a selfed single-cross ear ranged from 2.7 to 5.4 percent oil and were significantly correlated* ($r = +0.75$) *with the oil content of their progeny ears. This indicates that the single-kernel differences in oil content were heritable, and this method may greatly increase selection efficiency in breeding for higher oil content in corn.*

Corn oil, an important food fat relatively rich in linoleic acid, has been in strong demand in recent years, but the supply of corn oil has been limited to the demand for products of the corn milling industries (*1*). The most effective method of increasing the supply of corn oil is through breeding for corn of higher oil content. Sprague *et al.* (*2*) demonstrated the effectiveness of the recurrent selection procedure for oil improvement in corn by increasing mean oil content of a synthetic variety from 4.7 to 7.0 percent in two selection cycles. However, the selection was perforce based on extraction analytical values obtained on a ground aliquot of composite samples of ears. Such time-consuming procedures limit the scope of breeding work and force the breeder to base his selection decisions on population averages rather than on individual differences. Alexander (*3*) recently proposed that development of a nondestructive method of measuring oil content of individual corn kernels would provide optimum selection pressure in the recurrent selection procedure.

Conway and Smith (*4*) recently demonstrated that wide-line nuclear magnetic resonance (NMR) spectroscopy provides a rapid, accurate, and nondestructive method for determining fat in multiple or single-kernel samples of corn dried to below 5 percent moisture. The basic instrument is a Schlumberger model 104 NMR analyzer and model 104-3 integrator. To facilitate single-kernel analysis, instrument sensitivity was improved by installing a 2-ml "high-gain" radio-frequency coil in place of the standard 40-ml coil and by using a specially fabricated sample cell so that each kernel was positioned at the optimum location in the magnetic field. All kernels analyzed were dried uniformly to 5 percent moisture to suppress the water signal. Samples of corn of known oil content ranging from 3.9 to 8.8 percent oil were used for calibration purposes. Twenty-five individual kernels from each sample were examined with instruments and then were ground collectively and analyzed for fat by a standard solvent extraction procedure (*4*). The oil content was linearly related to the NMR signal amplitude. Maximum deviations from the calibration line were 0.1 percent fat, absolute. Time required for measurement was 4 minutes for each kernel.

To determine the heritability of single-kernel variations in oil content, analyses were made on 289 kernels from one selfed ear of the single-cross Hy × Oh 45, and 189 kernels from one ear of a nearly homozygous inbred designated HO-18. The range in single-kernel values for the single cross was 2.70 to 5.41 percent oil (Fig. 1). The two parents, Hy and Oh 45, of the single

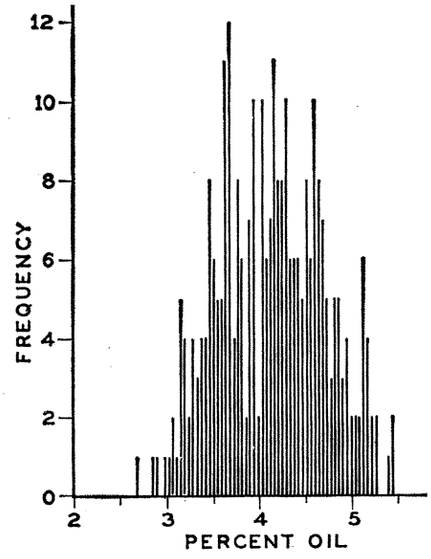

Fig. 1. Frequency distribution of percent oil in single kernels from one selfed ear of the corn single cross, Hy × Oh 45.

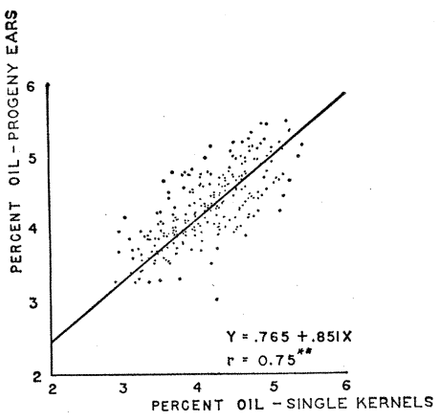

Fig. 2. Oil content of single kernels of the corn single cross, Hy × Oh 45, plotted against oil content of grain from corresponding progeny ears.

cross are standard inbreds that differ somewhat in oil content, 3.6 and 4.6 percent oil, respectively. The range of oil content for kernels of the HO-18 line was 7.9 to 12.5 percent oil, with a frequency distribution curve similar to that of the single cross. All of the analyzed kernels were planted, and bulked kernels from each selfed progeny ear were analyzed for oil content by using the 40-ml coil and an instrument sweep time of 2 minutes.

