



EXERCISE FOR DOGS

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INTRODUCTION

The well-being of dogs used in research is contingent upon the development and implementation of appropriate programs that promote: disease prevention, adequate veterinary care, proper nutrition, sound husbandry, socialization and appropriate facilities (92). There are two factors affecting well-being: physiological and psychological. Physiological well-being may be defined as a state of clinical health or absence of disease or injury. Psychological well-being, however, is problematic in definition because of the complexity of assessing the "mental state" of an animal. One working definition refers to psychological well-being as a state in which an animal is free of distress for the most part, is in good health, exhibits a substantial range of behaviors typical of the species and can deal effectively with its environment (64).

Psychological well-being of dogs has been of recent concern to biological scientists, animal protection groups, the general public and regulatory agencies. The 1985 amendments to the Animal Welfare Act (Public Law 99-189) directed the Animal and Plant Health Inspection Service (APHIS) to promulgate regulations that would require registered dealers, exhibitors and research institutions to provide dogs with the opportunity to exercise. All registrants must develop an institutional plan that would satisfy regulatory requirements (1). APHIS has suggested that opportunities for exercise may be provided in a number of different ways. For example:

Dogs may be group housed in cages, pens or runs that provide at least 100 per cent of the regulated space requirement for each dog.

Individually housed dogs can be housed in cages, pens or runs that provide at least double the minimum regulated space required.

Dogs can be given access to a run or open space.

Dogs can be given positive physical contact with a human which encourages exercise (e.g. play).

Treadmills, carousels, swimming or other forms of forced exercise cannot be utilized to meet regulatory criteria since the intent of Congress was to provide the dog with the "opportunity" for exercise (1).

Controversy has surrounded the development of standards to satisfy Congressional intent (2,5). Although research has been conducted using dogs as a model for exercise physiology, little scientific work has been conducted to determine a dog's exercise "needs" in a physiologic and psychological sense (63,64,66,92). However, comparative studies may be beneficial in establishing physiological reference values of physical fitness that can be used to further investigate physiological "need".

Many factors are thought to influence the physiological and psychological well-being of the confined dog. Genotype, housing, behavior, sex, breed, age and socialization have been cited as variables (69,87,90). Of these factors housing and socialization (animal or human) have been studied to a limited degree. To date, studies have not been able to significantly demonstrate that cage size affects exercise and/or physical fitness when submaximal heart rate, muscle enzymes (O₂ utilization) and plasma cortisol (stress) are measured (63,66,70,71).

There is, however, evidence that well-socialized dogs are more likely to be active than those that are socially deprived (67,69,76). Socialization can be provided through conspecifics, human contact or both. Ethological studies of wild animals have revealed that when all physiological criteria are met through food abundance, shelter and there is absence of predation animals will not "exercise". The conservation of energy is of utmost importance in wild animals and unnecessary expenditure is not a viable strategy. Therefore exercise happens as a result of animals satisfying other behavioral and physiological activities (e.g. foraging for food, socializing or seeking shelter (69). Socialization in packs for the purpose of maintaining hierarchy, resource access and breeding privilege may be considered one of the activities. How this extrapolates to the confined domestic dog has not been determined.

More research into physiological and psychological factors is needed to fully determine their importance in maintaining a dog's psychological well-being in a variety of environments and how to measure those factors to determine whether needs are met (63,64,66,67).

This Special Reference Brief (SRB) is designed to provide bibliographic information on exercise for dogs. The SRB has been divided into categories that are related to the subject area: Regulatory Issues, Exercise Physiology, Environmental Physiology and Behavior, Husbandry and Management and, Biological Reference Values. The information in this document was derived from a variety of information resources. All citations available from the collection of the National Agricultural Library (NAL) will provide the NAL call number.

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REGULATORY ISSUES

001

9 CFR Part 3 Animal Welfare; Standards; Final Rule: Subpart A -- Dogs and Cats. Federal Register 56(32):6432-6460 (February 15, 1991).

NAL call number: JK6.F4

Descriptors: regulations, housing, handling, transport, treatment, care.

