tinued 14 days after challenge for a total of 17 daily doses. Since clinical observations would not permit clear-cut differentiation between poliovirus infection and drug toxicity, the evaluation of the results was based upon the histopathological analysis of spinal cord and brain stem sections. There is an indication that both drugs were effective in decreasing the incidence of disease in the polio-infected monkeys, although the activity was seen only at marginal toxic levels.

It is significant that, in additional experiments in which the drugs were administered intramuscularly to monkeys at near toxic levels, no sparing effect similar to that seen with oral treatment was noted. In a limited study the activity of the drugs was not altered or enhanced by the oral administration of these compounds in divided dosages when compared with the same total dose at a single daily interval.

The evidence indicates that the effective agent is guanidine itself and not a derivative. Chromatographic studies were used to follow the fate of 2-C^{14} guanidine hydrochloride when it was administered orally in mice. The animals were given radioactive guanidine corresponding to 20 μc of activity, and then samples of blood, feces, and urine were taken at various intervals after administration of the compound. Two-dimensional paper chromatograms were prepared, and autoradiograms showed that the drug was adsorbed and excreted rapidly as unaltered guanidine with the urine containing many times more guanidine than either blood or feces. There was no apparent conversion of guanidine to other compounds.

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6 March 1961

Foliar Retention of Strontium-90 by Wheat

Abstract. Wheat harvested from the University of Maryland Agronomy Farm in June 1959 contained 20 to 50 micromicrocuries of strontium-90 per kilogram of grain. More than 90 percent of the strontium-90 came from deposition on aboveground plant parts, and less than 10 percent was taken up through the soil. About 1 to 2 percent of the strontium-90 fallout during the time the heads were exposed was retained in the grain.

In order to further understanding of the mechanisms contributing to strontium-90 contamination of plants, Russell (*1*) has suggested the consideration of two components, one of which is absorbed through leaves, stems, and surface roots after lodging on them. The other component is absorbed through roots after incorporation into the soil. Specific activity measurements are helpful in separating the two components under natural fallout conditions, since the Sr^{90} deposited in fallout is essentially carrier-free, while that which is incorporated into the soil is diluted by the exchangeable strontium in the soil.

Specific activity determinations were made on four samples of mature winter wheat plants collected on 17 and 18 June 1959 from the University of Maryland Agronomy Farm, Beltsville, Md. Three samples were of the Leapland variety and one of Knox. The plants were separated into chaff, grain, leaves, stems, and roots, the roots being obtained from the surface 4 in. of soil and thoroughly washed with tap water to remove the soil adhering to them. The samples were dry ashed and dissolved in HCl. Calcium was determined in a small portion of the sample by titration with ethylenediaminetetraacetic acid, following double precipitation as calcium oxalate to remove interfering amounts of phosphate. Strontium was determined in the same portion by flame photometry. Strontium-90 was determined in the main part of the sample by separating and counting its radioactive daughter yttrium-90 (see Table 1).

The flame photometric strontium determination was not sensitive enough to detect the strontium content of the grain. While each plant sample contained a total of 5 to 10 mg of strontium, the grain contained less than 0.15 mg of strontium. This is in the lower range of results reported by Duckworth and Hawthorn (*2*), who showed that the grain contained 2 to 5 percent of the total Sr^{89} taken up by wheat plants grown in sand culture. Our analyses showed much lower strontium-calcium ratios in the grain than in other parts of the plant, which indicates a marked discrimination

Table 1. Content of Ca, Sr, and Sr^{90} in wheat plants harvested on University of Maryland Agronomy Farm, 17 and 18 June 1959. Samples A, C, and D were Leapland variety; sample B was Knox variety.

Sample	Wt. (g)	Ca (g)	Sr (mg)	Sr^{90} ($\mu\mu$c)	Specific activity ($\mu\mu$c/mg)	Calculated Sr^{90} from the air (%)
			Chaff			
A	293	0.19	0.39	128	328	93
B	374	0.34	0.71	211	297	91
C	434	0.47	1.87	217	116	80
D	264	0.30	1.61	124	77	70
			Grain			
A	1029	0.44	<0.09	22	>245	>90
B	1515	0.66	<0.14	80	>570	>95
C	1666	0.73	<0.12	61	>510	>95
D	974	0.39	<0.08	28	>350	>93
			Leaves			
A	175	0.62	1.24	368	297	92
B	178	1.02	1.76	351	199	87
C	286	1.54	2.68	494	184	88
D	189	0.93	2.60	304	117	80
			Stems			
A	556	0.54	1.96	126	64	62
B	496	0.86	3.00	175	58	55
C	714	1.04	4.83	187	39	41
D	528	0.73	3.34	97	29	21
			Roots			
A	54	0.08	0.67	16	24	
B	63	0.14	0.95	25	26	
C	39	0.10	0.78	18	23	
D	59	0.11	0.77	18	23	

against strontium relative to calcium in the formation of wheat grain.

The specific activity of strontium was highest in the grain, and next highest in the chaff and leaves. It was about one-fifth as high in the stems and one-tenth as high in the roots. It is natural to assume that the specific activity of strontium in the roots equals that of strontium taken up from the soil. However, soil contamination on the root samples might lower the specific activity by adding stable strontium. On the other hand, since the root sample was taken near the surface, it is possible that its strontium would have a higher specific activity than the average for strontium taken up from the soil. These errors are expected to be small and they tend to offset each other. It is thought that the specific activity of strontium in roots gives a fairly good estimate of that taken up from the soil. This value was used in Table 1 to calculate the percentages of Sr^{90} absorbed through the aboveground parts.

