

DBA/2

DBA/2NHsd

Developed in 1909 by Little from mice used in color experiments and this strain is the oldest of all inbred strains of mice. In 1929-30, crosses were made between sub-lines, and several new lines established; two of these were called 12 (now DBA/1) and 212 (now DBA/2).

DBA/2NHsd

In 1951, from Mider to the National Institutes of Health (NIH), Bethesda, Maryland, USA. Harlan obtained a breeding nucleus from NIH. Harlan became Envigo in 2015, then Envigo was acquired by Inotiv in 2021.

Harlan Laboratories Israel became an independent company in 2023

RESEARCH APPLICATIONS

Coat color, behavior, audiogenic seizures, epilepsy, calcification, metabolism, fetal resorption, immunology, infectious diseases, etc.

CHARACTERISTICS

Anatomy

Large testes weight (Shire and Bartke, 1972). Low brain weight (Storer, 1967; Roderick et al, 1973; Wahlsten et al, 1975). High total leukocyte count, high erythrocyte count, low hematocrit, low mean corpuscular volume and low hemoglobin (Russell et al, 1951). Small forebrain, neocortex and hippocampus volume (Wimer et al, 1969). Cerebellum has an intraculminate fissure between vermian lobule IV and vermian lobule

V (the ventral and dorsal lobules of the culmen) (contrast SJL, C57BL/10 and BALB/c) (Cooper et al, 1991). Large heart/ body weight (Mokler and Iturrian, 1973). High proportion of acidophilic and low proportion of

chromophobe cells in adenohypophysis of DBA/Sy substrain (Keramidas and Symeonidis, 1973).

Hematopoietic stem cell pool 11-fold higher than in C57BL/6. This is largely due to loci on chromosome 1 (Muller- Sieburg and Riblet, 1996). High level of spontaneous sister chromatid exchange (Nishi et al, 1993).

Behavior

Low alcohol preference (Fuller, 1964; Rodgers, 1966; McClearn, 1965).

High severity of ethanol withdrawal symptoms compared with C57BL/6, possibly associated with differences in neuroactive steroid sensitivity (Finn et al, 1997). High shock-avoidance

learning (Bovet et al, 1966); Bovet et al, 1969). Low avoidance conditionability (Royce, 1972). Long time of immobility in a forced swimming test (Nikulina et al, 1991) Low shuttle-box avoidance, high wheel activity (Messeri et al, 1972). Good

long-term memory compared with C3H/ He (Bovet et al, 1969). Slow extinction

of learned conditioned avoidance response (Schlesinger and Wimer, 1967). Susceptible to audiogenic seizures (Fuller and Sjursen, 1967). Long latency to attack crickets (Butler, 1973). High rearing, low defecation in Y-maze (McClearn et al, 1970).

Low locomotor activity when grouped but not when single (Davis et al, 1967). Low social dominance of males in competition for females (DeFries and McClearn, 1970). Low balsa-wood gnawing activity (Fawcington and Festing, 1980). Low preference for sweet tasting substances (saccharin, sucrose, dulcin and acesulfame, averaged) (Lush 1988).

DBA/2 mice failed to react to a spatial change of objects in an open field, and therefore resemble rats with dorsal lesions of the hippocampus. They may represent a model of hippocampal dysfunction (Ammassari-Teule et al, 1995). Feed restriction for nine days causes a high incidence of stereotypic cage cover climbing (contrast C57BL/6) (Cabib and Bonaventura, 1997).

Drugs

Resistant to skin ulceration by DMBA (Thomas et al, 1973). Resistant to induction of subcutaneous tumors by 3-methylcholanthrene (Kouri et al, 1973; Whitmire et al, 1971). Resistant to induction of adenocarcinomas of the colon by 1,2-dimethylhydrazine (Evans et al, 1974). Resistant to teratogenic effect of 1-ethyl-1-nitrosourea (Diwan, 1974). Phenobarbital i.p. does not induce hepatic epoxide hydase (Oesch et al, 1973). Resistant to lethal effects of ozone (Goldstein et al, 1973). Susceptible to induction of cleft palate by cortisone (Kalter, 1965). Good ovulatory response to 3 I.U. of PMS but zero response to 7 I.U. (Zarrow et al, 1971). Low incidence of convulsions induced by flurothyl (Davis and King, 1967). Long hexobarbital sleeping time and low liver hexobarbital oxidase level (Vesell, 1968). Sensitive to chloroform toxicity (Hill et al, 1975; Deringer et al, 1953). Sensitive to seizures induced by nicotine (Marks et al, 1989). Sensitivity may be related to brain alpha-bungarotoxin binding, which is significantly higher in ST/b than in sensitive DBA/2 mice (Marks et al, 1996). High self-selection of nicotine which is inversely correlated with sensitivity to nicotine-induced seizures (Robinson et al, 1996). High bronchial reactivity to methacholine and serotonin (Konno et al, 1993). Resistant to daunomycin-induced nephrosis (Kimura et al, 1993). High neural sensitivity to pentylenetetrazol convulsions (Kosobud et al, 1992). Sensitive to neurotoxic effects of monocrotophos (Rao et al, 1991). Low histamine release from peritoneal mast cells induced by compound 48/80, a calcium dependent histamine releaser (Toda et al, 1989). High histamine release from peritoneal mast cells induced by Ca²⁺ ionophore A23187 (contrast C57BL/6) (Toda

et al, 1989). Carries gene (Tpmt) for high levels of thiopurine methyltransferase activity, catalysing the S-methylation of 6-mercaptopurine and other heterocyclic and aromaticthiol compounds (unlike C57BL/6 and AKR) (Otterness and Weinshilboum, 1987a; 1987b). Resistant (contrast five strains) to the induction of micronuclei by polycyclic aromatic hydrocarbons, presumably due to uninducible Ah locus (Sato et al, 1987). Iron overload does not cause inhibition of hepatic uroporphyrinogen decarboxylase and uroporphyrin in contrast with C57BL/10ScSn. This was not correlated with the Ah locus in a study involving 12 mouse strains (Smith and Francis, 1993). Resistant to hepatotoxic effects of cadmium (Shaikh et al, 1993). Low voluntary consumption of morphine in two-bottle choice situation (Belknap et al, 1993). Less susceptible to the development of micronuclei than BALB/c following treatment with clastogenic base analogues and nucleosides (Sato et al, 1993). Unique poor responsiveness to the antinociceptive effects of nitrous oxide, a polygenic trait (Quock et al, 1996). Nine- fold lower ED50 for haloperidol-induced catalepsy than C57BL/6, but this is not associated with numbers of cholinergic neurons (Dains et al, 1996). Airways hyperreactive to acetylcholine (Zhang et al, 1995). Resistant to rate-depressant effects of ethanol on schedule-controlled behavior (Elmer and George, 1995). A diet containing 15% dairy fat, 1% cholesterol and 0.5% cholic acid did not cause a high incidence of cholesterol gallstones (like AKR, SM contrast C57L, SWR, A) (Faulkner et al, 1995).

