129

129S2/SvHsd

Developed by Dunn at Columbia University in 1928 from a cross of coat color stocks and a chinchilla (*Tyr*$^{c\text{-}ch}$) stock from Castle. Strain 129 has a common origin with strain 101. In 1945, this strain was passed to Russell at the Jackson Laboratory, Bar Harbor. This stock was maintained segregating at the Tyr locus, such that the coat color of the mice were either albino or light chinchilla. In 1947, to Hunt at Michigan State and in 1948 again introduced at the Jackson Laboratory (129/ReJ) after a forest fire.

In 1953, to LC Stevens at the Jackson Laboratory. Stevens initially studied the genetic basis of testicular teratomas in mice of the 129 parental strain. To determine the cellular origin of teratomas, he performed outcrosses to introduce onto 129 background mutations that affect gonads or germ cells. This led to the "Steel" and "Ter" substrains. The Steel substrains originated from an outcross to C3H-MgfSl-J, followed by 12-14 generations of backcrossing to 129/Sv. The resulting mice are pigmented white-bellied agouti. The steel-J mutation increased the teratoma incidence to 10%. From Glaxo-Welcome to Harlan Laboratories. Harlan became Envigo in 2015, then Envigo was acquired by Inotiv in 2021.

NOMENCLATURE

There is substantial genetic variation among substrains of strain 129 (Simpson *et al*, 1997; Threadgill *et al*, 1997). Therefore, the Committee on Standardized Genetic Nomenclature for Mice has approved a new nomenclature for strain 129 (Festing *et al*, 1999). The new nomenclature is based on the substrains identified and defined in terms of microsatellite markers by Simpson *et al* (1997). A letter and a number have been introduced in front of the slash that will identify each of the substrains. The letter is either P, S, T or X indicating whether it is a 'Parental', 'Steel', 'Ter' (susceptible to teratomas) or genetically-contaminated "X" substrain, respectively.

The major parental lineages include:

- 129P - derived from the original parent strain
- 129S - derived from a congenic strain made by outcrossing the steel mutation
- 129T - derived from the 129 congenic that originally carries the teratoma mutation
- 129X - derived from a genetically-contaminated "X" substrain

Therefore the 129/OlaHsd strain is renamed into 129P2/OlaHsd and 129/SvHsd is renamed into 129S2/SvHsd.

The choice of a particular substrain may be of critical importance for a particular project.

RESEARCH APPLICATIONS

Transgenesis, testicular teratomas.

CHARACTERISTICS

Strain 129 is useful for ovary transplant and ova transfer studies. It is best known for the high incidence of testicular teratomas, but more recently it has been the most widely-used strain in the production of targeted mutations due to the availability of several lines of embryonic stem cells.

Anatomy

Large brain/body weight ratio, small spinal cord (Roderick *et al*, 1973). Small forebrain volume and neocortex (Wimer *et al*, 1969). A large proportion of 129P2/OlaHsd mice has major shunts between the hepatic portal system and the vena cava, allowing the passage of microspheres up to 50 µm in diameter. These shunts are associated with resistance to *Shistosoma japonicum cercariae* (Coulson and Wilson, (1989). High retinal ganglion cell number in 129P3/J substrain (Williams *et al*, 1996). Absence of corpus callosum in about 70% of mice of the 129P3/J substrain. This may be related to retarded formation of the hippocampal commissure in this strain and in BALB/c mice (Livy and Wahlsten, 1997). High bone density of femur in 129P3/J substrain (Beamer *et al*, 1996).

Behavior

Low avoidance conditionability (Royce, 1972). Low shock-avoidance learning (Royce *et al*, 1971). Low preference for sweet tasting substances (saccharin, sucrose, dulcin and acesulfame, averaged 129S substrain) (Lush 1988). Prefers moderate concentrations of saline (contrast C57BL/6) (Beauchamp and Fisher, 1993; Gannon and Contreras, 1995). Normal sensitivity to provoked ataxy by diazepan (Crabbe *et al*, 1998).

Drugs

Resistant to skin ulceration by DMBA (Thomas *et al*, 1973.). Resistant to induction of subcutaneous tumors by 3-methylcholanthrene (Kouri *et al*, 1973.). Resistant to X-irradiation (Roderick, 1963; Storer, 1966). Females have long sleeping time under hexobarbital anesthetic (Lovell, 1976). Resistant to toxic effects of isoniazid (Taylor, 1976). Insensitive (eosinophil response) to cortisone acetate (Wragg and Speirs, 1952). Sensitive uterine response to estrogens (Chai and Dickie, 1966; Drasher, 1965). Susceptible to ozone-induced decreases of tracheal potential (Takahashi *et al*, 1995).

