determine when the maximum amount of water had been absorbed. They were then divided into 20 groups of 25 selected seeds each. Five groups were planted individually in 0.45 pound of moist, composted soil contained in individual waxed-paper boxes. Five other groups were planted in individual boxes containing an equal amount of composted soil with which 2,4-D had been mixed at the rate of 4 pounds/acre. All 10 boxes were placed at a controlled temperature of 20°C. The same two procedures were then repeated using the remaining groups of seed, but these were maintained in the moist soil at a constant temperature of 30°C.

Seeds in the untreated soil at 20°C. germinated and grew vigorously within a few days after they were planted. Emergence and growth of those in the treated soil were greatly inhibited by the acid (Table 2). After 11 days at 20°C., some plants in the treated soil had grown above the surface, but they were deformed and stunted.

The seeds at 30 C. remained dormant. Inactivation of 2,4-D in the treated soil was determined by repeatedly planting mustard seeds in it. After 19 days, the 2,4-D was completely inactivated, as indicated by the fact that mustard seeds germinated, and the plants grew as vigorously in the treated as in the untreated soil. Boxes containing the treated and those containing the untreated soil were then transferred to 20°C. The clover seeds in both germinated and grew vigorously, none being deformed (Table 2).

It is evident from results with this species of clover that the seeds were relatively resistant to 2,4-D while dormant, but

TABLE 2

PERCENTAGES OF EMERGENCE OF SUBTERRANEAN CLOVER (*Trifolium subterraneum*) IN UNTREATED SOIL (U) AND IN SOIL TO WHICH 2,4-D WAS ADDED IN AMOUNTS EQUIVALENT TO 4 POUNDS/ACRE (T)

Replications	7 days at 20°C.		11 days at 20°C.		19 days at 30°C.; 3 days at 20°C.		19 days at 30°C.; 9 days at 20°C.	
	U	T	U	T	U	T	U	T
1	76	0	100	48	88	68	88	80
2	72	0	100	32	44	76	80	88
3	80	0	92	48	48	68	88	80
4	64	0	92	48	44	24	96	96
5	64	0	100	32	92	84	96	80
Average	71	0	97	42	63	64	90	85

became extremely sensitive to the acid after the seed coats were broken and the seeds began to germinate. Mustard seeds likewise proved to be relatively insensitive to 2,4-D when the compound was applied to the resting seed. Mustard seeds in later stages of germination were extremely sensitive to the compound. It is indicated on the basis of these results that 2,4-D is likely to be most efficient as a preplanting soil treatment for killing seeds of obnoxious plants if applied at a time when the greatest number of such seeds are germinating.

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Inactivation of Certain Neurotropic Viruses *in Vitro* by Serum Lipids

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The inactivation of viruses by some lipids, particularly fatty acids and their soaps, is well known (*1*) and has been attributed generally to the surface action of the chemicals. While investigating various aspects of the neutralization test with neurotropic viruses, a slight but definite and reproducible reduction of the titer of the viruses was noted when the latter were incubated with clear sera deriving from several normal animal species, as compared with that shown by viruses in buffered saline solution controls. Moreover, the lipid fraction obtained from such sera either by acetone-ether or by hot alcohol extractions, emulsified in buffered saline solution and added to a virus suspension, induced rapid and pronounced reduction in titer—a drop of .01 to .0001 within 5 minutes.

The test was carried out by mixing equal volumes of a 1:500 suspension of infected mouse-brain in buffered saline solution and of the emulsion of lipid; as a control, a similar mixture was used in which buffered saline solution substituted for the emulsion of lipid. The pH was maintained at 7.0–7.2. The mixtures were then placed in a water bath at 37°C., portions being removed at intervals from 5 minutes to 24 hours and titrated in mice by means of intracerebral injection. Serum lipids from

TABLE 1

INTRACEREBRAL TITER OF JAPANESE B ENCEPHALITIS VIRUS FOLLOWING INCUBATION AT 37°C. IN THE PRESENCE OF LIPIDS

Test	Virus suspended in:	Length of incubation			
		5 min.	4 hr.	8 hr.	24 hr.
1	Buffered saline (control)	$10^{-3.3}$	$10^{-3.3}$	$10^{-3.5}$	$10^{-3.5}$
	Horse serum lipids	$10^{-5.8}$	$10^{-3.3}$	$<10^{-2.5}$	$<10^{-2.5}$
2	Buffered saline (control)	$10^{-3.7}$		$10^{-3.5}$	$10^{-7.2}$
	Egg-yolk lipids	$10^{-3.3}$		$10^{-3.3}$	$10^{-6.3}$
	Human brain lipids	$10^{-7.6}$		$10^{-6.0}$	$10^{-5.0}$

mice, hamsters, rabbits, and horses, have been found active; for practical reasons horse serum has been used extensively. The viruses thus far tested with similar results were those of St. Louis, Russian Far East, and Japanese B encephalitis. Test 1 (Table 1) shows a typical experiment.

The viral inactivation took place in the presence of serum protein at 2–4°C., although more slowly, and the inactivating agent was not dialyzable and withstood heating at 99° C. for 1 hour. There was no correlation between the change in surface or interfacial tension brought about by the lipid and the degree of viral inactivation.