Genetics

Coat color genes

- *a*, *b*, *C*, *d* : non-agouti, dilute brown.

Histocompatibility

- *H-2^d*, *Thy-1^b*.

Biochemical markers

- *Apoa-1^b*, *Car-2^b*, *Es-1^b*, *Es-2^b*, *Es-3^c*, *Gpd-1^b*, *Gpi-1^a*, *Hba^g*, *Hbb^d*, *Idh-1^b*, *Ldr-1^a*, *Mod-1^a*, *Mup-1^a*, *Pep-3^b*, *Pgm-1^b*, *Pgm-2^a*, *Trf^b*.

Although the DBA/1 and DBA/2 are substrains of the DBA there are differences between these strains,

probably due to a substantial residual heterozygosity following the crosses between the substrains. DBA/1 and DBA/2 differ at least at the following loci: *Car-2*, *Ce-2*, *Hc*, *H-2*, *If-1*, *Lsh*, *Tla*, and *Qa-3*.

With such large differences, they should probably be regarded as different strains rather than substrains of the same strain. This strain carries the *Mus musculus musculus* Y-chromosome, while others have the *M. m. domesticus* type (Nishioka, 1987).

Immunology

Resistant to experimental allergic encephalomyelitis (Levine and Sowinski, 1973). Low lymphocyte phytohemagglutinin response (Heiniger et al, 1975). Serum antinuclear factor 26% incidence (Barnes and Tuffrey, 1967). Poor immune response to type III pneumococcal polysaccharide (Braley and Freeman, 1971). Good immune response to synthetic double-stranded

RNA (Steinberg et al, 1971). Poor immune response to cholera A and B antigens (Cerny et al, 1971). Poor immune response to both ovomucoid and ovalbumin (Vaz et al, 1971).

Precipitating and skin-sensitising antibodies have fast electrophoretic mobility (Fahey, 1965). Non-discriminator between 'H' and 'L' sheep erythrocytes (McCarthy and Dutton, 1975). Low anti-DNP antibody concentration (Paul et al, 1970). Poor immune response to Pro-Gly-Pro-ovalbumin and (Pro-Gly- Pro)n, but good immune response to (Pro66, Gly34)n (Fuchs et al, 1974). High susceptibility to IgG1-mediated

but low susceptibility to IgE-mediated passive cutaneous anaphylaxis (De Souza et al, 1974). Develops a lethal form of syngeneic graft-vs-host disease when treated with cyclosporine (unlike five other strains) (Prud'homme et al, 1991). Erythrocytes have a high agglutinability (Rubinstein et al, 1974). Poor immune response to *Salmonella strasbourg* lipopolysaccharide, depending on substrain) (Di Pauli, 1972). Low PHA-stimulated lymphocyte blastogenic response (Hellman and Fowler, 1972). Low immune response to ferritin (Young et al, 1976). Resistant to induction of anaphylactic shock by ovalbumin (Tanioka and Esaki, 1971).

Resistant to experimental autoimmune orchitis induced by two or three sc injections with viable syngeneic testicular germ cells without any adjuvants (Tokunaga et al, 1993). Anti-BPO IgE monoclonal antibody failed to produce potent systemic sensitization sufficient for provocation of lethal shock in most aged (six-ten months) mice (Harada

et al, 1991). High expression of neutral glycosphingolipid GgOse(4)Cer in concanavalin A stimulated T lymphoblasts (Muthing, 1997).

Infection

Resistant to infection by *Salmonella typhimurium* strain C5 (Plant and Glynn, 1974). Susceptible to liver fluke *Opisthorchis felinus* (Zelentsov, 1974).

Susceptible to natural intestinal helminth infection (Eaton, 1972). Develops a chronic non-healing lesion on infection with *Leishmania tropica*, the parasite causing cutaneous leishmaniasis (Howard et al, 1980). Susceptible to the induction of dental caries due to infection with *Streptococcus mutans* (Kurihara et al, 1991). Susceptible to the development

of chronic Chagas' cardiomyopathy in post-acute *Trypanosoma cruzi* infection (Rowland et al, 1992). Infection with larval *Echinococcus multilocularis* by transportal injection of hyatid homogenate results in

well developed protoscoleces (Nakaya et al, 1997). Highly susceptible to infection with *Pseudomonas aeruginosa* with rapid accumulation of bacterial burden and high mortality, in contrast with resistant BALB/c mice (Morissette et al, 1995).

Susceptibility is associated with a delay in inflammatory response and the initiation of bacterial clearance (Morissette et al, 1996). Susceptible to disseminated *Cryptococcus neoformans* (Irokanulo et al, 1995). Highly susceptible to infection with *Candida albicans* (Ashman et al, 1996). Resistant, with low amylase response to the fungus *Paracoccidioides brasiliensis* (Xidieh et al, 1994). Highly susceptible, with high mortality following infection with *Mycoplasma pulmonis* (Cartner et al, 1996). Susceptible to infection by *Helicobacter felis* with moderate to severe chronic active gastritis in the body of the stomach, which increased over time (Sakagami

et al, 1996). Low susceptibility to BALB/ Tennant leukemia virus (Tennant, 1965). Hyperglycemia can be induced by encephalomyocarditis virus, which also causes diabetes mellitus (Boucher and Notkins, 1973; Boucher et al, 1975).

High susceptibility to develop leukemia on infection with Friend virus (Dietz and Rick, 1972). Mouse mammary tumor proviral loci have been identified by Lee and Eicher (1990).

