Fankhauser (*2*) has pointed out, "In the thousands of experiments which have been performed up to the present time, not a single haploid animal has been raised to a stage approaching sexual maturity." He is referring, of course, to animals in which all individuals are normally diploid. Normal, mature, androgenetic haploids might be expected to occur in species with haploid males, such as bees or wasps. During many years of intensive breeding of the parasitic wasp *Habrobracon juglandis,* several hundred mosaic individuals have been found among which 11 only (*5*) have had regions which were unquestionably paternal in origin. Among the progeny from crosses of dominant females by recessive males (condition in which androgenetic males can be identified) only five males have been reported showing genetic traits exclusively paternal with no traces of mosaicism. None of these was given a breeding test. A sixth, with "glass" eyes, bred as "glass," showing the gonads to be derived from the sperm nucleus. Thirteen of these 17 individuals were produced by females of one stock, and none was found in crosses from the stocks used in this experiment. Spontaneous androgenesis is, therefore, very rare, even in a species with normal male haploidy.

In a recent experiment, unmated females of an inbred wild type stock of Habrobracon were heavily X-rayed,[2] then mated to untreated males with recessive mutant traits. The surviving progeny (from eggs treated in first meiotic prophase) included among the expected wild type males (haploid and maternal) and females (diploid and biparental) a few males normal in structure and behavior and with the recessive mutant traits (haploid and paternal). Breeding tests demonstrated that their gonads were also paternal in origin, and the use of body color differences helped to show that they were not mosaic. Their normal fertility was proof of their haploidy, since diploid males in this species are almost completely sterile. Table 1 summarizes the results.

The cytological phenomena underlying the production of these motherless males remain to be investigated. Two possibilities suggest themselves: (1) The irradiated maternal chromosomes may be retarded in movement and fail to reach the male pronucleus in time for first cleavage or, having reached it, are soon eliminated so that the haploid paternal chromosome complement forms the embryo. The observations of Packard and of Dalcq demonstrate this type of behavior. (2) The fusion nucleus may fail to function, hampered by its irradiated chromatin, and, when dispermy occurs, the free sperm may form the embryo.

In egg X-rayed with lethal dose (*ca.* 45,000 r) and allowed to develop parthenogenetically, about 1.1 per cent die at first cleavage, while the remainder develop well beyond this stage, often to blastoderm. In normal eggs about 1 per cent show dispermy. Either of these facts would seem to limit the production of androgenetic males to about 1 per cent, but survival percentages may not be dependable criteria of modes of origin because of differential viability.

TABLE 1

Dose in r units	Number females treated	Progeny			
		Wild type males	Wild type females	Recessive males	Per cent androgenesis
28,000	378	82	341	15	4.21
29,300	43	8	10	3	23.07
42,000	202	1	7	1	12.50
Controls ..	17	160	467	0	0.0

The production of these normal, sexually mature individuals from the sperm nucleus is of theoretical interest from two aspects. It adds evidence to a concept which now seems to need little—that hereditary traits are carried by the nucleus—and appears to strengthen the point of view that X-ray injury, at least up to lethal dose, is directly chromosomal, since untreated chromosomes can function normally in the heavily treated cytoplasm of an egg whose own chromosomes are so seriously injured as to be unable to function.

[2] By L. R. Hyde at the Marine Biological Laboratory, Woods Hole, Massachusetts.

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Diabetes Produced by Feeding Alloxan to Cats[1]

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It is well established that diabetes may be experimentally induced in animals by *injection* of an appropriate amount of alloxan solution intravenously, intraperitoneally, intramuscularly, or subcutaneously. In studying the introduction of alloxan into the alimentary canal without subjecting the animal to the effect of an anesthetic or an operative procedure, we have discovered that diabetes can be produced by *feeding* alloxan to cats. Furthermore, in addition to the destructive effect on the beta cells of the pancreas, we have noticed injury to the adrenal cortex, the anterior lobe of the pituitary, the liver, and the kidneys.