002

"Doghouse or dogtrot -- How much exercise does a dog need?" Upfront 9(1) Winter 1991, The Veterinary Medical Experiment Station, College of Veterinary Medicine, The University of Georgia, Athens, GA 30602 (Newsletter).

Descriptors: caging, indoor and outdoor housing, exercise, physical fitness.

003

"Caging systems for dogs under the new standards of the Animal

Welfare Act." W.E.Britz. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 48-52.

NAL call number: QL737.C22C36

Descriptors: pens, runs, kennels, facility design, floor space.

004

"Regulations for canine wellbeing in Canada." H.C. Rowsell. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 11-18.

NAL call number: QL737.C22C36

Descriptors: legislation, housing, Canadian Council on Animal Care, recommendations.

005

"Regulatory requirements for exercise of dogs." D.F. Schwindaman. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 3-7.

NAL call number: QL737.C22C36

Descriptors: Animal Welfare Act, proposed regulations, housing, exercise requirements.

006

"Billion dollar price tag for new animals rules." C. Holden. Science 242 (4879):662-663 (November 4, 1988).

NAL call number: 470 Sci2

Descriptors: dogs, nonhuman primates, facilities, costs, regulations, Animal Welfare Act, exercise, cages, biomedical research.

EXERCISE PHYSIOLOGY

Cardiovascular

007

"Augmentation of coronary flow improves myocardial function in exercise." [Abstract] P.A. Gwartz, J.M. Dodd et.al. Journal of Cardiovascular Pharmacology 15(5):752-758 (May 1990).

Descriptors: dogs, coronary blood flow (CBF), ventricular pressure, atrial pressure, prazosin, adenosine, submaximal exercise.

008

"Endurance training alters arterial baroreflex function in dogs."

P.A. Gwartz, M.A. Brandt, H.J. Mass et.al. Medicine and Science in Sports and Exercise 22(2):200-206 (April 1990).

Descriptors: arterial pressure, baroreceptor pressure, electrocardiogram, heart rate, R-R interval, nitroprusside, carotid occlusion.

009

"Does exercise training alter myocardial creatine kinase MB isoenzyme content?" T.D. Miller et.al. *Medicine and Science in Sports and Exercise* 21(4):437-440 (August 1989).

Descriptors: dogs, myocardial degeneration-regeneration.

010

"Daily exercise enhances coronary resistance vessel sensitivity to pharmacological activation." S.E. DiCarlo, R.W. Blair, V.S. Bishop et.al. *Journal of Applied Physiology* 66(1):421-428 (January 1989).

NAL call number: 447.8 J825

Descriptors: dogs, intracoronary infusion, alpha-adrenergic agonists, beta 2-adrenergic agonists, vasodilator, nonspecific potentiation, stellate ganglionectomy.

011

"Endurance training in dogs increases vascular responsiveness to analpha 1-agonist." J.M. Evans, J.N. Funk, J.B. Charles, et.al. *Journal of Applied Physiology* 65(2):625-632 (August 1988).

NAL call number: 447.8 J825

Descriptors: baroreflex modulation, heart rate, vascular resistance, phenylephrine, treadmill, ganglionic blockade.

012

"Effects of chronic beta-adrenergic blockade on exercise training in dogs." E.E. Wolfel, J. Lindenfeld, J. Smoal, et.al. *Journal of Applied Physiology* 64(5):1960-1967 (May 1988).

NAL call number: 447.8 J825

Descriptors: propranolol, treadmill, heart rate, blood volume, arterial lactates.

013

"Hemodynamics and left ventricular function: A comparison between adult racing greyhounds and greyhounds completely untrained from birth." L.A. Pape, J.M. Price, S. Alpert, et.al. *Basic Research in Cardiology* 81(4):417-424 (July-August 1986).

Descriptors: left ventricular function, cardiomegaly, systemic vascular resistance, cardiac index, stroke volume.

014

"Dynamic exercise training in foxhounds. I. Oxygen consumption and hemodynamic responses." T.I. Musch, G.C. Haidet, G.A. Ordway, et.al. *Journal of Applied Physiology* 59(1):183-189 (July 1985).