Genetics

Coat color genes

- *Aw, C, P*: white-bellied agouti.

Substrain 129P2/OlaHsd differs from 129S2/SvHsd at many loci, particularly those on chromosome seven, which has the albino and pink-eyed dilute loci.

Most substrains carry the white-bellied agouti gene A^{W} though only a subset have the agouti pattern as many carry albino or chinchilla and/or the pink-eyed dilution gene, p, which is derived from Asian mice of the *Mus musculus* type (Brilliant *et al*, 1994).

This strain carries the *Mus musculus musculus* Y-chromosome, while others have the *M. m. domesticus* type (Nishioka, 1987).

Immunology

High lymphocyte phytohemagglutinin response (Heiniger *et al*, 1975). Responder to synthetic polypeptide (Glu^{57}, Lys^{38}, Ala^{5}) (Pinchuck and Maurer, 1965). Erythrocytes have a high agglutinin ability (Rubinstein *et al*, 1974). High responder to Dextran (Blomberg *et al*, 1972). Experimental systemic lupus erythematosus including severe ocular changes and blepharitis can be induced by injection of human monoclonal anti-DNA antibodies (Chan *et al*, 1995).

Infection

Carries no detectable endogenous ecotropic MuLV DNA sequences (Jenkins *et al*, 1982). Intermediate sensitive to Yersinia enterocolitica, while C57BL/6 is resistant and BALB/c is sensitive (Bohn *et al*, 1998).

Life-span and spontaneous disease

Low overall tumor incidence (7% in males, 21% in females), including lymphoma 2% in males and 7% in females, soft tissue sarcomas 2% in males and 1% in females and benign tumors 2% in males and 3% in females) (Smith *et al*, 1973). Lung tumors 4-46% (Festing and Blackmore, 1971). Testicular teratomas about 1% in most substrains, but 30% in the terSv substrain (Stevens, 1973). Incidence of teratomas increased in p53-deficient mice (Harvey *et al*, 1993). The Ter gene has been mapped to chromosome 18 (Asada *et al*, 1994). High incidence of urinary calculi (Russell and Meier, 1966). A review of the life span of aging mice has been described by Myers, (1978). Median life-span 22.9 months in 129P3/J males and 21.6 months in 129P3/J females (Storer, 1966). Median life-span 27.3 months in 129P3/J males and 24.3 months in 129P3/J females (Smith *et al*, 1973). Median life-span 23.3 months in 129/RrJLac males and 22.3 months in 129/RrJLac females (Festing and Blackmore, 1971).

Normal physiology and biochemistry

High plasma cholesterol at 12 and 24 weeks (Weibust, 1973). Low plasma triglyceride levels (Jiao *et al*, 1990). High Na/K ratio in erythrocytes and plasma (Waymouth, 1973). High serum ceruloplasmin levels in males but low levels in females (Meier and MacPike, 1968). High plasma cholinesterase activity (Angel *et al*, 1967). Low mean heart rate but high mean heart adaptation rate (Blizard and Welty, 1971). High cell turnover in 129P3/J substrain as estimated by rapid clearance of DNA-bound radioactivity (Heiniger *et al*, 1972). Venous blood has a high pH (Bernstein, 1966). High hepatic microsomal coumarin hydroxylase activity in females (Van Iersel *et al*, 1994). High levels of apoA-IV messenger RNA in liver compared with C57BL/6 (Reue *et al*, 1993). Has defective secretory group II phospholipase A2 gene (confer strains C57BL/6 and B10.RIII) (Kennedy *et al*, 1995).

Miscellaneous

Recommended host for transplantable tumor hemangiendothelioma BW6473 (Kaliss, 1972). The E14 clone of embryonic stem cells was derived from mice of 129P2 substrain. (Hooper *et al*, 1987; Papaioanou and Johnson, 1993). Substrain 129S2 is widely used in gene targeting experiments because most of the available embryonic stem cell lines have been developed from strain 129S2. The D3 clone of embryonic stem cells was derived from mice of this substrain (Doetschman *et al*, 1985; Papaioanou and Johnson, 1993). Characteristics of the 129 strain have been described by Festing (1997) and Lyon (1996).

Production

Poor breeding performance, colony output 0.8 young/female/wk, litter size at weaning 4.5 (Festing, 1976)

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