tropical lows are present. The peak of this microseismic activity usually comes when these eastward-moving low pressure storms reach the Weddell Sea (Fig. 3). There are several possible explanations as to why the storms are recorded more precisely when east of the station than west. There is the possibility of two different geological structures across which microseismic energy does not carry. The lows may deepen considerably after reaching the Weddell Sea. The bottom of the Bellingshausen Sea may be such that microseisms are not generated when a cyclone is in that vicinity. A detailed analysis of the phenomenon has been reported elsewhere (*2*).

The seismograms and all other original data can be obtained from the archives of the Geophysics Laboratory, Department of Geology, Columbia University.

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Sodium Nucleate Inhibition of Arginase Activity [1]

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It was found that under certain conditions sodium nucleate (yeast sodium nucleate, Schwartz) inhibited arginase activity. This finding was considered significant because of the universal presence of nucleic acids in all cells. A further study was then undertaken to determine the nature of this inhibition. The results of these studies are summarized in Table 1.

TABLE 1

EFFECT OF SODIUM NUCLEATE ON ARGINASE ACTIVITY

Reaction mixture	No. determinations	Micromoles urea/ml*	Percentage inhibition
Enzyme + substrate (control)	10	0.195	
Enzyme-nucleate + substrate	5	.000	100
Enzyme + substrate-nucleate	5	.190	None
Enzyme + substrate + added Mn^{++}	3	.195	
Enzyme-nucleate + substrate + added Mn^{++}	3	0.200	None

* All determinations are ± 0.015.

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The enzyme was prepared by extracting dried acetone powder of beef liver with tribasic potassium phosphate and by precipitation of the nonarginase protein by heating the extract to 60° C. The enzyme was then activated with Mn^{++} according to the method of Mohamed and Greenberg (*1*). Arginase activity was determined according to the photometric method of Van Slyke and Archibald (*2*). The enzyme contained 103 Van Slyke units of arginase per ml or 9.42

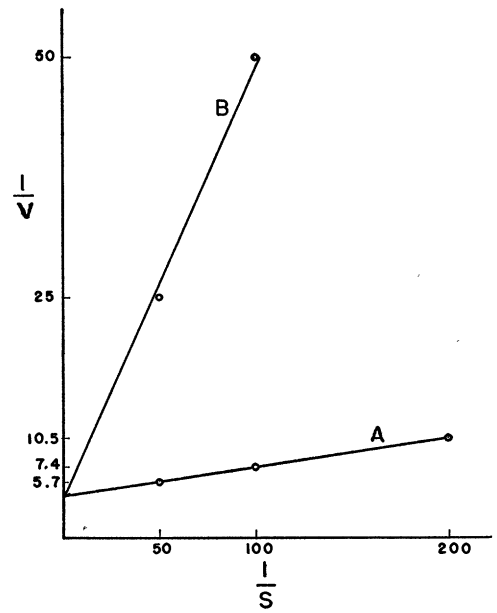

FIG. 1. Competitive inhibition of arginase by sodium nucleate. *A* represents arginase activity with no added nucleate, *B* with 0.75 mg sodium nucleate/ml added to the enzyme portion. S = substrate concentration in moles. V = enzyme activity, expressed in μM/ml.

such units per mg protein. The enzyme was diluted just prior to the reaction with the special salt solution of Kallman and Kopac (*3*). The enzyme dilution was 1:500. For the enzyme-nucleate mixture this consisted of equal aliquots of sodium nucleate dissolved in enzyme diluent and of 1:250 diluted enzyme preparation. The substrate-buffer mixture consisted of 0.06 *M* l(+)-arginine monohydrochloride (Eastman Kodak Company) dissolved in 0.1 *M* diethyl-barbiturate buffer of pH 9.5, prepared according to Michaelis (*4*). The enzyme reaction was initiated by mixing 0.5 ml diluted enzyme preparation with 0.5 ml substrate-buffer mixture. The final substrate concentration was thus 0.03 *M*. The incubation temperature was 25° C, and the reaction period was 15 min. Under these conditions it was found that 1 mg sodium nucleate per ml of reaction mixture caused complete inhibition of arginase activity. It should be pointed out here that the sodium nucleate gradually loses its inhibitory power on standing for a few days in a dissolved state; hence, for maximum inhibition, the nucleate should be dissolved just prior to use.