NAL call number: 447.8 J825

Descriptors: maximal exercise, submaximal exercise, treadmill, cardiac output, lactate, VO₂max.

015

"Cardiac output and muscle blood flow in exercising dogs." R. Pendergast, J.A. Krasney, A. Ellis, et.al. *Respiratory Physiology* 61(3):317-326 (September 1985).

NAL call number: QP121.A1R4

Descriptors: average blood flow, treadmill, oxygen uptake, cardiac output, muscle blood flow.

016

"Proximal coronary vasomotor reactivity after exercise training in dogs." A.A. Bove and J.D. Dewey. *Circulation* 71(3):620-625 (March 1985).

Descriptors: treadmill, submaximal exercise, endurance, alpha-adrenergic stimulation, serotonin.

017

"Effects of exercise training on coronary transport capacity." M.H. Laughlin. *Journal of Applied Physiology* 58(2):468-476 (February 1985).

NAL call number: 447.8 J825

Descriptors: dogs, sedentary, exercise-trained, coronary blood flow, permeability surface area, labelling, muscles, vasodilation.

018

"Maximum coronary blood flow and minimum coronary resistance in exercise-trained dogs." I.Y. Liang, M. Hamra and H.L. Stone. *Journal of Applied Physiology* 56(3):641-647 (March 1984).

NAL call number: 447.8 J825

Descriptors: microspheres, adenosine, myocardial flow.

019

"Coronary vascular response to adrenergic stimulation in exercise-conditioned dogs." P.A. Gwartz and H.L. Stone. *Journal of Applied Physiology* 57(2):315-320 (August 1984).

NAL call number: 447.8 J825

Descriptors: treadmill, resting, submaximal exercise, alpha-receptor stimulation, neural control, potentiation.

020

"Blood volume, heart rate, and left ventricular ejection fraction changes in dogs before and after exercise during endurance training." I.C. Mackintosh, I.C. Dormel, A.L. Van Gelder et.al. *American Journal of Veterinary Research* 44(10):1960-1962 (October 1983).

NAL call number: 41.8 AM3A

Descriptors: radionuclide angiography, interrelationships, cardiovascular system.

021

"Exercise in electrocardiographic interpretation." D.G. Allen and R.S. Downey. *The Canadian Veterinary Journal* 24(6):199 (June 1983).

NAL call number: 41.8 R3224

Descriptors: tracing analysis, diagnostics, interpretation, clinical studies.

022

"Effect of exercise conditioning on coronary resistance." I.Y. Liang and H.L. Stone. *Journal of Applied Physiology* 53(3):631-636 (September 1982).

NAL call number: 447.8 J825

Descriptors: treadmill, diastolic coronary resistance, aortic pressure, left coronary circumflex flow, adrenergic blockade.

023

"Heart rate adaptation to exercise training in cardiac denervated dog." G.A. Ordway, J.B. Charles, D.C. Randall, et.al. *Journal of Applied Physiology* 52:1586-1590 (1982).

NAL call number: 447.8 J825

Descriptors: intrapericardial denervation, chronic exercise, bradycardia, treadmill.

024

"Effects of intensive exercise training on myocardial performance and coronary blood flow." R.J. Barnard, H.W. Duncan, K.M. Baldwin, et.al. *Journal of Applied Physiology* 49(3):444-449 (September 1980).

NAL call number: 447.8 J825

Descriptors: treadmill, gastrocnemius malate dehydrogenase, cardiac output, stroke volume, tension-time index, pressure time-index.

025

"Changes in diastolic coronary resistance during submaximal exercise in conditioned dogs." I.Y. Liang and H.L. Stone. *Journal of Applied Physiology* 54(4):1057-1062 (April 1983).

NAL call number: 447.8 J825

Descriptors: left circumflex coronary flow, aortic pressure, heart rate, adrenergic blockade, myocardial oxygen consumption.

026

"Coronary flow, myocardial oxygen consumption, and exercise training in dogs." H.L. Stone. *Journal of Applied Physiology* 49:759-768 (1980).

