corresponded approximately to that for a man in a suit (0.28 square foot/kg) so that about 560 mg of γ isomer were in the cloth/kg of body weight. Table 2 indicates the results.

The symptoms of animals affected, whether by direct skin application or by wearing of impregnated suits, were those typical after parenterally administered GBH: weakness, sometimes flaccid paralysis, and finally periodic convulsions, generally leading to eventual death. The observation period was one week or longer.

In both types of experiments it was evident that, of the species tested, rabbits are most sensitive and guinea pigs least sensitive to cutaneously applied GBH.

Chemical determinations (*3*) of the total loss of hexachlorocyclohexanes from the impregnated suits of rabbits showed the following averages: 17% after one wearing, 23% after two wearings, and 36% after three launderings and no wearings.

While it seemed unlikely that any of the affected animals could have absorbed GBH from a route other than the percutaneous, particularly since at no time was it observed that the clothed animals or the unclothed restrained animals were able to ingest the substance by licking, it was, nevertheless, desirable to rule out inhalation as a possible route of intoxication. Therefore, two rabbits were left for a week in cages with minimal openings and with walls covered by GBH-treated cloth behind a screen, the surface area of the cloth being large enough to produce at room temperature as much vapor as would be given off by an impregnated rabbit suit at body temperature. During an observation period of 10 days, no ill effects were noted. A third rabbit, clothed in a GBH-treated suit, confined in a rabbit box permitting body movement, and placed in a ventilated hood so that vapor could not be inhaled, died within 24 hrs.

Further evidence for the unimportance, in these studies, of inhalation as a toxic route is given by the following experiment: Inasmuch as it was suspected that movement might be significant in bringing about greater absorption through the skin, three rabbits in GBH-treated suits (see Table 2) were confined, in a ventilated hood, in small wire cages permitting the minimal amount of movement consistent with normal respiratory function. After confinement for 96 hrs, only one rabbit had exhibited typical symptoms followed by death, which occurred shortly before it was removed from the cage. The other two, however, began to develop symptoms soon after removal from their cages and eventually died. Since bodily motion seemed to contribute to an increased rate of absorption of GBH in the clothed animals, it is presumed that movement brings about flaking of the small crystals from the fibers and, through chafing by the clothing, causes them to be worked into the skin.

The work of others on the toxicity of GBH to rabbits shows that only small amounts would have to be absorbed to produce symptoms: the acute i.v. LD_{50} is about 4 mg/kg (*5*), while during a 3-week period of daily inunction of the γ isomer in dimethyl phthalate, symptoms occurred with daily doses of 20 mg/kg (*2*). In wearing tests on rabbits with cloth freshly impregnated with acetone at 2.0, 4.0, and 8.0 gm of GBH/square foot, typical symptoms, including convulsions, occurred (*2*).

In conclusion, it may be stated that the effective insecticidal component of hexachlorocyclohexane, the γ isomer, appears to be sufficiently hazardous to some mammals to warrant the utmost caution in its use as a miticidal impregnate at 2 gm/square foot in human clothing. Even at 64% of this concentration, suits were lethal to 4/4 rabbits in 72 hrs. Unless it can be shown that man is markedly more resistant than the rabbit, it is probable that γ-benzene hexachloride can be used safely as an impregnate only at concentrations so low as to eliminate any advantages it might otherwise offer in insecticidal effectiveness and durability over other compounds currently under test.

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Inactivation of 2,4-D on Sweet-Potato Slips With Activated Carbon[1]

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A recent article by Lucas and Hamner (*1*) on the inactivation of 2,4-D in cleaning knapsack sprayers with activated carbon suggested the possible use of this material to protect sensitive field crops from 2,4-D injury.

In order to test the above use, two field experiments were conducted with Unit 1 Porto Rico sweet-potato slips, one on Leeper clay at State College, Mississippi, and one on Sarpy sandy loam at Stoneville, Mississippi.

The soil, which received normal seedbed preparation, was treated with the sodium salt of 2,4-D immediately before planting. The concentrations used were 1,000 and 4,000 ppm (free acid equivalent) at State College, and 1,000, 2,000, 3,000, and 4,000 ppm at Stoneville. The solutions were applied with 3-gal compressed air sprayers at the rate of 155 gal/acre.

One-half of each plot was planted with untreated sweet-potato sprouts and the other half with sprouts, the roots of which were first moistened and then dusted with activated carbon (Norit A, about 1 lb/1,000 sprouts). The treatments were replicated four times at State College and three times at Stoneville.