Life-span and spontaneous disease

Primary lung tumors 1% in males, 2% in females. Lymphatic leukemia zero in males, 2% in females and 3% in virgin

females. Mammary adenocarcinomas in unfostered

substrains 1% in males, 72% in breeding females and 48% in virgin females (Hoag, 1963). A high proportion of mammary tumors are of the acinar type (Tengbergen, 1970). Overall tumor incidence 15% in males, 49% in females, including lymphomas 10% in males and 12% in females; mammary tumors zero in males and 31% in virgin females (Smith et al, 1973). Leukemia 3% (Myers et al, 1970). Long life-span in SPF fostered

conditions (629 days in males, 719 days in females) with 6-35% liver and 1-23% lung tumors (Festing and Blackmore, 1971).

Long life-span in conventional conditions (707 days in males, 714 days in females) (Storer, 1966). Life-span 722 days in males and 683 days in females (Goodrick, 1975). High incidence of expression of RNA tumor virus group-specific antigen (Diwan et al, 1973). Type B reticulum cell neoplasms 18% at about 20 weeks

(Dunn and Deringer, 1968). Spontaneous calcified heart lesions progress with age. 90% of individuals affected by one year (Rings and Wagner, 1971). Incidence of calcareous heart lesions high among some related strains (Di Paola et al, 1964). Dystrophic cardiac calcification may be related to disturbed myocyte calcium metabolism (Brunnert, 1997). Chronic hypertrophic gastritis, duodenal polyps and calcareous pericarditis frequently

observed. Other lesions include malignant lymphoma and degenerative processes

in the myocardium, skeletal muscle, subcutaneous adipose tissue, cornea and blood vessels. Lesions partly depend on diet (Hare and Stewart, 1956). Carry three separate recessive genes similar to those found separately in C57BL/6J, BALB/cBy and WB/ReJ, causing age-related hearing loss (Willott et al, 1995).

Miscellaneous

Recommended host for the

following transplantable tumors: fibrosarcoma SaD2, lymphatic leukemia P1534 and mammary adenocarcinoma CaD2 (Kaliss, 1972). Hybrids involving DBA/2 are recommended host for transplantable leukemia L1210, melanoma S91 and MOPC myeloma used as models in screening potential anticancer drugs (EORTC Screening Group, 1972). The Fv2r allele appears to be lethal on the DBA/2

genetic background (Blank and Lilly, 1976). High mortality after neonatal thymectomy (Law, 1966).

The relationship of genotype, sex, body weight, and growth parameters to lifespan in inbred and hybrid mice is described

by Ingram et al (1982).

Characteristics of the DBA/2 strain have been described by Festing (1997) and Lyon et al, (1996).

Physiology and

biochemistry High metabolic rate (Storer, 1967). High metabolic rate at 26°C (Pennycuik, 1967).

High cell turnover as estimated by rapid

clearance of DNA-bound radioactivity (Heiniger et al, 1972).

High proportion of paradoxical (REM) sleep (Pagel et al, 1973).

High concentration of epinephrine and norepinephrine in adrenals (Ciranello et al, 1972). Low Na/K ratio in erythrocytes but high ratio in plasma (Waymouth, 1973).

Arterial blood has a high pH (Bernstein, 1966). Low

concentration of prostaglandin F in epididymus (Badr,

1975). High plasma cholinesterase (Angel et al, 1967).

Low liver tyrosine amino transferase activity in fasted mice (Blake, 1970). High calcium uptake by the heart (Mokler and Iturrian, 1973). High sensitivity to thyrotropin (Levy et al, 1965).

High coumarin hydroxylating ability (Lush and Arnold, 1975).

High coumarin hydroxylase activity in both sexes (Van Iersel et al, 1994). Low N'-

methylnicotinamide oxidase activity in both sexes (Huff and

Chaykin, 1967). High serum haptoglobin level (Peacock et al, 1967). Low hepatic benz (alpha) pyrene hydroxylase activity (Kodama and Bock, 1970). High hepatic delta-aminolaevulinate dehydratase activity (Doyle and Schimke, 1969). Low aldehyde and alcohol dehydrogenase activity compared with C57BL/6 (Sheppard et al, 1968). High hepatic delta-aminolaevulinic acid synthetase activity after DISC treatment (Gross and Hutton, 1971). High hepatic urokinase activity (Hanford et al, 1974). High basal level of growth hormone at 78 days and low basal level of serum prolactin (Sinha et al, 1975). High brain L-glutamic acid decarboxylase, choline acetyltransferase and acetylcholinesterase activity (Tunncliffe et al, 1973). Low brain sulphatide and plasmalogen and high brain sterol (Sampugna et al, 1975).

Low brain cholinesterase (Pryor et al, 1966). Resistant to the development of atherosclerosis on a semi-synthetic high fat diet (Nishina et al, 1993).

Hyporesponsive to diets containing high levels of fat and cholesterol (Kirk et al, 1995). Mild hypercapnia with hypoxia significantly elevated minute ventilation rate (Tankersley et al, 1994).

Reproduction

The DBA/2 strain has a poor breeding performance and the young mice are very small at time of weaning. Colony output 0.85 young/female/week. Low litter size at weaning of 4.7 (Festing, 1976). Poor breeding performance. Litter size 4.2, sterility 31% (Nagasawa et al, 1973).

Intermediate breeding performance (Hansen et al, 1973). Corpora lutea may persist over many cycles, becoming hyalinized and calcified (Chai and Dickie, 1966). Has shorter and less regular estrus cycles than C57BL/6J (Nelson et al, 1992). Susceptible to fetal resorption resulting from restraint-induced stress when mated to C3H/HeJ males, in contrast with CBA/J and A/J. This was reduced by alloimmunization with C3H cells (Clark et al, 1993).