NAL call number: 447.8 J825

Descriptors: coronary blood flow, atrial pacing, occlusion, reactive hyperemia.

027

"Cardiovascular responses to local hindlimb hypoxemia: Relation to the exercise reflex." J. Longhurst and R. Zelis. *American Journal of Physiology* 237(3):359-H365 (September 1979).

NAL call number: 447.8 AM3

Descriptors: chemoreceptors, hypercapnia, acidosis, pressure reflex, tachycardia reflex.

028

"Myocardial blood flow and hemodynamic responses to exercise training in dogs." A.A. Bove, P.B. Hultgren, T.F. Ritzer, et. al. *Journal of Applied Physiology* 46:571-578 (1979).

NAL call number: 447.8 J825

Descriptors: hypertrophy, hemodynamics, bloodflow, treadmill.

029

"Effects of exercise training on coronary reactive hyperemia and blood flow in the dog." M.H. Laughlin, J.N. Diana and C.M. Tipton. *Journal of Applied Physiology* 45:604-610 (1978).

NAL call number: 447.8 J825

Descriptors: coronary occlusion, blood flow, vascular resistance,

weight ratios, hypertrophy.

030

Venous Pressure Changes: Their Measurement and Significance in Exercising Dogs [Doctoral dissertation] by Andrew Algis Schoenberg, University of Utah, 1972. University Microfilms, Ann Arbor, MI; 1972.

NAL call number: DISS 72-7, 724

Descriptors: vascular reactivity, physiology.

031

"A submaximal test for dogs: Evaluation of effects of training, detraining, and cage confinement." C.M. Tipton, R.A. Carey, W.C. Eastin, et.al. *Journal of Applied Physiology* 37:271-275 (1974).

NAL call number: 447.8 J825

Descriptors: coronary blood flow, blood pressure, atropine.

Musculoskeletal

032

"Effects of exercise on blood flow to canine articular tissues."

P.A. Simkin, A. Huang and R.S. Benedict. *Journal of Orthopaedic Research* 8(2):297-303 (March 1990).

Descriptors: articular blood flow, microsphere technique, treadmill, justa-articular bone.

033

"Moderate running exercise augments glycosaminoglycans and thickness of articular cartilage in the knee joint of young Beagle dogs." I. Kiviranta, M. Tammi, J. Jurvelin, et.al. *Journal of Orthopaedic Research* 6(2):188-195 (1988).

Descriptors: histology, microspectrophotometry, stifle joint, GAGs, chondroitin sulfates, calcification.

034

"Training effects on regional blood flow response to maximal exercise in foxhounds." T.I. Musch, G.C. Haidet, G.A. Ordway, et.al. *Journal of Applied Physiology* 62(4):1724-1732 (April 1987).

NAL call number: 447.8 J825

Descriptors: treadmill, blood flow, muscles, dynamic exercise training.

035

"Dynamic exercise training in foxhounds: II. Analysis of skeletal muscle." D. Parson, T.I. Musch, R.L. Moore, et.al. *Journal of Applied Physiology* 59(1):190-197 (July 1985).

NAL call number: 447.8 J825

Descriptors: gastrocnemius, triceps, semitendinosus, treadmill, biochemical analysis, histochemical analysis.

036

"Muscle cell electrical hyperpolarization and reduced hyperkalemia in physically conditioned dogs." J.P. Knochel, J.D. Blachley, J.H. Johnson, et.al. *Journal of Clinical Investigation* 75(2):740-745 (February 1985).

NAL call number: 447.8 J825

Descriptors: treadmill, potassium, skeletal muscle, biochemical analysis, somatostatin.

037

"Hypothalamic rectal and muscle temperatures in exercising dogs effect of cooling." B. Kruk, H. Kaciuba-Uscilko, K. Nazar, et.al. *Journal of Applied Physiology* 58(5):1444-1448 (1985).

NAL call number: 447.8 J825

Descriptors: endurance, body temperature, hyperthermia, heart rate, respiratory rate, blood lactic acid, plasma osmolality.