Fractionation of serum lipids by using several solvents showed that when serum was extracted in succession with acetone, ether, and hot ethyl alcohol-ether, each extract was effective in inactivating virus. Lipids from other animal sources have been tested. Whole lipids obtained from egg yolk were not effective even after 24-hour incubation; those deriving from brain showed only a moderate activity (Test 2). On frac-

tionation of the brain lipids, the acetone fraction had a marked inactivating action as well as a low surface tension; the ether and hot alcohol-ether fractions were only moderately active, irrespective of surface tension.

The inactivation of neurotropic viruses by serum lipids is now being investigated in connection with (a) the mechanism, including influence of the degree of dispersion, and closer identification of the active agent; (b) the bearing of the results on the neutralization test as it is now carried out; and (c) its possibilities as the basis for chemotherapy of experimental infections.

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The Abundance of Thallium in the Earth's Crust

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The most generally accepted value for the abundance of thallium in the earth's crust is that given by Goldschmidt (*2*) as 0.00003 per cent Tl, by weight.

Although analytical data on the abundance of thallium in rocks are very meager (most analyses for thallium are confined to pegmatitic minerals), it should be possible to make a reasonably accurate estimate of its abundance in the earth's crust as a result of its close association with rubidium in minerals. It has been shown (*1*) that, with the exception of some sulfide minerals where thallium alone may be present, rubidium and thallium are confined essentially to potassium minerals and the cesium mineral, pollucite, and that in these the ratio Rb/Tl varies relatively slightly from area to area and is independent of the type of potassium host mineral (mean weight ratio per cent Rb/per cent Tl = 100). A plot of log per cent Rb_2O vs. log per cent Tl_2O for about 170 mineral specimens so far investigated, covering a thousand-fold concentration range, shows that throughout this range a straight line of unit slope accommodates the plotted points most satisfactorily. Consequently, one may infer that in the earth's crust as a whole the ratio Rb/Tl may be regarded as equal to about 100.

The value of the abundance of rubidium (0.03 per cent Rb) given by Goldschmidt (*2*) is probably reasonably accurate, although this value might be altered slightly because of several relatively recent rubidium determinations on rocks; hence the abundance of thallium in the earth's crust is 0.03/100 = 0.0003 per cent. One may infer, therefore, that the older value (0.00003 per cent) is low by a factor which may be as high as about 10.

It may be noted that, as mentioned above, thallium has a dual geochemical behavior and is usually present as a trace in many sulfides. In comparison with the quantity of thallium in the vast amounts of potash minerals, however, the thallium contained in relatively small quantities of sulfide minerals is probably insignificant; if significant, its presence in sulfide minerals would tend to increase the factor of 10 referred to above.

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Reaction of Certain Plant Growth Regulators With Ion Exchangers

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Several investigators have reported that 2,4-D and certain other plant growth regulators may be readily leached from some soils (*2, 3, 5*). The fact that large volumes of water did not always completely remove the 2,4-D would indicate that some of the compound may be adsorbed by the soil. It was recently shown that 2,4-D is inactivated by adsorption on charcoal (*4*).

The degree of adsorption of several plant growth regulators by certain ion exchange materials and the readiness with which the compounds are eluted after having been adsorbed are reported here.

The cation exchangers used were a resin exchanger, Amberlite IR-100,[1] a carbonaceous exchanger, Zeo-Karb H, a synthetic sodium alumino-silicate, Decalso, and a processed glauconite, Zeo-Dur. The anion exchangers were the amine resins, Amberlite IR-4B and De-Acidite.

All cation exchangers were screened −20 + 40 mesh. IR-100 and Zeo-Karb H were treated with a number of portions of 5 per cent hydrochloric acid, with frequent stirring, for a period of 48 hours; Decalso and Zeo-Dur, with several changes of 4 per cent sodium or calcium chloride over a period of 24 hours. After the materials were thoroughly washed with distilled water they were dried in an oven at 40°C. The anion exchange materials were prepared by stirring the samples with portions of 5 per cent sodium carbonate over a 24-hour period, washing, and then drying for about 5 hours at 40°C.

Six plant growth regulators were used for experimentation: 2,4-dichlorophenoxyacetic acid (2,4-D), ammonium 2,4-dichlorophenoxyacetate ($NH_4$2,4-D), cupric 2,4-dichlorophenoxyacetate [Cu(2,4-D)$_2$], calcium 2,4-dichlorophenoxyacetate [Ca(2,4-D)$_2$], 2,4,5-trichlorophenoxyacetate (2,4,5-T), and isopropyl N-phenylcarbamate (IPPC). The 2,4-D was purified by running it through several salt-acid cycles. Cu(2,4-D)$_2$ was prepared by reacting an excess of an aqueous solution of $NH_4$2,4-D with a solution of cupric chloride, and then washing the precipitate of Cu(2,4-D)$_2$ free of ammonium chloride. Ca(2,4-D)$_2$ was made by adding calcium chloride to an aqueous solution of $NH_4$2,4-D. The spectrophotometric method developed by Bandurski (*1*) was employed to measure the compounds in solution.

Static trials were divided into two types: (1) those in which it was determined how much of a compound an exchanger material removed from a solution, and (2) those in which elution of regulators from exchangers was studied.

In static trials 0.5-gram samples of the exchanger were placed in 250-ml. Erlenmeyer flasks. Fifty ml. of the appro-

[1] The Amberlites were obtained from the Resinous Products and Chemical Company and other exchangers from the Permutit Company.