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Author: SHELDON, W. G.

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## ALOPECIA OF CAPTIVE FLYING SQUIRRELS

W. G. SHELDON, D.V.M.<sup>†</sup>

**Abstract:** A group of captive flying squirrels (*Glaucomys volans*) developed partial alopecia. These animals had been maintained in captivity for an unknown period of time and fed a diet of sunflower seeds and peanuts. Complete regrowth of hair occurred within the following 11 months after a diet of mouse chow\* was fed to a group of these animals.

Hair growth abnormalities in wild animals have rarely been reported.<sup>4</sup> This paper reports partial alopecia in a group of captive flying squirrels. The flying squirrels were caught in the hardwood forest area of east Texas, and had been in captivity for an unknown length of time. They were caged in a large outside enclosure and maintained on a diet of sunflower seeds and peanuts. Osteomalacia was diagnosed in several flying squirrels from this colony in October, 1968. The cause of this condition was attributed to the nutritionally inadequate diet of sunflower seeds and peanuts. One alopecic animal was seen in October, 1968. Apparently the alopecia appeared sporadically in the colony and the lesion was progressive. In January, 1969 a large number of the animals were affected.

### MATERIALS AND METHODS

#### Animals.

Eight animals with varying degrees of alopecia were obtained for study. Five apparently normal, recently captured animals were obtained for comparison. Both groups were obtained in January, 1969.

#### Diet.

Four of the alopecic animals were fed diet no. 1, (pecans, apples, oranges and hard boiled eggs). The remaining 4 alopecic animals were fed diet no. 2 (mouse chow). The normal animals were separated into 2 groups, 2 animals receiving diet no. 1, and 3, diet no. 2. All animals received water *ad libitum*. The groups were fed these diets for 4 months. Then all animals were fed only mouse chow and water.

#### Caging.

The animals were housed for 4 months in 4 groups, according to the diet they

received. In April, 1969, all groups were combined and placed in a cage which was 5 feet high, 4 feet deep, 4 feet wide and covered with ¼-inch hardware cloth. The cage contained a resting board which supported a cardboard box that was utilized by the animals for rest and seclusion. The box was replaced weekly. The animals were maintained in an area of the laboratory which was not air conditioned or heated. A window exhaust fan was utilized during the hot summer months.

#### Clinical Observations.

All animals were weighed and examined monthly and periodically photographed to record the regrowth of hair.

#### Pathology.

The day after arrival at the laboratory, the alopecic area on the mid-dorsum of all animals was biopsied. The group of 5 normal animals were biopsied in the same anatomical location. Because of the rapid regrowth of skin and hair in the

<sup>†</sup> From the Laboratory Animal Resources Center, Department of Veterinary Public Health, College of Veterinary Medicine, and the Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843.

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\* Wayne Lab Block, Allied Mills, Chicago, Illinois.

area of the original biopsy of the alopecic animals, this area was again biopsied 1 month later. After total regrowth of hair, all animals were again biopsied close to the original biopsy site. This final biopsy was taken in January, 1970.

Tissues were fixed in buffered neutral formalin, processed automatically and embedded in paraffin. They were sectioned at 4 to 6 microns and stained with hematoxylin and eosin.

## RESULTS

### Clinical Observations.

All 8 animals had lost hair from their backs but in varying amounts. The most severe lesion was a complete loss of hair extending from the neck to the base of the tail including the outer surfaces of the limbs and trunk (Figure 1). Those less severely affected had thinning of the hair over the back with complete loss only in a limited area in the middle of the back. The alopecic areas and the thinning of hair were symmetrical. The remaining hair was faded, dull, rough, and unkempt. The alopecic animals were

thin and unthrifty. The hair of the 5 normal animals was thick, lustrous and well groomed. These animals were in good physical condition.

### Body Weights.

The mean initial weight of the 8 alopecic animals was 57.0 grams and ranged from 46.0 to 64.0 grams. The mean initial weight for the 5 normal animals was 64.3 grams and ranged from 59.0 to 73.0 grams. In January, 1970, the average weight of the remaining animals that were alopecic on arrival was 86.0 grams. The average weight of the 3 remaining normal animals at this time was 78.0 grams. All animals except one gained weight. Figure 2 shows the average monthly weights. Five animals (3 alopecic and 2 normal) died from an overdose of ether.

### Regrowth of Hair.

The regrowth of hair was first apparent in the region of the biopsy 1 month after the surgical procedure. Growth of hair then occurred towards the tail from the biopsy area and from the back of the



FIGURE 1. Appearance of a flying squirrel with alopecia.