REFERENCES

- Ammassari-Teule M, Tozzi A, Rossi-Arnaud C, Save E, Thinus-Blanc C (1995) Reactions to spatial and nonspatial change in two inbred strains of mice: Further evidence supporting the hippocampal dysfunction hypothesis in the DBA/2 strain. *Psychobiology* 23, 284-289.
- Angel CR, Mahin DT, Farris RD, Woodward KT (1967) Heritability of plasma cholinesterase activity in inbred mouse strains. *Science* 156, 529-530.
- Ashman RB, Fulurija A, Papadimitriou JM (1996) Strain-dependent differences in host response to *Candida albicans* infection in mice are related to organ susceptibility and infectious load. *Infect. Immun.* 64, 1866-1869.
- Badr FM (1975) Prostaglandin levels in tissues of the male reproductive system in six strains of mice. *Endocrinol.* 96, 540-543.
- Barnes RD, Tuffrey M (1967) Serum antinuclear factor and the influence of environment in mice. *Nature* 214, 1136-1138.
- Belknap JK, Crabbe JC, Riggan J, O'Toole LA (1993) Voluntary consumption of morphine in 15 inbred mouse strains. *Psychopharmacology* 112, 352-358.
- Bernstein SE (1966) Physiological characteristics. In: *Biology of the Laboratory Mouse*. 2nd ed. (Green EL, ed). New York: McGraw-Hill, pp. 337-350.
- Blake RL (1970) Regulation of liver tyrosine amino transferase activity in inbred strains and mutant mice. I. Strain variance in fasting enzyme levels. *Int. J. Biochem.* 1, 361-370.
- Blank KJ, Lilly F (1976) Lethality of the Fv-2 resistance allele in with a DBA/2 background. *Genetics* 83, 58.
- Boucher DW, Notkins AL (1973) Virus-induced diabetes mellitus. I. Hyperglycemia and hyperinsulinemia in mice infected with encephalomyocarditis virus. *J. Exp. Med.* 137, 1226-1239.
- Boucher DW, Hayashi K, Rosenthal J, Notkins AL (1975) Virus-induced diabetes mellitus. III. Influence of sex and strain of host. *J. Infect. Dis.* 131, 462-466.
- Bovet D, Bovet-Nitti F, Oliverio A (1966) Effects of nicotine on avoidance conditioning of inbred strains of mice. *Psychopharmacologia* 10, 1-5.
- Bovet D, Bovet-Nitti F, Oliverio A (1969) Genetic aspects of learning and memory in mice. *Science* 163, 139-149.
- Braley HC, Freeman MJ (1971) Strain differences in antibody plaque-forming cell responses in inbred mice to pneumococcal polysaccharide. *Cell. Immunol.* 2, 73-81.
- Brunert SR (1997) Morphologic response of myocardium to freeze-thaw injury in mouse strains with dystrophic cardiac calcification. *Lab. Animal Sci.* 47, 11-18.
- Butler K (1973) Predatory behavior in laboratory mice. Strain and sex comparisons. *J. Comp. Physiol. Psychol.* 85, 243-249.
- Cabib S, Bonaventura N (1997) Parallel strain-dependent susceptibility to environmentally-induced stereotypes and stress-induced behavioral sensitization in mice. *Physiol. Behav.* 61, 499-506.
- Cartner SC, Simecka JW, Briles DE, Cassell GH, Lindsey JR (1996) Resistance to Mycoplasma lung-disease in mice is a complex genetic trait. *Infect. Immun.* 64, 5326-5331.
- Chai CK, Dickie MM (1966) Endocrine variations. In: *Biology of the laboratory mouse*, 2nd ed (Green EL, ed). New York: McGraw-Hill, pp. 387-403.
- Cerny J, McAlack RF, Sajid MA, Friedman H (1971) Genetic differences in the immunocyte response of mice to separate determinants on one bacterial antigen. *Nature New Biol.* 230, 247-248.
- Ciranello RD, Barchas R, Kessler S, Barchas JD (1972) Catecholamines: strain differences in biosynthetic enzyme activity in mice. *Life Sci.* 11, 565-572.
- Clark DA, Barwatt D, Chaouat G (1993) Stress-triggered abortion in mice prevented by alloimmunization. *Am. J. Reprod. Immunol.* 29, 141-147.
- Cooper PA, Benno RH, Hahn ME, Hewitt JK (1991) Genetic analysis of cerebellar foliation patterns in mice (*Mus musculus*). *Behav. Genet.* 21, 405-419.
- Dains K, Hitzemann B, Hitzemann R (1996) Genetics, neuroleptic response and the organization of cholinergic neurons in the mouse striatum. *J. Pharmacol. Exp. Therapeut.* 279, 1430-1438.
- Davis WM, King WT (1967) Pharmacogenetic factor in the convulsive responses of mice to flurothyl. *Experientia* 23, 214-215.
- Davis WM, King WT, Rabbini M (1967) Placebo effect of saline on locomotor activity in several strains of mice. *J. Pharmacol. Sci.* 56, 1347-1349.
- DeFries JL, McClearn GE (1970) Social dominance and Darwinian fitness in the laboratory mouse. *Am. Naturalist* 104, 408-411.
- Deringer MK, Dunn TB, Heston WE (1953) Results of exposure of strain C3H mice to chloroform. *Proc. Soc. Exp. Biol. Med.* 83, 474-479.
- De Souza CM, Maia LCS, Vaz NM (1974) Susceptibility to cutaneous anaphylaxis in inbred strains of mice. *J. Immunol.* 112, 1369-1372.
- Dietz M, Rick MA (1972) Effect of host strain and H-2 type on spontaneous regression of murine leukemia virus. *Int. J. Cancer* 104.