Method. One part of alloxan was freshly mixed

[1] The authors wish to express their gratitude to Sidney M. Bergman for his interest in this work.

with five parts of a favorite food and offered to a cat that had fasted 24 hours. If it did not eat promptly, the food was taken away and the procedure repeated 12 or 24 hours later. Animals that would not eat at that time were not used for these experiments. It is essential that they eat all of the dose quickly (in about 5 or 10 minutes), since, if the food is eaten too slowly, the alloxan is diluted to below its cytotoxic level.

The dose varied from 0.5 to 1.0 gram/kg. and was higher for immature animals than for mature ones. Six to 12 hours after the alloxan meal, the animals were given milk, and the next day they were fed their usual diet of milk and fresh raw meat.

Results. Of the 14 cats that ate the food mixed with alloxan, two ate it too slowly, and one vomited some of the food. These three did not attain a diabetogenic concentration of alloxan and seemed unharmed by their experience. A fourth cat developed a complete anuria and died at the end of 72 hours.

The 10 cats that developed diabetes showed a marked albuminuria on the first day and had both albumin and sugar in the urine on the second day. In some animals the urine passed during the first 24 hours was of a bright red color, due to the excretion of murexide. Four of these cats showed upper respiratory irritation with sneezing and frothy mucus at the external nares. One had conjunctivitis, and one had blood in the stool on the sixth and seventh days.

The experiments were terminated to permit blood and tissue studies: 2 cats on the third day; 3 on the eighth day; and 1 each on the sixteenth, nineteenth, twenty-first, thirty-sixth, and sixty-fourth days. The average blood sugar of the five animals sacrificed on the third to the eighth day was 259 mg. per cent, and of the 5 cats sacrificed from the sixteenth to the sixty-fourth day it was 245 mg. per cent.

Specimens of the pancreas, adrenal, pituitary, liver, and kidney were taken and fixed in modified Bouin's solution. Sections were stained by the method of Gomori (*1*) and with hematoxylin and eosin.

Histopathology. In the animals sacrificed early, the pancreas showed pyknotic nuclei and fragmentation of the beta cells; later, some islets showed atrophy and hyalinization.

The adrenal cortex showed most of the injury to the cells in the fascicular layer. In cases exhibiting severe damage there were areas of focal necrosis and hyalinization. The medullary portion seemed to escape injury.

The anterior lobe of the pituitary showed damaged areas varying from hydropic degeneration with pyknotic nuclei to necrosis with hyalinization and cystic degeneration. There was no evidence of injury to the posterior lobe.

The liver exhibited changes varying from congestion of the sinusoids, with granular degeneration of the cytoplasm and chromatolysis of the nuclei, to small and large areas of necrosis and fatty degeneration, involving in some cases more than half the liver cells.

In the kidneys there was mild congestion to marked swelling of the glomerular tufts which in some cases obliterated the space between Bowman's capsule and the tuft. The epithelium of the convoluted tubules showed hydropic degeneration, necrosis, and desquamation into the lumen. The straight tubules frequently contained hyaline casts. This acute injury to the kidneys tended to recovery. No distinct kidney damage was observed in some of the animals allowed to live a longer time.

Discussion. In these feeding experiments the severity of the diabetes seemed to be modified by the damaging effect of alloxan upon the adrenal cortex and the anterior lobe of the pituitary. This has been found true in surgically induced diabetes (*3*), when the adrenals or pituitary are removed before total ablation of the pancreas, and in alloxan diabetes (*2*). It is for that reason, we think, that these animals did not need glucose to tide them over the hypoglycemic stage, or insulin for the hyperglycemia.

From the work of Tipson and Ruben (*4*) it appears probable that alloxan (or its reduction products) occurs normally in animal bodies. They obtained indications that it occurs in highest concentration in the liver, which may be the organ that changes it to a less toxic substance, e.g. urea.

When alloxan is introduced into the animal body via the alimentary canal, it reaches the liver first and in highest concentration. The ensuing destruction of liver cells results in impaired liver function, which may be the reason our animals have shown more adrenal, pituitary, and kidney damage than in experiments reported by others in which the drug was introduced parenterally.

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Sex Hormonal Action and Chemical Constitution

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The following communication presents a new hypothesis regarding the essential chemical and structural features sufficient for male and female sex hormonal activity as evidenced by comb growth in the