The 289 single kernels from the selfed ear of the single cross Hy × Oh 45 produced 256 progeny ears which similarly ranged from 3.00 to 5.4 percent oil. The correlation between oil content of the single kernels and that of their progeny was highly significant [$r = +0.75$ (Fig. 2)], indicating that the single-kernel differences were heritable. The eight kernels with the highest content produced progeny averaging 4.99 percent oil, compared with the average of all progeny of 4.28 percent. This represents a mean improvement in oil content of about 16 percent through single-kernel selection.

From the 189 kernels of HO-18, 137 progeny ears were obtained. The correlation of the oil content of the single kernels with that of their progeny was not significant ($r = +0.14$). The extreme susceptibility of the progeny plants to stalk rot undoubtedly had an adverse effect on grain quality and thus obscured any real genetic differences.

Normally, selections for oil content are based on analysis of bulk samples from individual ears in segregated populations. Since single-kernel variations in oil content are to some degree heritable, it is possible with NMR spectroscopy to enhance selection efficiency by selecting kernels with highest oil content within the selected families (ears). This is essentially a form of embryo selection which will result in increased oil content in the grain of the succeeding generation.

Further studies are under way to determine the effectiveness of single-kernel selection for oil content in stocks with various degrees of genetic heterozygosity. Information is needed on the number of generations beyond which single-kernel selection will no longer be effective as the genetic variation decreases and oil content increases with selection. Such information will help to formulate efficient plans for utilizing the single-kernel selection technique for improving the oil content of corn.

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Virus-Containing Leukocytes in Polioencephalitis

Abstract. *Crystalline aggregates of strain MM virus occur in polymorphonuclear leukocytes in association with osmiophilic granular structures which are occasionally membrane-bound. This suggests either a phagocytosis and segregation of virus by leukocytes, analogous to the disposition of bacteria by leukocytes, or a utilization of the leukocyte by the virus as a host cell for virus replication.*

After subcutaneous injection in white mice of a brain homogenate infected with the MM strain of Columbia SK virus (*1*), a severe polioencephalitis occurred within 48 hours. The presence of intraneuronal crystalline aggregates of virus-like particles has been previously reported (*2*), and this and other alterations in nerve cells have been described in detail (*3*). It is believed that such crystalline structures are made up of virus particles, since they closely resemble poliovirus crystals seen in tissue culture (*4*) and the size of the individual particles is approximately that determined for the poliovirus and other enterovirus groups (*5*); furthermore, there was a marked elevation in titer of virus in brain at the time of the encephalitis. Finally, homogenates prepared from the brains of these animals proved fatal in repeated passages in mice, with production of a typical polioencephalitis. Brain homogenates prepared from control animals injected with uninfected homogenate were not pathogenic, and light and electron microscopy of the brains of control animals revealed no crystalline structures. The purpose of this report is to illustrate and describe similar virus crystals seen within more than 40 polymorphonuclear leukocytes in areas of polioencephalitis in three infected animals from the same experimental series, and to comment briefly on the relation of the virus to this host cell.

The occurrence of influenza virus within leukocytes was demonstrated by means of the fluorescent antibody technique by Hanson *et al.* (*6*). Two electron-microscopic studies also showed individual particles which were interpreted, in still other in vitro studies in which Coxsackie virus (*7*) and influenza virus (*8*) were used, as virus within vacuoles in leucocytes. Mannweiler and Palacios (*9*) showed possible virus crystals in endothelial cells of poliovirus-infected rhesus monkeys and mentioned, but did not illustrate, aggregations of virus-like particles in leukocytes within the vessel lumen. As emphasized by Kallman *et al.* (*10*), the occurrence of a crystalline array of virus particles greatly increases the likelihood of their proper identification.

Figure 1 (top) shows a portion of a polymorphonuclear leukocyte from the brain of a white mouse infected 2 days earlier. Within the cytoplasm are virus particles which measure approximately 190 A, with a center-to-center spacing of about 210 A. Figure 1 (bottom) is a different section of the same cell at higher magnification. The ordered aggregate is still apparent; this indicates that it is three-dimensional. The crystals are closely associated with finely granular material of moderate osmiophilia. Also apparent are particles of the same appearance within structures bound by a single membrane which re-