(*8*). This expectation was not borne out: within the age range tested, age did not appear to affect cholesterol levels. It will be necessary to extend the age range and to study more strains of mice before a definitive statement concerning the age variable can be made. As in all cases where the result takes on the form of "no difference," special caution is necessary before any generalizations are made (*9*).

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References and Notes

1. R. P. Cook, Ed., *Cholesterol* (Academic Press, New York, 1958).
2. Committee on Standardized Genetic Nomenclature for Mice, *Cancer Research* **20**, 145 (1960).
3. W. T. Caraway and H. Fanger, *Am. J. Clin. Pathol.* **25**, 317 (1955).
4. Details of this procedure are described in *Technical Bull. No. 6077 C* of Beckman Instruments, Inc.
5. J. Mayer and A. K. Jones, *Am. J. Physiol.* **175**, 339 (1953).
6. C. Zomzely and J. Mayer, *Nature* **182**, 1738 (1958).
7. K. J. Carpenter and J. Mayer, *Am. J. Physiol.* **193**, 499 (1958).
8. L. E. Schaefer, D. Adlersberg, A. G. Steinberg, *Circulation* **17**, 537 (1958).
9. This work was supported in part by a grant from the Cleveland Heart Society and by grant G-14410 from the National Science Foundation. While contributing to this research one of us (A.F.D.) was supported by cardiovascular training grant HT 5052 (C8) from the U.S. Public Health Service.

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Strontium-90 and Cesium-137 Absorbed by Rice Plants in Japan, 1960

Abstract. About 60 percent of strontium-90 contained in polished rice in 1960 is due to root absorption from soil. The amount of cesium-137 absorbed by rice plants directly from fallout during the period between ear-shooting and harvest is assumed to be about 20 percent of total cesium-137 in the plant.

Numerous studies have been focused on the problem of the relationship between fallout rate and plant contamination (*1*). In order to investigate the mechanism of radioactive strontium and cesium contamination of rice, which is consumed in great quantity in Asian countries, samples of rice plants growing in the autumn of 1960 were analyzed for Sr^{90} and Cs^{137} (*2*). For comparison, groups of rice plants were covered with polyethylene sheets during the period between ear-shooting and harvest, in order to eliminate floral absorption of current fallout activity. Contents of Sr^{90} and Cs^{137} were determined for plants in the open and for those under cover. The results are summarized in Table 1.

First-harvest lowland rice was kept under cover from 10 August until 1 October. Second-harvest samples were covered from 1 October until 7 November. Fallout rates of Sr^{90} during August, September, and October 1960 were 0.020, 0.062 and 0.031 mc/km² month (*3*). The fallout rates of Cs^{137} in October and November were 0.136 and 0.095 mc/km² month (*3*). The cumulative deposits of Sr^{90} and Cs^{137} were 20 and 55 mc/km² respectively. The annual rainfall is 1600 mm. The latitude is 35° 40′ N. Rice-paddy soil is an ordinary loam containing 0.25 percent calcium.

The ratio of the Sr^{90} content of polished rice in covered plants to that of control plants is 0.62. Therefore, about 60 percent of the Sr^{90} content of polished rice is assumed to have been absorbed from the soil, because strontium does not move readily from leaf to grain. In other words, the contribution of airborne seasonal fallout was about 40 percent of the total Sr^{90} contamination of polished rice. The data suggest that the Sr^{90} content of polished rice will be maintained at about 60 percent of the present level. It would decrease only at a very slow rate even if there were no more fallout.

Husks, bran, and leaves from covered plants have from 20 to 40 percent as much Sr^{90} as the same parts from control plants. These parts are more likely to absorb fallout directly, whereas the polished rice is protected by surrounding plant tissues.

Cesium-137 in covered and control samples of second harvest rice was analyzed by the dipicrylamine-cesium chloroplatinate method (*4*). The results (Table 2) show that the Cs^{137} content of the covered plants and of the control plants is almost the same. Cesium can be translocated easily from leaf to grain (*5*). Therefore, the Cs^{137} contents of polished rice, bran, and husks of covered samples did not reflect adequately a relationship between aerial and root absorption. In addition to Cs^{137} absorbed by the roots, the rice kernels contained Cs^{137} which had been deposited on leaves before the plants were covered, and which had then been translocated.

Table 1. Strontium-90 content (strontium units, micromicrocuries, or picocuries, of Sr^{90} per gram of Ca) of various parts of covered rice plants and controls. The rice is the lowland rice plant, which grows in a water paddy. The second-harvest rice plant grows rapidly, and permits two harvests a year.

Sample	First harvest		Second harvest	
	Control	Covered	Control	Covered
Leaf	60	43	71	29
Husk	216	82	286	53
Bran	254	90	245	46
Polished rice	53	33	24	15

Table 2. Cesium-137 content of rice plant (picocuries of Cs^{137} per kilogram of air-dried material).

Sample	Covered	Control	Covered / control
Leaf	370	440	0.8
Husk	116	144	0.8
Bran	287	389	0.7
Polished rice	27	24	1

For the whole rice plant, contribution of direct contamination from fallout during the period from ear-shooting to harvest (1 October to 7 November) is indicated as 20 percent of the total Cs^{137}. The plants were planted on 3 August; the growing period to the time of ear-shooting was about 2 months. The fraction of direct absorption of Cs^{137} from fallout activity which is transferred to cereal kernels has been considered by others to be proportionately greater because of the characteristic low availability of Cs^{137} once it is deposited in the soil. But in the case of lowland rice, there is higher availability of Cs^{137} from the paddy soil than from ordinary field soils. Paddy soil represents a special case because of its chemical characteristics when flooded (*6*).

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References and Notes

1. R. Ichikawa *et al.*, *Science* **133**, 2017 (1961); J. D. Burton *et al.*, *Nature* **185**, 498 (1960); R. G. Menzel *et al.*, *Science* **134**, 559 (1961); G. M. Milbourn *et al.*, *J. Nuclear Energy* **10**, 116 (1959); H. Reissig, *Kernenergie* **3**, 390 (1959); J. Rivera, *Science* **133**, 755 (1961).
2. Special thanks are due to the kind help of Messrs. Suzuki, Miwa, and Igarashi, research officials of Chiba Agricultural Research Station.
3. M. Izawa *et al.*, unpublished data.
4. N. Yamagata *et al.*, *Analyst* **85**, 282 (1960).
5. L. J. Middleton, *Nature* **181**, 1300 (1958).
6. K. Tenshō *et al.*, *Soil and Plant Food* **6**, 176 (1961).

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