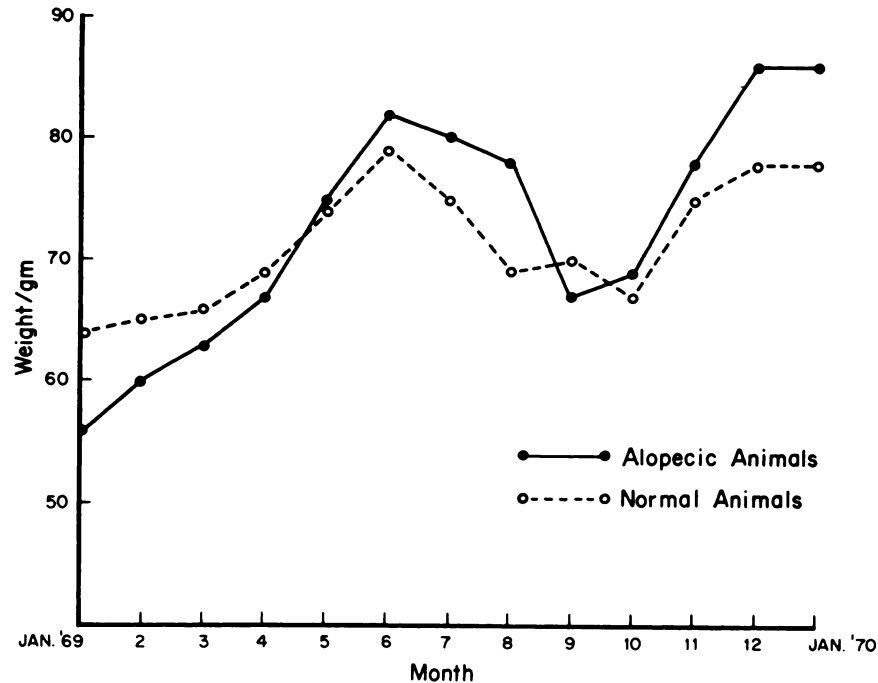


FIGURE 2. The average monthly weights of flying squirrels from January, 1969 to January, 1970.

head towards the area of the biopsy. Regrowth of hair was complete in all animals by November, 1969. The growth of hair seemed more rapid in September and October. Regrowth of hair of animals which died had begun but was not complete. These animals died prior to September, 1969.

The hair of the 3 surviving normal animals remained unremarkable until September and October, 1969. At this time, seasonal shedding and regrowth of hair was apparent. Loss of the old hair coat began near the head and proceeded posteriorly down the back and sides. This normal seasonal physiological process required approximately 2 months.

#### Histopathology.

The initial skin biopsies from the alopecic animals were histologically similar. All exhibited mild hyperkeratosis and

areas of acanthosis. The hair follicles were in the catagen stage, and most contained broken shafts of unpigmented hair. All sections contained hair shafts in which keratin or keratin-like material was adhered to and streamed from the surface of the shaft (Figure 3). The subcutaneous tissue was devoid of fat. There was an absence of an inflammatory cell response in all sections except 1. This section contained a focal erosion of the epidermis with a few neutrophils in the area. Following healing and regrowth of hair, the animals were again biopsied. Sections showed very active follicular development and hair growth.

The 5 normal animals on initial biopsy revealed normal hair follicles containing pigmented hair shafts. All animals were rebiopsied near the original biopsy site 12 months later and all the skin sections were considered normal. The sections from the alopecic and normal animals were indistinguishable at this time.

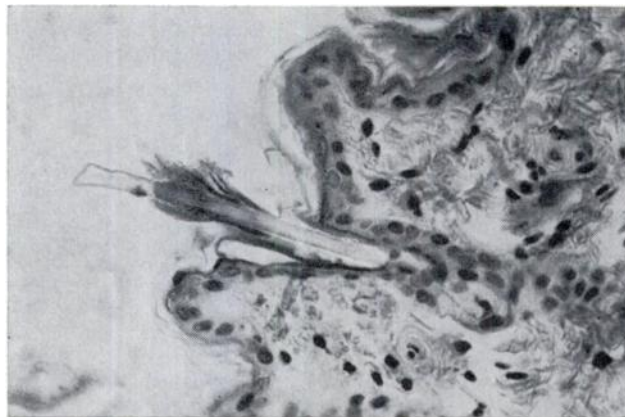


FIGURE 3. This skin section exhibits mild hyperkeratosis and a keratin-like material adhered to a broken unpigmented hair shaft. HandE X 400.

#### DISCUSSION

The precise cause of the alopecia remains undetermined; however, a nutritional deficiency would have to be considered. It has been demonstrated in mice<sup>3</sup> and rats<sup>1</sup> that caloric restrictions can inhibit or delay hair growth and replacement. A diet restricted to peanuts and sunflower seeds is unlikely to contain sufficient nutrients. Sunflower seeds are deficient in lysine<sup>5</sup> and peanuts are deficient in methionine.<sup>6</sup> The nutrient requirements of the flying squirrel are unknown, but if their requirements are similar to those of the rat, these two amino acids are essential.<sup>2</sup>

The favorable response of the flying squirrels after being placed on a diet formulated to meet the requirements of rats and mice is an indication that the dietary requirements of these species are similar. It was not known at the beginning of the experiment whether flying squirrels would eat mouse chow. After it became apparent that this was an acceptable and apparently nutritious diet, all animals were fed this food as their only source of nutrients. The individual from whom the flying squirrels were obtained is currently feeding this chow to his captive flying squirrels with success.

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