All exposed parts showed a major fraction of Sr^{90} deposited directly from the atmosphere. In the grain, over 90 percent of the Sr^{90} entered by deposition on exposed parts and less than 10 percent by way of the soil. Other data on fallout in Maryland (*3*) indicate that the soil level in March 1959 was about 80 μc of Sr^{90} per acre, and that fallout during April, May, and June was about 9, 3, and 3 μc/acre, respectively. Thus, fallout was about 15 μc/acre during the spring growing season and about 3 μc/acre during the time the wheat heads were exposed.

The retention of Sr^{90} fallout by wheat plants and grain may be estimated as follows. The average Sr^{90} content of the grain was 35 $\mu\mu$c/kg. Based on an estimated yield of 40 bu/acre, the Sr^{90} content of the grain averaged 0.038 μc/acre, of which more than 0.035 μc was direct deposition. Thus, the grain contained about 1 percent of the Sr^{90} deposited while the heads were exposed, and absorbed about 0.004 percent of that in the soil. Similarly, the whole crop contained 0.63 μc/acre, of which 0.49 μc was direct deposition. Thus, the whole crop retained about 3 percent of that deposited during the growing season, and took up about 0.2 percent of that in the soil (*4*).

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4. This report is a contribution from the Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Department of Agriculture. This research was supported by the U.S. Atomic Energy Commission. We appreciate this support and the cooperation of the University of Maryland in allowing the wheat samples to be taken.

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Single Unit Activity of Anterior Hypothalamus during Local Heating

Abstract. There are heat-sensitive units in the anterior hypothalamus which respond with an increase of discharge frequency to a rise in hypothalamic temperature of less than 1°C. The increase of unit discharge occurred in advance of the onset of polypnea, and the unit has little phasic response or after discharge, and shows little adaptation.

Hypothalamic involvement in the mechanism of body temperature regulation is now generally accepted. Numerous experiments have been done and most of them indicate that a thermally sensitive area is located in the anterior hypothalamus. By local radio-frequency heating of the ventral telencephalon, between the anterior commissure and the base of the brain, Magoun *et al.* (*1*) demonstrated a marked acceleration of respiratory rate and the appearance of sweat on the foot pads. Polypneic panting and cutaneous vasodilatation have also been induced in unanesthetized animals either by local electrical stimulation at 50 cy/sec (*2*) or by warm water circulation of the hypothalamus (*3*). With lesions in the anterior hypothalamus, animals do not react to a rise of environmental temperature (*4*). Electrophysiological approaches to the hypothalamic temperature-sensitive neurones have so far been rather limited. C. von Euler (*5*) recorded slow potential changes from the hypothalamus which correlated with the occurrence of heat polypnea and panting. In view of the above, an experiment was designed to record single neuron activity in the hypothalamus during local heating.

Cats were anesthetized with urethane in doses of 1.2 g/kg of body weight. (In some cases urethane itself induced polypnea for an hour or more.) Tungsten or steel electrodes, with exposed tips of about 1 μ, were inserted stereotaxically into the anterior hypothalamus. For radio-frequency heating, two thermodes, insulated except for 4 mm at the tip, were implanted in the brain substance to within 1 mm of the base of the skull at the level of the anterior commissure and 4 mm on either side of the mid-line. The frequency of the low-voltage heating current, applied to the hypothalamus through the two thermodes, was 3 Mcy/sec. The duration of stimulus was usually less than 3 min. Conductive warming with a water circulator (*3*) was also used.

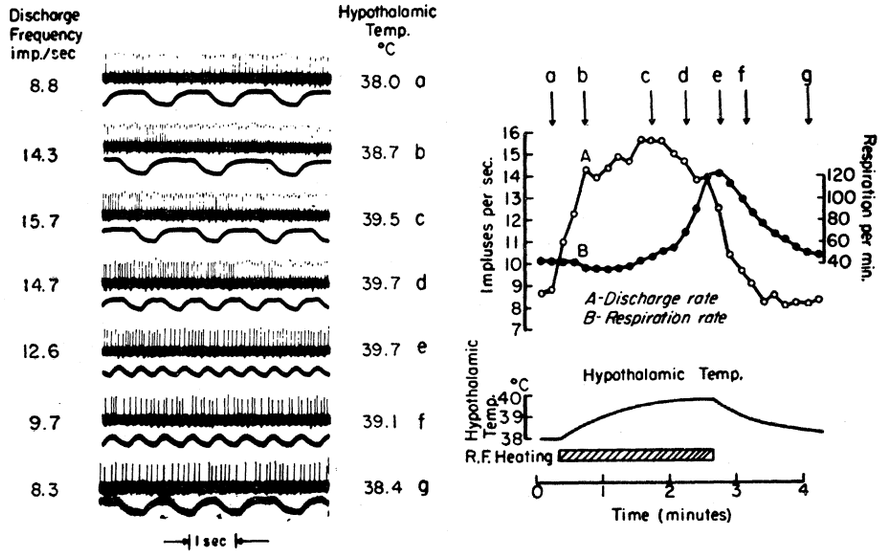

Fig. 1. Effect of local radio-frequency heating of the anterior hypothalamus on electric activity of single cell and respiration.