- Di Paola JA, Strong LC, Moore GE (1964) Calcareous pericarditis in mice of several genetically related strains. *Proc. Soc. Exp. Biol. Med.* 115, 496-497.
- Di Pauli R (1972) Genetics of the immune response. I. Differences in the specificity of antibodies to lipopolysaccharides among different strains of mice. *J. Immunol.* 109, 394-400.
- Diwan BA (1974) Strain-dependent teratogenic effects of 1-ethyl-1-nitrosourea in inbred strains of mice. *Cancer Res.* 34, 151-157.
- Diwan BA, Meier H, Huebner RJ (1973) Transplacental effects of 1-ethyl-1-nitrosourea in inbred strains of mice. III. Association between infectious or subinfectious endogenous type-C-RNA tumor virus expression and chemically induced tumorigenesis. *J. Natl. Cancer Inst.* 51, 1965-1970.
- Doyle D, Schimke RT (1969) The genetic and developmental regulation of hepatic aminolaevulinate dehydratase in mice. *J. Biol. Chem.* 244, 5449-5459.
- Dunn TB, Deringer MK (1968) Reticulum cell neoplasm, type B, or 'Hodgkin's-like lesion' of the mouse. *J. Natl. Cancer Inst.* 40, 771-821.
- Eaton GJ (1972) Intestinal helminths in the mouse. *Lab. Animal Sci.* 22, 850-853.
- Ehling UH (1964) Strain variation in reproductive capacity and radiation response of female mice. *Radiation Res.* 23, 603-610.
- Elmer GI, George FR (1995) Genetic differences in the operant rate-depressant effects of ethanol between four inbred mouse strains. *Behavioral Pharmacology* 6, 794-800.
- EORTC Screening group (1972) Handbook of materials and methods. *Eur. J. Cancer* 8, 185-196.
- Evans JT, Hauschka TS, Mittelman A (1974) Differential susceptibility of four mouse strains to induction of multiple large-bowel neoplasms by 1,2-dimethylhydrazine. *J. Natl. Cancer Inst.* 52, 999-1000.
- Fahey JL (1965) Differences in the electrophoretic mobility of antibody from inbred strains of mice. *J. Immunol.* 94, 819-823.
- Faulkner CB, Davidson MK, Davis JK, Schoeb TR, Simecka JW, Lindsey JR (1995) Acute Mycoplasma pulmonis infection associated with coagulopathy in C3H/HeN mice. *Lab. Animal Sci.* 45, 368-372.
- Fawcington E, Festing MFW (1980) Mouse strain differences in balsam wood gnawing. Unpublished data.
- Festing MFW (1976) Breeding performance of mouse colonies at the MRC Laboratory Animals Centre. Unpublished data.
- Festing MFW (1997) Inbred Strains of mice. *Mouse genome* 95, 519-686.
- Festing MFW, Blackmore DK (1971) Life span of specified-pathogen-free (MRC category 4) mice and rats. *Lab. Anim.* 5, 179-192.
- Finn DA, Roberts AJ, Lotrich F, Gallaher EJ (1997) Genetic differences in behavioral sensitivity to a neuroactive steroid. *J. Pharmacol. Exp. Therapeut.* 280, 820-828.
- Fuchs S, Mozes E, Maoz A, Sela M (1974) Thymus independence of a collagen-like synthetic polypeptide and of collagen and the need for thymus and bone marrow-cell cooperation in the immune response to gelatin. *J. Exp. Med.* 139, 148-158.
- Fuller JL (1964) Measurement of alcohol preference in genetic experiments. *J. Comp. Physiol. Psychol.* 57, 85-88.
- Fuller JL, Sjursen FH (1967) Audiogenic seizures in eleven mouse strains. *J. Hered.* 58, 135-140.
- Goldstein BD, Lai LY, Ross SR, Cuzzi-Spada R (1973) Susceptibility of inbred mouse strains to ozone. *Arch. Environ. Health* 27, 412-413.
- Goodrick CL (1975) Lifespan and the inheritance of longevity of inbred mice. *J. Gerontol.* 30, 257-263.
- Gross S, Hutton J (1971) Induction of hepatic aminolaevulinic acid synthetase activity in strains of inbred mice. *J. Biol. Chem.* 246, 606-614.
- Hanford WC, Nep RL, Arfin SM (1974) Genetic variation in histidine ammonia-lyase activity in the mouse. *Biochem. Biophys. Res. Comm.* 61, 1434-1437.
- Hansen CT, Judge FJ, Whitney RA (1973) Catalog of NIH rodents. National Institutes of Health. DHEW publication (NIH) 74-606, Bethesda.
- Harada M, Nagata M, Takeuchi M, Ohara T, Makino S, Watanabe A (1991) Age-dependent difference in susceptibility to IgE antibody- and IgG1 antibody-mediated passive anaphylactic shock in the mouse. *Immunological Investigations* 20, 515-523.
- Hare WV, Stewart HL (1956) Chronic gastritis of the glandular stomach, adenomatous polyps of the duodenum and calcareous pericarditis in strain DBA mice. *J. Natl. Cancer Inst.* 16, 889-911.
- Heiniger HJ, Chen HW, Meier H, Taylor BA, Commerford LS (1972) Studies on the genetic control of cell proliferation. 1. Clearance of DNA-bound radioactivity in 19 inbred strains and hybrid mice. *Life Sci.* 11, 87-98.
- Heiniger HJ, Taylor BA, Hards EJ, Meier H (1975) Heritability of the phytohemagglutinin responsiveness of lymphocytes and its relationship to leukemogenesis. *Cancer Res.* 35, 825-831.
- Hellman A, Fowler AK (1972) Studies of the blastogenic response of murine lymphocyte. III. Specific viral transformation. *Proc. Soc. Exp. Biol. Med.* 141, 106-109.

