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.

priate solutions were then pipetted into the flasks, which were then stoppered and allowed to stand for 48 hours, with frequent shaking. At this time the concentrations of the growth regulator in the supernatant liquid were determined, and the amounts of compound adsorbed or eluted calculated.

In elution studies the regulators were dissolved in 95 per cent ethyl alcohol and shaken with the exchangers for about 30 minutes. The alcohol was then evaporated by placing the container in a circulating oven at about 70°C. The growth regulators were also added to exchanger materials by shaking the exchangers with aqueous solutions of the compounds. The amount of regulator adsorbed by the exchanger was calculated by measuring the decrease in concentration of the compound in the supernatant liquid.

however, adsorbed less $Cu(2,4\text{-}D)_2$ than 2,4-D, $Ca(2,4\text{-}D)_2$, or $NH_42,4\text{-}D$. These results indicate that when 2,4-D or its salts are added to soils in chemically equivalent quantities, equal amounts of the anion might be adsorbed by the soil. This might not hold true in soils containing anion or acid exchanging materials. IR-100 H adsorbed less 2,4,5-T than 2,4-D or its salts, but adsorbed much more IPPC. With the anion exchanger the situation was reversed.

It was determined that IPPC was strongly adsorbed by IR-100 in the hydrogen, sodium, or calcium cycle, while 2,4-D was strongly adsorbed only by the resin in the hydrogen cycle. Much less 2,4-D was adsorbed by Amberlite IR-100 H when the pH of the solution was 3.3 than when it was 2.5 or lower. Perhaps acidic soils would have higher adsorptive capacities

TABLE 1

ADSORPTION OF PLANT GROWTH REGULATORS BY EXCHANGER MATERIALS*

Compound	Exchanger																	
	IR-100 H			Zeo-Karb H			Decalso			Zeo-Dur			De-Acidite			IR-4B		
	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed	Micro eq. adsorbed	Mg. adsorbed, ½ gram oven-dry exchanger	% adsorbed
2,4-D	5.78	1.46	51.1	11.0	2.58	97.3	00	00	00	00	00	00	5.23	1.83	46.2	9.05	2.53	80.0
$NH_42,4\text{-}D$	5.97	1.62	52.8	11.0	2.78	97.3	00	00	00	.16	.041	1.41	5.08	1.91	44.9	8.45	2.55	74.7
$Cu(2,4\text{-}D)_2$	5.72	1.64	50.6	11.0	2.93	97.3	00	00	00	.01	.003	0.09	3.42	1.36	30.2	7.70	2.46	68.1
$Ca(2,4\text{-}D)_2$	6.13	1.68	54.2	11.1	2.82	98.1	.27	.70	2.39	.18	.047	1.59	5.49	2.08	48.5	8.60	2.62	76.0
2,4,5-T	4.77	1.39	42.2	11.0	2.98	97.3	00	00	00	.73	.201	6.45	6.17	2.49	54.6	9.21	2.99	81.4
IPPC	8.70	1.78	76.9	11.2	2.13	99.0	.45	.87	3.98	.43	.083	3.80	1.03	0.29	9.1	5.47	1.24	48.4

* Each figure is average of 3 replicates.

Pyrex glass tubes about 40 mm. in diameter and 25 cm. in height were used for studies of leaching. The tubes were tapered at the lower end so that the lower 5 cm. was about ¼ inch in diameter. The exchanger beds, which were about 10 cm. in height, were supported by a plug of glass wool at the point of constriction of the tube. A reservoir of liquid could be maintained above the exchanger material. A piece of rubber tubing about 1½ inches long and with a screw-type clamp was fitted over the lower end of the leaching tube.

After the exchanger material was placed in the tube, distilled water was slowly forced into the lower end until the level of water reached the top of the exchanger bed, after which the screw clamp was closed. This backwashing was necessary in order to prevent presence of air pockets in the bed. After the bed was allowed to stand for 15 minutes, 55 ml. of distilled water was added above it. The screw clamp was then opened so that a slow drip rate was obtained which allowed 55 ml. of water to leach through in about 45 minutes.

The relative adsorptive capacities of 6 exchanger materials for 6 plant growth regulators were studied. Aqueous solutions of 0.000226 normality of 2,4-D (50 ppm), $NH_42,4\text{-}D$, $Cu(2,4\text{-}D)_2$, $Ca(2,4\text{-}D)_2$, 2,4,5-T, and IPPC were prepared. IPPC was considered to have a valence of 1. Fifty ml. of these solutions was added to 0.439-gram samples of IR-4B or 0.5-gram samples of all other exchangers. The data in Table 1 indicate that IR-100 H and Zeo-Karb H adsorbed much of the growth regulators, while the Decalso and Zeo-Dur adsorbed little or none. IR-100 H adsorbed almost equal micro equivalents of 2,4-D and its salts. De-Acidite and IR-4B, for 2,4-D than alkaline soils. The amount of 2,4-D adsorbed by ion exchangers from solutions varying in concentration from 20 to 200 ppm was about directly proportional to the concentration of the 2,4-D in the initial solution.

Less elution of 2,4-D from Amberlite IR-100 H was caused by 0.75 N solutions of NaCl, $CaCl_2$, or $AlCl_3 \cdot 6H_2O$ than by water (Table 2). Similar results were obtained with solutions containing anions of three different valences. IPPC, however, was eluted from IR-100 H by NaCl solution. Hydrochloric acid readily eluted 2,4-D from the acid exchangers IR-4B and De-Acidite. These data suggest that much of the 2,4-D in soil remains adsorbed and not subject to leaching.