038

"Morphometric analyses on the muscles of exercise trained and untrained dogs." C.M. Cabri and N.T. James. *American Journal of Anatomy* 166(3):359-368 (March 1983).

NAL call number: 447.8 AM32

Descriptors: endurance, treadmill, muscle biopsy, stereology, heterochromatin, euchromatin.

039

"Effects of exercise on the histochemical changes of articular chondrocytes in adult dogs." S.A. Kincaid and D.C. Van Sickle. *American Journal of Veterinary Research* 43(7):1218-1226 (1982).

NAL call number: 41.8 Am3A

Descriptors: enzymes, humeral head, lactic acid dehydrogenase, succinic acid, nicotinamide dinucleotide dehydrogenase, glucose-6-phosphatases, lipid synthesis.

040

"Influence of physical activity on ligament insertions in the knees of dogs." G.S. Laros, C.M. Tipton and R.R. Cooper. *Journal of Bone and Joint Surgery* 53A:275-286 (1971).

Descriptors: articulation, joint.

041

"Physical fitness in the confined dog: Criteria and monitoring of muscular performance." J.T. Yoder, B.W. Kingrey and L.R. Dragestedt. *American Journal of Veterinary Research* 25:727-738 (1964).

NAL call number: 41.8 Am3A

Descriptors: laboratory, treadmill, blood lactate, pulse rate, alkaline reserve, hemoglobin, muscle fibers.

Biochemical/Metabolic

042

"Effects of exercise programs on serum biochemical stress indicators in purpose-bred Beagle dogs." S. Campbell. In: *Canine Research Environment* J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 77-82.

NAL call number: QL737.C22C36

Descriptors: cage housing, serum chemistry, cortisol, lymphocyte transformation.

043

"Effect of exercise conditioning on red blood cell volume and erythropoietin concentration in the beagle dog." H.U. Magerlein, S.A. Heffner and M.R. Fedde. *Journal of Sports Medicine and Physical Fitness* 30(3):231-234 (1990).

Descriptors: hematology, treadmill, endurance training, blood cell index.

044

"Physiological and blood biochemical responses to submaximal treadmill exercise in Canaan dogs before, during and after training." J.C. Sneddon, P.P. Minnaar, J.F. W. Grosskopf, et.al. *Journal of the South African Veterinary Association* 60(2):87-91 (June 1989).

NAL call number: 41.8S08

Descriptors: indices of fitness, heart rate, rectal temperature, plasma creatine kinase, plasma lactate, hemoglobin.

045

"Hematologic, biochemical, blood-gas, and acid-base values in Greyhounds before and after exercise." J.E. Ilkiw, P.E. Davis and D.B. Church. *American Journal of Veterinary Research* 50(4):583-586 (April 1989).

NAL call number: 41.8 Am3A

Descriptors: heart rate, respiratory rate, rectal temperature, blood cell counts, sodium, chloride, aspartate transaminase, creatine kinase, urea.

046

"Changes in hematology and plasma biochemistry during maximal exercise in Greyhounds." D.H. Snow, R.C. Harris and E. Stuttard. *Veterinary Record* 123(19):487-489 (1988).

NAL call number: 41.8 V641

Descriptors: red blood cell counts, hemoglobin, hematocrit, plasma protein, creatinine, blood lactate, plasma glucose, ammonia, glycerol, uric acid.

047

"Factor VIII complex in canine plasma after submaximal treadmill exercise." M.A. Turrentine, A.W. Hahn and G.S. Johnson. *American Journal of Veterinary Research* 47(1):39-42 (January 1986).

NAL call number: 41.8 Am3A

Descriptors: coagulation Factor VIII, von Willibrand factor, coagglutinin cofactor activity, plasma concentrations.

048

"Intermuscular variation in enzyme response to training in dogs." R.B. Armstrong and M.H. Laughlin. *Federation Proceedings* 44:1371 (1985).

NAL call number: 442.9 F31P

Descriptors: succinate dehydrogenase, gastrocnemius, triceps brachii, gluteal, gracilis, flexor digitorum superficialis.