62. Hill RN, Clemens TL, Liu DK, Vesell ES (1975) Genetic control of chloroform toxicity in mice. *Science* 190, 159-161.
63. Hoag WG (1963) Spontaneous cancer in mice. *Ann. NY Acad. Sci.* 108, 805-831.
64. Howard JG, Hale C, Chan-Liew WL (1980) Immunological regulation of experimental cutaneous leishmaniasis 1. Immunogenetic aspects of susceptibility to *Leishmania tropica* in mice. *Parasite Immunol.* 2, 303-314.
65. Huff SD, Chaykin S (1967) Genetic and androgenic control of N-methylnicotinamide oxidase activity in mice. *J. Biol. Chem.* 242, 1265-1270.
66. Ingram DK, Reynolds MA, Les EP (1982) The relationship of genotype, sex, body weight, and growth parameters to lifespan in inbred and hybrid mice. *Mech. Ageing Dev.* 20, 253-266.
67. Irokanulo EAO, Akueshi CO (1995) Virulence of *Cryptococcus neoformans* serotypes A, B, C and D for four mouse strains. *J. Med. Microbiol.* 43, 289-293.
68. Kaliss N (1972) Transplanted tumors. *Jax Notes* 410, Jackson Laboratory, Bar Harbor, Maine
69. Kalter H (1965) Interplay of intrinsic and extrinsic factors. In: *Teratology* (Wilson JG, Warkany J, eds). Chicago: University of Chicago Press.
70. Keramidias GD, Symeonidis A (1973) Characteristic microscopic differences in the adenohypophysis of high and low mammary tumor strains of mice. *Pathol. Eur.* 8, 35-36.
71. Kimura M, Takahashi H, Ohtake T, Sato T, Hishida A, Nishimura M, Honda N (1993) Interstrain differences in murine daunomycin-induced nephrosis. *Nephron* 63, 193-198.
72. Kirk EA, Moe GL, Caldwell MT, Lemmark JA, Wilson DL, LeBoeuf RC (1995) Hyper- and hypo-responsiveness to dietary fat and cholesterol among inbred mice: Searching for level and variability genes. *J. Lipid Res.* 36, 1522-1532.
73. Kodama Y, Bock FG (1970) Benz [a] pyrene-metabolizing enzyme activity of livers of various strains of mice. *Cancer Res.* 30, 1846-1849.
74. Konno S, Adachi M, Matsuura T, Sunouchi K, Hoshino H, Okazawa A, Kobayashi H, Takahashi T (1993) Bronchial reactivity to methacholine and serotonin in six inbred mouse strains. [Japanese]. *Japanese Journal of Allergy* 42, 42-47.
75. Kosobud AE, Cross SJ, Crabbe JC (1992) Neural sensitivity to pentylenetetrazol convulsions in inbred and selectively bred mice. *Brain Res.* 592, 122-128.
76. Kouri RE, Salerno RA, Whitmire CE (1973) Relationships between arylhydrocarbon hydroxylase inducibility and sensitivity to chemically induced subcutaneous sarcomas in various strains of mice. *J. Natl. Cancer Inst.* 50, 363-368.
77. Kurihara Y, Naito T, Obayashi K, Hirasawa M, Kurihara Y, Moriwaki K (1991) Caries susceptibility in inbred mouse strains and inheritance patterns in F1 and backcross (N2) progeny from strains with high and low caries susceptibility. *Caries Res.* 25, 341-346.
78. Law LW (1966) Studies of thymic function with emphasis on the role of the thymus in oncogenesis. *Cancer Res.* 26, 551-574.
79. Lee BK, Eicher EM (1990) Segregation patterns of endogenous mouse mammary tumor viruses in five recombinant inbred strain sets [published erratum appears in *J. Virol.* (1991) 65,1666]. *J. Virol.* 64, 4568-4572.
80. Levine S, Sowinski R (1973) Experimental allergic encephelomyelitis in inbred and outbred mice. *J. Immunol.* 110, 139-143.
81. Levy RP, McGuire WL, Shaw RK, Bartsch GE (1965) Effect of species differences of mice on the bioassay of thyrotropin. *Endocrinol.* 76, 890-894.
82. Lush IE, Arnold CJ (1975) High coumarin 7-hydroxylase activity does not protect mice against Warfarin. *Heredity* 35, 279-281.
83. Lush IM (1988) The genetics of tasting in mice. VI. Saccharin, acesulfame, dulcin and sucrose. *Genet. Res.* 53, 95-99.
84. Lyon MF, Rastan S, Brown SDM (1996) Genetic variants and strains of the laboratory mouse. 2 Volumes. Oxford, New York, Tokyo: Oxford University Press.
85. Marks MJ, Pauly JR, Grun EU, Collins AC (1996) ST/b and DBA/2 mice differ in brain alpha-bungarotoxin binding and alpha-7 nicotinic receptor subunit messenger-RNA levels - a quantitative autoradiographic analysis. *Molecular Brain Research* 39, 207-222.
86. Marks MJ, Stitzel JA, Collins AC (1989) Genetic influences on nicotine responses. *Pharmacol. Biochem. Behav.* 33, 667-678.
87. McCarthy MM, Dutton RW (1975) The humoral response of mouse spleen cells to two types of sheep erythrocytes. *J. Immunol.* 115, 1316-1321.
88. McClearn GE (1965) Genotype and mouse behavior. In: *Genetics Today* (Geerts JJ, ed). Proc. XI Int. Genetics Congress, The Hague, Sept. 1964.