TABLE 2

ELUTION OF 2,4-D FROM 0.5-GRAM SAMPLES OF IR-100 H BY WATER AND 0.75 N SOLUTIONS CONTAINING A MONO-, DI-, OR TRIVALENT CATION

Solution	2,4-D eluted	2,4-D eluted
	(mg.)	(%)
water	0.685	45.7
HCl	0.720	48.0
NaCl	0.335	22.3
$CaCl_2$	0.370	24.7
$AlCl_3 \cdot 6H_2O$	0.436	29.1

Comparative rates of leaching of 2,4-D, $NH_42,4\text{-}D$, $Cu(2,4\text{-}D)_2$, 2,4,5-T, and IPPC from beds of Decalso and Zeo-Dur about 10 cm. in height were studied. One-hall or more of all the compounds were usually leached from the exchanger

materials by 55 ml. of water, and the compounds were usually removed in about the same amounts. The relatively soluble $NH_4$2,4-D was not removed in greater quantities than 2,4-D, which is of much lower solubility. It seems probable that in a soil 2,4-D or a relatively insoluble 2,4-D salt might be converted to soluble forms by ammonium, sodium, or other ions present in the soil solution.

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Granulosa Cell Tumors in Intrapancreatic Ovarian Grafts in Castrated Mice[1]

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Biskind and Biskind (*1*) reported that granulosa cell tumors have developed in ovaries transplanted into spleens of three castrated female rats. Our previous experiments showed the formation of granulosa cell tumors and luteomas in intrasplenic ovarian grafts in castrated male and female mice (*3*). These studies were based on two principles: (1) the capability of the liver to inactivate ovarian hormones when the hormones circulate through the hepatic portal system, and (2) the increase of pituitary gonadotropins subsequent to castration. It was assumed that the prolonged stimulation, by augmented amounts of gonadotropic hormones, of intrasplenic ovarian grafts was responsible for the neoplastic growths. More recent investigations (*2*) revealed that the development of ovarian tumors in intrasplenic ovarian grafts was inhibited by administration of estradiol benzoate and testosterone propionate. The malignancy of the induced granulosa cell tumors was indicated by the ability to metastasize and to transplant in new hosts. The present experiment, using intrapancreatic ovarian transplantation in castrated mice, demonstrates that splenic tissues do not play a direct role in the pathogenesis of ovarian tumors arising in the grafts.

Male and female mice of A, C_3H, CBA, and C_{57} strains and hybrid mice were used. These were castrated and received, at the same time, an autoplastic or homoplastic ovarian graft in the pancreas. Among the first group of 5 experimental animals, two granulosa cell tumors and one pretumorous growth were found 168 days after grafting. No tumor was noted in two grafts with vascularized adhesions that permitted drainage through other than the hepatic portal system. One tumorous graft in a male mouse (C_3H strain) was 7 x 8 x 10 mm. in diameter; the other, which developed in a female hybrid mouse (AC_3), measured 10 x 11 x 13 mm. in diameter. The uterus of the latter animal weighed 75 mg. at autopsy. The pretumorous graft occurred in a male mouse of the A strain.

Microscopically, the granulosa tumor cells were arranged in a folliculoid pattern showing numerous mitotic figures. Some of the folliculoid structures contained hemorrhagic cavities. Luteinized cells and small necrotic areas were present, and a spicule of bone was observed at the periphery of one tumorous ovarian graft. Major portions of the tumors were separated from the pancreatic tissue by bursa-like spaces lined by germinal epithelium. No metastasis was observed in the liver. The pretumorous graft showed masses of tubular ingrowths from the germinal epithelium, and the transformation of some of the epithelial cells into granulosa tumor cells was noted. Thus, the morphology of granulosa cell tumors induced in the pancreatic site resembled that of the tumors developed in intrasplenic ovarian grafts. The present experiments are interpreted to substantiate further the assumption that overaction of gonadotropic hormones is responsible for the development of the ovarian tumors in mice.

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Differential Phytotoxicity of Metabolic By-Products of *Helminthosporium victoriae*[1]

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The "*Helminthosporium* blight" of oats caused by *H. victoriae* Meehan and Murphy has developed so rapidly that it has attained the proportions of a major plant disease within two years after its discovery. Susceptibility is apparently limited to oat varieties and selections that possess the "Victoria-type" resistance to crown rust (*Puccinia coronata avenae* (Corda) Eriks. & E. Henn.). The unusually fast build-up of the disease has been facilitated by the widespread planting of large acreages to susceptible varieties.

The means by which *H. victoriae* causes necrosis has been the subject of some speculation. In a previous article (*2*) the suggestion was made that the pathogenic action of this fungus involves the production of a toxic substance. Inoculation tests with sterilized mycelium and filtered extracts from cultures have given evidence that a very potent toxin is secreted by the fungus, which is responsible for the characteristic longitudinal foliar striping or discoloration. Data regarding its production and effects are briefly summarized in this paper.

Evidently the basal infection of the oat plant is the only direct manifestation of parasitic action by *H. victoriae*, since the organism has not been isolated from the blighted leaves until after complete necrosis of the tissue. It may be that this

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