from pheasant hens and turkey males were fertile, and of these 23 percent hatched. This indicates that, under favorable conditions, better results than those shown in Table 1 may be expected.

Early posthatching mortality in 1953 was high for hybrids out of pheasant female-turkey male crosses, with only one survivor; but posthatching mortality was low for hybrids out of the reciprocal cross, with five survivors. Differences in survival were apparently due to managerial factors. The hybrids were raised with mixed groups of young birds of several species and their hybrids. Under such conditions the small turkey-pheasant hybrids from pheasant eggs fared badly at first, while the larger hybrids from turkey eggs did better. Much of the later mortality was caused by severe pendulous crop, but several of the survivors were saved by surgical removal of the crop. Provision of adequate shade or prompt surgery would undoubtedly have saved most of the birds that died after they were a few weeks old.

The mature hybrids are intermediate in weight between the turkey and the pheasant. Their head furnishings resemble those of the pheasant; the skin on the sides of the head around the eye is partly free from feathers but otherwise the head and neck are feathered (Fig. 1). When not fully grown, the feathers on the head and neck of some hybrids have been observed to resemble those illustrated by Edwards (*7*). The tail feathers are intermediate in length. The plumage color of the hybrids from this particular cross (ring-neck pheasant and Bronze turkey) is dark brown shading to black, except on the wings, which are lighter.

Neither eggs nor semen were obtained from the year-old hybrids. Mating activity was not observed, although there was some brightening of the skin on the head of the males. Thus, these intergeneric hybrids, like those from the pheasant and domestic fowl, are apparently sterile. The survival of these pheasant-turkey hybrids has, however, been superior to that reported for domestic fowl-turkey hybrids (*5*, *6*), and is about equal to that of pheasant-domestic fowl hybrids.

Fig. 1. Head of a 6-mo-old hybrid out of a Bronze turkey female and a ring-neck pheasant male. Except for some variation in plumage color and area of featherless skin around the eye, it is typical of both sexes from this and the reciprocal cross.

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Leukemogenic Effects of Ionizing Radiation on Atomic Bomb Survivors in Hiroshima City

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Following the explosions of the atomic bombs in Japan, a great increase in leukemia was reported among survivors (*1*). However, statistical confirmation of the high incidence of leukemia was not possible because of the unusual distribution of survivors by age and sex. During 1953, additional cases of leukemia appeared among the survivors. Using these new cases, an analysis was carried out that established statistical evidence of the leukemogenic effects of atomic irradiation on man (*2*). The 98,000 survivors in Hiroshima City, and the 50 verified cases of leukemia occurring among them, were distributed according to distance from the hypocenter. In addition, the survivors were further classified according to the degree of irradiation. Thus, individuals with a history of epilation, oropharyngeal lesions, or purpura were classified as heavily irradiated (severe radiation complaints); those without such complaints were considered lightly irradiated (no complaints).

Statistical tests carried out on the data appearing in Table 1 indicate the following. (i) A highly significant difference in incidence exists between survivors with serious radiation complaints and those with no complaints. Within each distance group, the incidence of leukemia is higher among the survivors with serious complaints. (ii) There is a significant difference in incidence among the distance groups. For each complaint group, the incidence of leukemia is highest among survivors exposed closest to the hypo-

Table 1. Incidence of leukemia in the Hiroshima survivors related to distance from the hypocenter and the presence of severe radiation complaints.

Distance from hypocenter	Population*			Cases of leukemia			Incidence		
	SRC†	NRC‡	Total	SRC	NRC	Total	SRC	NRC	Total
0– 999	750	450	1,200	14	1	15	1: 53	1: 450	1: 80
1,000–1,499	2,250	8,250	10,500	15	9	24	1: 150	1: 917	1: 438
1,500–1,999	1,750	16,950	18,700	3	2	5	1: 583	1: 8,475	1: 3,740
2,000–2,499	950	16,250	17,200	1	1	2	1: 950	1: 16,250	1: 8,600
2,500 and over	850	49,650	50,500	0	4	4		1: 12,412	1: 12,625
Total	6,550	91,550	98,100	33	17	50	1: 198	1: 5,385	1: 1,962

* Population estimated and rounded off to the nearest 50 persons. These population figures were based on the Commission's 1949 radiation census and the Japanese national census (1950). Numbers of survivors with severe radiation complaints were estimated from observations made by the Commission's genetics department on 19,675 Hiroshima survivors of childbearing age (*3*).

† SRC: severe radiation complaints (heavily irradiated).

‡ NRC: no radiation complaints (lightly irradiated).

center. (iii) No interaction of distance and radiation complaints is evident. That is to say, the difference in incidence between the complaint groups is not dependent on the distance from the hypocenter. (iv) A linear relationship appears to exist between the logarithm of the distance and the logarithm of the incidence of leukemia. This relationship is demonstrated by a downward slope that is significantly different from zero. (v) There is no reason to believe that a difference exists between the individual regression coefficients for the two complaint groups. Thus, the rate of decrease in incidence with an increase in distance is apparently the same for the two groups.

Further examination of the data indicates that (i) the incidence of leukemia is "high" at distances close to the hypocenter, regardless of the presence or absence of severe radiation complaints; (ii) the incidence of leukemia approaches the normal expected incidence at distances of 2500 m or more from the hypocenter.

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Communications

Pollen Profiles, Radiocarbon Dating, and Geologic Chronology of the Lake Michigan Basin

Wave action of the high-water stage of Lake Michigan during the past 3 yr cut deeply into flanking dunes along the eastern shore of the lake and did millions of dollars of damage to summer homes, bathing beaches, and scenic highways along the shore. Below South Haven, Mich., on the property of the summer camp operated by the Michigan Congregational Christian Conference, the waves uncovered a 30-in. layer of compacted peat perched on a 5-ft layer of sand and covered by a 25-ft dune.

The peat apparently accumulated in an interdunal pond whose bottom was sealed by an iron precipitation. The vertical cut of the peat permitted easy sampling at 1-in. intervals for pollen analysis. A trench dug to a depth of 75 in. into the sand underlying the compacted peat terminated in a basal layer of blue silt capped by a layer of wood. Samples were taken of the blue silt and of all narrow organic streaks that appeared in the 75-in. layer of sand. All samples contained sufficient pollen for a very satisfactory pollen analysis and determination of the forest history.

The 30 in. of peat record four major forest changes and an equal number of intermediate changes. The blue silt and the 75-in. layer of sand were deposited during a very prominent spruce-fir period (up to 94-percent spruce-fir pollen). The compacted peat began during the late spruce-fir period when pine showed aggressive participation in the forest cover. The succession of forests indicated in the pollen profile of the 30 in. of peat was spruce-fir-Jack pine to Jack pine-spruce-fir to Jack pine to Jack-white (red) pine (spruce and fir almost extinct) to white-red pine, to pine-oak-chestnut to oak-pine to oak-pine-hemlock-broadleaved forest.

The closing layers of the peat mark the beginning