89. McClearn GE, Wilson JR, Meredith W (1970) The use of isogenic and heterogenic mouse stocks in behavioral research. In: *Contribution to behavior genetic analysis. The mouse as a prototype* (Lindzey G, Thiessen DD, eds). New York: Appleton-Century-Crofts, pp 3-32.
90. Messeri P, Oliverio A, Bovet D (1972) Relations between avoidance and activity. A diallel study in mice. *Behav. Biol.* 7, 733-742.
91. Mokler CM, Iturrian WB (1973) Strain differences in subcellular calcium distribution in striated muscle of the mouse. *Proc. Soc. Exp. Biol. Med.* 142, 919-923.
92. Morissette C, Skamene E, Gervais F (1995) Endobronchial inflammation following *Pseudomonas aeruginosa* infection in resistant and susceptible strains of mice. *Infect. Immun.* 63, 1718-1724.
93. Morissette C, Francoeur C, Darmondzwaig C, Gervais F (1996) Lung phagocyte bactericidal function in strains of mice resistant and susceptible to *Pseudomonas aeruginosa*. *Infect. Immun.* 64, 4984-4992.
94. Muller-Sieburg CE, Riblet R (1996) Genetic control of the frequency of hematopoietic stem cells in mice: Mapping of a candidate locus to chromosome 1. *Journal Of Experimental Medicine* 183, 1141-1150.
95. Muthing J (1997) Neutral glycosphingolipids and gangliosides from spleen T lymphoblasts of genetically different inbred mouse strains. *Glycoconjugate Journal* 14, 241-248.
96. Myers DD, Meier H, Huebner RJ (1970) Prevalence of murine C-type RNA virus group specific antigen in inbred strains of mice. *Life Sci.* 9, 1071-1080.
97. Nagasawa H, Miyamoto M, Fujimoto M (1973) Reproductivity in inbred strains of mice and project for their efficient production. *Exp. Animals (Japan)* 22, 119-126.
98. Nakaya K, Nakao M, Ito A (1997) *Echinococcus multilocularis*: Mouse strain difference in hydatid development. *J. Helminthology* 71, 53-56.
99. Nelson JF, Karelus K, Felicio LS, Johnson TE (1992) Genetic influences on estrous cyclicity in mice: evidence that cycle length and frequency are differentially regulated. *J. Reprod. Fertil.* 94, 261-268.
100. Nikulina EM, Skrinskaya JA, Popova N. K (1991) Role of genotype and dopamine receptors in behavior of inbred mice in a forced swimming test. *Psychopharmacology* 105, 525-529.
101. Nishi Y, Hasegawa MM, Inui N (1993) Genetic variations in baseline and ultraviolet light-induced sister chromatid exchanges in peritoneal lymphocytes among different mouse strains. *Mutation Research - Fundamental and Molecular Mechanisms of Mutagenesis* 286, 145-154.
102. Nishina PM, Wang J, Toyofuku W, Kuypers FA, Ishida BY, Paigen B (1993) Atherosclerosis and plasma and liver lipids in nine inbred strains of mice. *Lipids* 28, 599-605.
103. Nishioka Y. (1987) Y-chromosomal DNA polymorphism in mouse inbred strains. *Genet. Res.* 50, 69-72.
104. Oesch F, Morris N, Daly JW (1973) Genetic expression of the induction of epoxide hydrolase and aryl hydrocarbon hydroxylase activities in the mouse by phenobarbital or 3-methylcholanthrene. *Molec. Pharmacol.* 9, 692-696.
105. Otterness DM, Weinshilboum RM (1987a) Mouse thiopurine methyltransferase pharmacogenetics: biochemical studies and recombinant inbred strains. *J. Pharmacol. Exp. Therapeut.* 240, 180-186.
106. Otterness DM, Weinshilboum RM (1987b) Mouse thiopurine methyltransferase pharmacogenetics: Monogenic inheritance. *J. Pharmacol. Exp. Therapeut.* 240, 817-824.
107. Pagel J, Pegram V, Vaughn S, Donaldson P, Bridges W (1973) The relationship of REM sleep with learning in mice. *Behav. Biol.* 9, 383-388.
108. Paul WE, Yoshida T, Benacerraf B (1970) Genetic control of the specificity of anti-DNP antibodies. II. Differences in the specificity of anti-DNP antibody produced by several inbred strains of mice. *J. Immunol.* 105, 314-321.
109. Peacock AC, Gelderman AH, Ragland RH, Hoffman HA (1967) Haptoglobin levels in serum of various strains of mice. *Science* 158, 1703-1704.
110. Pennycuik PR (1967) A comparison of the effects of a variety of factors on the metabolic rate of the mouse. *Aust. J. Biol. Med. Sci.* 45, 331-346.
111. Plant J, Glynn AA (1974) Natural resistance to *Salmonella* infection, delayed hypersensitivity and Ir genes in different strains of mice. *Nature* 248, 345-347.
112. Prud'homme GJ, Sanders R, Parfrey NA, Ste-Croix H (1991) T-cell maturation and clonal deletion in cyclosporine-induced autoimmunity. *Journal of Autoimmunity* 4, 357-368.

