Chick yellow: Mutation on Chromosome 3 causing eye and coat color abnormalities

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Mutation (allele) symbol: *chky*
Mutation (allele) name: chick yellow
Strain of origin: Random bred Swiss stock
Current strain name: STOCK *Tdo2*^{chky}/J
Stock #003148 (jaxmice.jax.org)
Phenotype categories: pigment and eye

Abstract
A spontaneous autosomal recessive mutation, chick yellow (*chky*), has been identified. Homozygous *chky* mice have a yellow coat color and develop cataracts. The yellow color is only evident if the *chky*/*chky* mice are albino. The chky gene maps to distal Chromosome 3.

Origin and Description
In 1993 William D. Hohenboken identified mice with a coat color resembling the yellow color of baby chicks in a breeding colony of inbred Swiss stock. He established that the abnormal coat color was caused by an autosomal recessive mutation, designated chick yellow (*chky*). In 1995 mutant mice were transferred to the Mouse Mutant Resource, The Jackson Laboratory, for further analysis.

Homozygous *chky* mice are first identified at ~10 days of aged by the presence of yellow colored coat hair. This slightly yellowish color is visible only on an albino background (see images on MGI allele detail page). A recessive cataract phenotype also co-segregates with the *chky* mutation.

Homozygous *chky* mice are fertile and have a normal lifespan. Older mice in the *chky* colony may develop polydipsia. Because polydipsia is characteristic of some Swiss mice, this condition is unlikely caused by the *chky* mutation.

The *chky* breeding colony is maintained by mating heterozygous (*chky*/+) mice to homozygous (*chky*/*chky*) mice.

Genetic Analysis
The genetic location of *chky* was accomplished by intercrossing F1 mice obtained from

the mating of a *chky*/*chky* mouse to a BALB/cByJ mouse. A total of 47 F2 *chky*/*chky* (representing 94 meiosis) mice were collected for linkage analysis using The Mouse Mutant Resource standard mapping protocols. The *chky* gene was mapped to Chromosome 3 between D3Mit137 (NCBI 37 position 78.6 Mb) and D3Mit28 (NCBI 37 position 90.4 Mb). One recombinant with *D3Mit137* and three recombinants with *D3Mit28* were noted.

Pathology

A routine pathological screen[1] was preformed on several *chky*/*chky* mice of various ages. The single 1-month-old *chky*/*chky* mouse examined showed very early signs of cataract development. The two 3-months-old *chky*/*chky* mice examined displayed early lens extrusion and early signs of cataracts. Two older *chky*/*chky* mice were examined, one 7 months of age and the other 8 months of age. Both displayed retinal degeneration and cataracts, and the older one also had eye inflammation.

Hearing assessments by auditory brainstem response testing were conducted on two *chky*/*chky* mice and two *chky*/+ mice at 1 month of age; all four displayed normal hearing.

A complete necropsy of pelt pads and hair was conducted on two *chky*/*chky* mice, both 2 months of age; no lesions were noted and the skin appeared normal.

Addendum

This mutation was sequenced and found to be a point mutation in tryptophan 2,3-dioxygenase (MGI reference J:181237).

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[1]**Standard Histology Protocol used in the Mouse Mutant Resource:** For fixation of tissues, mice were deeply anesthetized with tribromoethanol (avertin) until they no longer displayed a withdrawal reflex in the hind limbs and then perfused intracardially with Bouin's fixative following a flush of the vasculature with saline solution. After soaking in Bouin's for one week to demineralize bones, tissues were dissected. Six segments of spine with axial muscles and spinal cord in situ, representing cervical, thoracic and lumbar spinal segments, were dissected. The brain was removed and sliced into 6 cross sectional pieces at the levels of olfactory lobes, frontal cortex, striatum, thalamus, midbrain, rostral and caudal medulla with cerebellum. Midsagittal slices of hind leg through the knees were prepared. Slices of basal skull through the pituitary and inner ears were taken. Both eyes, salivary glands and submandibular lymph node, trachea plus thyroid and sometimes parathyroid were removed and cassetted. A longitudinal slice of skin from the back was removed. The thymus, slices of lung, and a longitudinal slice of heart were cassetted. Similarly slices of liver through gall bladder, kidney with adrenal attached, pancreas and spleen were prepared. The stomach was sliced longitudinally to include both squamous and glandular portions. Loops of small intestine from 3 levels and slices of large intestine and cecum were removed, as were slices of urinary bladder. The whole uterus, with ovaries attached, was taken. In males testes were sliced longitudinally. The accessory male organs including seminal vesicles, coagulating gland and prostate were removed en block. Altogether in most cases all tissue fit into a total of 10 cassettes. The cassettes were processed in an automatic tissue processor to dehydrate tissues which were then embedded in paraffin. Six micron sections were cut and stained with hematoxylin and eosin (H&E). Sections of brain and spinal cord in vertebral bones also were stained with luxol fast blue (LFB) for myelin and cresylecht violet (CV) for cellular detail.