In order to determine whether this inhibition was competitive, it was necessary to study the effect of

the nucleate on the enzyme, using a series of low substrate concentrations—in the range where an increase in substrate concentration causes an increase in enzyme activity—the nucleate concentration being smaller than that causing full inhibition. From Fig. 1 it is seen that if the reciprocals of the enzyme activities ($1/V$) are plotted against the reciprocals of substrate concentrations ($1/S$) a typical competitive curve is obtained, the nucleate concentration for this series being 0.75 mg/ml reaction mixture. It was postulated that the nucleate inhibition of arginase activity was caused by the removal by the nucleate of the Mn^{++} from the enzyme-Mn^{++} complex, thus rendering the enzyme inactive. The ease of inactivation of arginase by removal (by dialysis) of the activating Mn^{++} has been demonstrated by Mohamed and Greenberg (*1*). Furthermore, Neuberg and Roberts (*5*) have shown the ease of binding of Mn^{++} by sodium nucleate. According to this hypothesis, addition of more Mn^{++}—more than sufficient to saturate the binding capacity of the sodium nucleate—should restore the enzyme activity. It was found that addition of $MnCl_2 \cdot 4H_2O$ in quantities to give 0.025 mg added $MnCl_2 \cdot 4H_2O$/ml of reaction mixture (beyond the required Mn^{++} added initially for activating the enzyme) was sufficient to remove the inhibition by the nucleate.

It was further observed that enzyme inhibition is present only if the nucleate is mixed first with the enzyme portion prior to the addition of the substrate, but no inhibition takes place if the nucleate is mixed first with the substrate prior to the addition of the enzyme. The only explanation that might be given would be that the nucleate, after binding the arginine upon mixing with the substrate buffer, is incapable of removing the Mn^{++} from the enzyme-Mn^{++} complex. That sodium nucleate is capable of binding arginine was shown by Neuberg and Roberts (*5*). This interpretation also requires the assumption that arginase is capable of splitting off urea from the arginine-nucleate complex. Such a possibility would seem to be indicated from arginase specificity studies of Akasi (*6*), Boulanger and Bertrand (*7*), and Calvery and Block (*8*), who showed that if arginine is bound through the alpha NH_2 group with its COOH group free, the exposed guanidine group would be available for hydrolysis by arginase. Furthermore, since the substrate concentration employed was not in excess, there would have been a drop in enzyme activity if only those arginine molecules were available for hydrolysis which were not bound by the nucleate. However, since no drop in activity occurred, it is assumed that those arginine molecules which were bound by the nucleate were also available for hydrolysis by the enzyme.

Thus, since sodium nucleate causes a competitive type of arginase inhibition, and since the addition of Mn^{++} removed this inhibition, it is assumed that the nucleate causes enzyme inhibition by competing with the arginase molecule for the Mn^{++}. The absence of this inhibition upon mixing of the nucleate first with the substrate is explained as being due to the saturation of the nucleate binding capacity with arginine. It might further be postulated that nucleic acids, because of their enormous binding capacity, exist in the living cell in a form capable of either picking up or giving off enzyme-activating ions, depending on certain chemical changes in the cellular environment. In doing that, nucleic acids might conceivably be involved in the regulation of enzyme action inside the cell. It might be desirable to determine whether sodium nucleate would similarly inhibit *in vitro* other intracellular enzymes which require activating ions that are easily bound by nucleates.

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Control of Nosema Disease of Honeybees with Fumagillin[1]

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Nosema disease is an infectious disease of adult honeybees caused by the protozoan *Nosema apis* (*1*). It is widespread, and under favorable conditions may cause extensive losses of adult workers and queens in the winter or spring. Attempts to control it with antibiotics, sulfa drugs, arsenicals, and antiprotozoan agents have so far proved unsuccessful (*2–6*), although it was recently reported (*4*) that sulphaquinoxaline (0.2%) lowered the percentage of dead infected bees in cages by about 35%: however, one third of the dead bees were still infected. In view of these failures to control the disease, the announcement of the striking amebicidal action of a new antibiotic, fumagillin (*7*), aroused great interest. Accordingly, some of this material was obtained (through the courtesy of the Upjohn Company) and tested against *N. apis* infections.

The antibiotic was dissolved in methyl alcohol and diluted to a definite volume with water. The required dosage, together with 1 ml of inoculum, consisting of 35 million *N. apis* cysts per ml, was added to a

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