113. Pryor GT, Schlesinger K, Calhoun WH (1966) Differences in brain enzymes among five inbred strains of mice. *Life Sci.* 5, 2105-2111.
114. Quock RM, Mueller JL, Vaughn LK, Belknap JK (1996) Nitrous-oxide antinociception in BXD recombinant inbred mouse strains and identification of quantitative trait loci. *Brain Res.* 725, 23-29.
115. Rao JV, Swamy AN, Yamin S (1991) In vitro brain acetylcholinesterase response among three inbred strains of mice to monocrotophos. *Journal of Environmental Science & Health - Part B: Pesticides Food Contaminants & Agricultural Wastes* 26, 449-458.
116. Rings RW, Wagner JE (1971) Incidence of cardiac and other soft tissue mineralized lesions in DBA/2 mice. *Lab. Animal Sci.* 22, 344-352.
117. Robinson SF, Marks MJ, Collins AC (1996) Inbred mouse strains vary in oral self-selection of nicotine. *Psychopharmacology* 124, 332-339.
118. Roderick TH, Wimer RE, Wimer CC, Schwartzkroin PA (1973) Genetic and phenotypic variation in weight of brain and spinal cord between inbred strains of mice. *Brain Res.* 64, 345-353.
119. Rodgers DA (1966) Factors underlying differences in alcohol preference among inbred strains of mice. *Psychosomat. Med.* 28, 498-513.
120. Rowland EC, Lozykowski MG, McCormick TS (1992) Differential cardiac histopathology in inbred mouse strains chronically infected with *Trypanosoma cruzi*. *Journal of Parasitology* 78, 1059-1066.
121. Royce JR (1972) Avoidance conditioning in nine strains of inbred mice using optimal stimulus parameters. *Behav. Genet.* 2, 107-110.
122. Rubinstein P, Liu N, Strenn EW, Decary F (1974) Electrophoretic mobility and agglutinability of red blood cells: a 'new' polymorphism in mice. *J. Exp. Med.* 139, 313-322.
123. Russell ES, Neufeld EF, Higgins CT (1951) Comparison of normal blood picture of young adults from 18 inbred strains of mice. *Proc. Soc. Exp. Biol. Med.* 78, 761-766.
124. Sakagami T, Dixon M, O'Rourke J, Howlett R, Alderuccio F, Vella J, Shimoyama T, Lee A (1996) Atrophic gastric changes in both *Helicobacter felis* and *Helicobacter pylori* infected mice are host dependent and separate from antral gastritis. *Gut* 39, 639-648.
125. Sampugna J, Clements J, Carter TP, Campagnoni AT (1975) Comparison of lipids in total brain tissue from five mouse genotypes. *J. Neurobiol.* 6, 259-266.
126. Sato S, Kitajima K, Konishi S, Takizawa H, Inui N (1987) Mouse strain differences in the induction of micronuclei by polycyclic aromatic hydrocarbons. *Mutation Res.* 192, 185-187.
127. Sato SI, Takizawa H, Inui N (1993) Mouse strain differences in induction of micronuclei by base analogues and nucleosides. *Mutation Research - Mutation Research Letters* 301, 45-49.
128. Schlesinger K, Wimer R (1967) Genotype and conditioned avoidance learning in the mouse. *J. Comp. Physiol. Psychol.* 63, 139-141.
129. Shaikh ZA, Jordan SA, Tewari PC (1993) Cadmium disposition and metallothionein induction in mice: Strain-, sex-, age- and dose- dependent differences. *Toxicology* 80, 51-70.
130. Sheppard JR, Albersheim P, McCleam GE (1968) Enzyme activities and ethanol preference in mice. *Biochem. Genet.* 2, 205-212.
131. Shire JGM, Bartke A (1972) Strain differences in testicular weight and spermatogenesis with special reference to C57BL/10J and DBA/2J mice. *J. Endocrinol.* 55, 163-171.
132. Sinha YM, Salocks CB, Vanderlaan WP (1975) Prolactin and growth hormone levels in different inbred strains of mice: patterns in association with estrous cycle, time of day and perphenazine stimulation. *Endocrinol.* 97, 1112-1122.
133. Smith AG, Francis JE (1993) Genetic variation of iron-induced uroporphyrin in mice. *Biochem. J.* 291, 29-35.
134. Smith GS, Walford RL, Mickey RM (1973) Lifespan and incidence of cancer and other diseases in selected long-lived inbred mice and their F1 hybrids. *J. Natl. Cancer Inst.* 50, 1195-1213.
135. Steinberg AD, Pincus T, Talal N (1971) The pathogenesis of autoimmunity in New Zealand mice. III. Factors influencing the formation of anti-nucleic acid antibodies. *Immunol.* 20, 523-531.
136. Storer JB (1966) Longevity and gross pathology at death in 22 inbred strains of mice. *J. Gerontol.* 21, 404-409.
137. Storer JB (1967) Relation of lifespan to brain weight, body weight and metabolic rate among inbred mouse strains. *Exp. Gerontol.* 2, 173-182.
- Tanioka Y, Esaki K (1971) Strain differences in mortality of anaphylactic shock in mice-challenging by intravenous injection. *Exp. Animals (Japan)* 20, 127-130.
138. Tankersley CG, Fitzgerald RS, Kleeberger SR (1994) Differential control of ventilation among inbred strains of mice. *American Journal of Physiology - Regulatory Integrative and Comparative Physiology* 267, R1371-R1377.
139. Tengbergen WJPR van E (1970) Morphological classification of mammary tumors in the mouse. *Path. Eur.* 5, 260-272.
140. Tennant JR (1965) Susceptibility and resistance to viral leukemogenesis in the mouse. I. Biological definition of the virus. *J. Natl. Cancer Inst.* 34, 625-632.
141. Thomas PE, Hutton JJ, Taylor BA (1973) Genetic relationship between aryl hydrocarbon hydroxylase inducibility and chemical carcinogen induced skin ulceration in mice. *Genetics* 74, 655-659.
142. Toda S, Kimura M, Tohya K (1989) Strain differences in histamine release from mouse peritoneal mast cells induced by compound 48/80 or A23187. *Jikken Dobutsu - Experimental Animals* 38, 135-137.
143. Tokunaga Y, Hiramane C, Itoh M, Mukasa A, Hojo K (1993) Genetic susceptibility to the induction of murine experimental autoimmune orchitis (EAO) without adjuvant. I. Comparison of pathology, delayed type hypersensitivity and antibody. *Clin. Immunol. Immunopathol.* 66, 239-247.
144. Tunnickliff G, Wimer CC, Wimer RE (1973) Relationships between neurotransmitter metabolism and behavior in seven inbred strains of mice. *Brain Res.* 61, 428-434.
145. Van Iersel M, Walters DG, Price RJ, Lovell DP, Lake BG (1994) Sex and strain differences in mouse hepatic microsomal coumarin 7-hydroxylase activity. *Food and Chemical Toxicology* 32, 387-390.
146. Vaz NM, Phillips-Quagliata JM, Levine BB, Vaz EM (1971) H-2 linked genetic control of immune responsiveness to ovalbumin and ovomucoid. *J. Exp. Med.* 134, 1335-1348.
147. Vesell ES (1968) Factors altering the responsiveness of mice to hexobarbital. *Pharmacology* 1, 81-97.
148. Wahlsten D, Hudspeth WJ, Bernhardt K (1975) Implications of genetic variation in mouse brain structure for electrode placement by stereotaxic surgery. *J. Comp. Neurol.* 162, 519-532.
149. Waymouth C (1973) Erythrocyte sodium and potassium levels in normal and anemia mice. *Comp. Biochem. Physiol.* 44A, 751-766.
150. Whitmire CE, Salerno RA, Rabstein LS, Heubner RJ, Turner HC (1971) RNA tumor-virus antigen expression in chemically induced tumors. Virus-genome specified common antigens detected by complement fixation in mouse tumors induced by 3-methylcholanthrene. *J. Natl. Cancer Inst.* 47, 1255-1265.
151. Willott JF, Erway LC, Archer JR, Harrison DE (1995) Genetics of age-related hearing loss in mice. II. Strain differences and effects of caloric restriction on cochlear pathology and evoked response thresholds. *Hearing Research* 88, 143-155.
152. Wimer RE, Wimer CC, Roderick TH (1969) Genetic variability in forebrain structures between inbred strains of mice. *Brain Res.* 16, 257-264.
153. Xidieh CF, Singer-Vermes LM, Calich VLG, Burger E (1994) Plasma amylase levels as a marker of disease severity in an isogenic murine model of paracoccidioidomycosis. *Journal of Medical and Veterinary Mycology* 32, 37-45.
154. Young CR, Deacon NJ, Ebringer A, Davis DAL (1976) Genetic control of the immune response to ferritin in mice. *J. Immunogenet.* 3, 199-205.
155. Zarrow MX, Christenson CM, Eleftheriou BC (1971) Strain differences in the ovulatory response of immature mice to PMS and to the pheromonal facilitation of PMS-induced ovulation. *Biol. Reprod.* 4, 52-56.
156. Zelensov AG (1974) Susceptibility of inbred mice to helminths. II. Development of *Opisthorchis felinus* in A/He, CBA/Lac, CC57W/Mv, C57BL/6J, DBA/2J and SWR/J mice [in Russian]. *Med. Parazit (Mosk.)* 43, 95-98.
157. Zhang LY, Levitt RC, Kleeberger SR (1995) Differential susceptibility to ozone-induced airways hyperactivity in inbred strains of mice. *Experimental Lung Research* 21, 503-518.

INFORMATION IN THIS TECHNICAL RESOURCES SHEET IS BASED ON
DATA FROM INOTIV COMPANY