The results of these tests are shown in Tables 1 and 2. The data show that activated carbon used in this manner minimized the injury to the sprouts from 2,4-D. The treated sweet-potato plants growing in soil previously

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treated with 2,4-D at 1,000 ppm appeared normal in every respect. The yield of sweet-potato roots for the treatments that received activated carbon were as follows for the test conducted at Stoneville, Mississippi: Ck, 319 bu; 1,000 ppm, 324 bu; 2,000 ppm, 298 bu; 3,000 ppm, 246 bu; 4,000 ppm, 234 bu. The yields were not definitely affected except in the manner in which 2,4-D influenced plant survival. The weeds were controlled by cultivation in this test. At the same time, this concentration of 2,4-D controlled annual weeds, such as crabgrass (*Digitaria sanguinalis*), pigweed (*Amaranthus retroflexus*), bindweed (*Convolvulus* sp.), spurge (*Euphorbia* sp.), and others, at State College, Mississippi, and in tests on other crops at Stoneville, Mississippi.

TABLE 1

EFFECT OF ACTIVATED CARBON ON THE SURVIVAL OF SWEET POTATOES AT STATE COLLEGE, PLANTED ON LEEPER CLAY SOIL PREVIOUSLY SPRAYED WITH VARYING RATES OF 2,4-D

Free-acid equivalent of 2,4-D		Survival of original planting (%)*	
Concentration of solution (ppm)	Lbs/acre	Activated carbon treatment	Untreated
0	0.0	100.0	93.0
1,000	1.3	95.0	2.5
4,000	5.2	32.0	0.0

* Average of 4 replications; 10 plants per plot; planted May 16, 1947; survival readings taken June 30, 1947.

TABLE 2

EFFECT OF ACTIVATED CARBON ON THE SURVIVAL OF SWEET POTATOES AT STONEVILLE, PLANTED ON SARPY SANDY LOAM PREVIOUSLY SPRAYED WITH VARYING RATES OF 2,4-D

Free-acid equivalent of 2,4-D		Survival of original planting (%)*	
Concentration of solution (ppm)	Lbs/acre	Activated carbon treatment	Untreated
0	0.0	70.0	75.0
1,000	1.3	78.0	5.0
2,000	2.6	70.0	1.7
3,000	3.9	62.5	0.0
4,000	5.2	28.3	0.0

* Average of 3 replications; 20 plants per plot; planted May 27, 1947; survival readings taken July 2, 1947.

The sweet potato plants that survived the heavy (4,000 ppm) treatment were dark green, and some of the leaves showed abnormalities.

The above data indicate that activated carbon may be used to protect certain crop plants against the effect of 2,4-D when the latter has been applied to the soil as a pre-emergence herbicide.

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Studies on Radiosensitivity of Cells[1]

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It has been commonly believed that the sensitivity of mammalian cells to ionizing radiations is proportional to cell activity in terms of mitotic proliferation—the more active the proliferation, the more sensitivity. An increased erythropoiesis can be initiated in the laboratory animal by phlebotomy or by the hemolytic action of acetyl phenylhydrazine on the circulating erythrocytes. These procedures made possible an experiment designed to compare the vulnerability to irradiation of the highly sensitive erythrocyte precursors existing in the normal hemopoietic tissue of rabbits with those in hemopoietic tissue of rabbits which have an induced hyperplasia of erythrocyte precursors (Table 1). The effect of 800 r

TABLE 1

PREPARATION AND TREATMENT OF ANIMALS

Phenylhydrazine Experiment			
Group	Phenylhydrazine subcutaneously	X-ray	No. of animals
I	None	None	10
II	*ca* 35–40 mg	800 r	28
III	None	800 r	16
IV	*ca* 35–40 mg	None	16
Blood Withdrawal Experiment			
Group	Blood removed	X-ray	No. of animals
V	None	None	10
VI	*ca* 90 cc	800 r	15
VII	None	800 r	15
VIII	*ca* 90 cc	None	10

whole-body X irradiation upon animals that have a previously induced regenerative anemia was compared with the effect of this same dose on normal animals of comparable age and weight. Determinations of the erythrocytes and reticulocytes/cu mm and hemoglobin in grams/100 ml are recorded in Figs. 1, 2, and 3. The normal irradiated animals developed an anemia that reached a maximum at 14 days. The animals in which a regenerative anemia had been produced prior to irradiation with

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