this phenomenon. Clearly, very little is known about how the juvenile hormones regulate insect metamorphosis, although somewhat more is known about how synergists work. Hopefully, a collocation of knowledge from both areas will enable new insights into the mode of action of insect hormones and their structure-function relationships.

The potential of insect juvenile hormones as agents for insect control has been the subject of considerable speculation (*10*). To date, however, most of the compounds of significant activity have been available only as laboratory tools, as the cost of synthesis of these in quantities adequate for field studies has been prohibitive. The present study has revealed several compounds of high biological activity which are already available in commercial quantities.

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Clay Sols versus Clay Gels: Biological Activities Compared

Abstract. *Clay gels were prepared by extrusion of sodium-Wyoming bentonite pastes through a small orifice. Clay sols were prepared from the gels by rapping on the laboratory bench for disturbance. Lettuce seeds germinated faster, microbes generated more heat, and corn seedlings absorbed more ^{22}Na in the sols than in the gels. These differences in biological activity are attributable to changes in water properties and ion activities that accompany transformation from gel to sol.*

We have tested the hypothesis that, when a clay-water system is in the sol state, biological activity differs from what it is when the system is in the gel state. This hypothesis was based on observations (*1*) suggesting that subtle changes in water structure affect biological activity, on ideas (*2*) as to how these changes exert their effect, and on laboratory evidence (*3*) indicating that changes in water structure do occur in clay-water systems during the transformation from gel to sol.

Three different experiments were performed:

1) A paste of Na-Wyoming bentonite was extruded through an 18-gauge hypodermic needle into pairs of petri dishes. One dish of each pair was subsequently rapped on the laboratory bench for disturbance of the paste within it. Then the surfaces of the pastes were smoothed with a spatula, and lettuce (*Lactuca sativa*) seeds were placed on each. The seeds were examined at intervals for determination of their rates of germination.

2) The paste of Na-Wyoming bentonite was mixed with a small amount of nutrient medium (a mixture of 0.1 percent glucose, 0.1 percent casamino acid, 0.01 percent yeast extract, and 0.01 percent arginine) and inoculated with *Streptococcus faecalis*. Immediately after inoculation the paste was extruded in equal parts into two cells of a Calvet differential microcalorimeter. One of the cells was rapped on the laboratory bench; the other was left undisturbed. The cells were then inserted in the microcalorimeter, and the difference between the heats produced by the microorganisms within them was measured.

3) The paste of Na-Wyoming bentonite was mixed with a paste of K-Wyoming bentonite for reduction of the concentration of exchangeable Na^+ to a desired level. Thereafter, sufficient NaCl was added to bring its concentration in the intermicellar solution to $10^{-4}N$, and ^{22}Na was added at a rate of approximately 0.2 μc per gram of suspension. The resultant mixture was extruded around the roots of corn (*Zea mays* L.) seedlings in glass tubes. Half of the tubes were rapped on the laboratory bench; the others were not. After 6 hours with no subsequent rapping and after 12 hours with rapping every 2 hours in a controlled-climate chamber, the seedlings from the two trials were removed from the clay, washed, and analyzed for ^{22}Na.

All results of the three experiments (Table 1) were reproducible. The results for uptake of ^{22}Na, which were amenable to statistical analyses, were different at the 1 percent level of probability. Table 1 shows that biological activity was greater in the systems that had been disturbed by rapping than in the undisturbed systems. The disturbed systems were more nearly in the sol state than were the latter; this fact was shown by several kinds of measurements. Thus our hypothesis is supported by the data.

Table 1. Effects of disturbance of a thixotropic clay-water system on biological activity within it: germination of seeds within 18 hours, heat production by microbes, and uptake of ^{22}Na by corn seedlings (cpm, counts per minute). Only the differential heat production was measured; q represents an unknown absolute value; heat production per microbe is presumed to be about 10^{-8} cal.

Seeds (%)	Heat (cal)	Uptake ($\times 10^{-3}$ cpm)	
		6 Hours	12 Hours
	System undisturbed		
74	q	5.55	7.08
	System disturbed		
98	$q+0.34$	6.28	8.75

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