049

"Hemodynamic effects of minus 6 degrees tilt on exercise-trained

vs cage-confined dogs." W.G. Squires, T.D. Branddon, D. Rotto, et.al. *Medicine and Science in Sports and Exercise* 17(2):282 (1985).

Descriptors: hematology, confinement.

050

"Important role of glucagon during exercise in diabetic dogs."

D.H. Wasserman, H.L. A. Lickley and M. Vranic. *Journal of Applied Physiology* 59(4):1272-1281 (1985).

NAL call number 447.8 J825

Descriptors: glucose kinetics, insulin, counter-regulatory hormones, epinephrine, norepinephrine, cortisol, lactate, immunoreactive glucagon (IRG).

051

"Strenuous exercise may cause health hazards for racing Greyhounds." G. Bjotvedt, C.W. Weems and K. Foley. *Veterinary Medicine and Small Animal Clinician* 79(12):1481-1487 (December 1984).

NAL call number: 41.8 M69

Descriptors: temperature, ear canal, rectal, blood samples, morphology, lactic acid, blood cell count, hemoglobin, packed cell volume, biochemical changes.

052

"Chylomicron triglyceride metabolism in resting and exercising fed dogs." R.L. Terjung, L. Budoltoski, K. Nazar, et.al. *Journal of Applied Physiology* 52(4):815-820 (April 1982).

NAL call number: 447.8 J825

Descriptors: fatty acids, working muscle, triglyceride uptake.

053

"Effects of heatstroke, dehydration and exercise on blood enzyme levels in the dog." A. Magazanik, Y. Epstein, Y. Shapiro and E. Sohar. In: *Contributions to Thermal Physiology: A Satellite Symposium of the 28th International Congress of Physiological Sciences*, Peces, Hungary, 1980 Z. Szelenyi and M. Szekely (eds.), Pergamon Press, Oxford, 1981, pp. 549-552.

NAL call number: QP1.I522 1980

Descriptors: treadmill, creatine phosphokinase, 1,6 diphosphate-aldolase, glutamic pyruvic transaminase, glutamic oxaloacetic transaminase.

054

"The physiological response of Siberian Husky dogs to exercise: Effect of interval training." A.E. Ready and G. Morgan. *Canadian Veterinary Journal* 25(2):86-91 (1984).

NAL call number: 41.8 R3224

Descriptors: hematology, hemoglobin, hematocrit, blood cell counts, lactate, creatine, phosphokinase, glutamic pyruvic transaminase, heart rate.

055

"Metabolic and temperature responses to physical exercise in thyroidectomized dogs." H. Kaciuba-Uscilko, Z. Brzezinska and A. Kobryn. *European Journal of Applied Physiology and Occupational*

Physiology 40(4):219-226 (1979).

Descriptors: exertion, fatty acids, norepinephrine, thyroid hormones.

056

"The effect of prolonged restriction of physical activity on exercise performance in dogs." E. Pohoska. *Acta Physiologica Polonica* 30(3):337-350 (1979).

NAL call number: 444.8 AC8

Descriptors: temperature, rectal, blood samples, glucose, lactate, free fatty acid, adrenaline, noradrenaline, muscle glycogen, muscle biopsy.

057

"The effect of restriction of physical activity on adaptation to prolonged exercise in dogs." E. Pohoska. *Acta Physiologica Polonica* 27(2):199-202 (1976).

NAL call number: 444.8 AC8

Descriptors: temperature, blood enzymes, muscle biology.

058

"Lactate metabolism in resting and exercising dogs." B. Issekutz, Jr., W.A.S. Shaw and A.C. Issekutz. *Journal of Applied Physiology* 40(3):312-319 (1976).

NAL call number: 447.8 J825

Descriptors: turnover, oxidation, gluconeogenesis, utilization.

Respiration

059

"Ventilatory responses during electrically induced muscular work in anesthetized dogs after both deafferentation and cross circulation of hindlimbs." A.C. Da Silva, et.al. *Brazilian Journal of Medical and Biological Research* 15(2-3):153-159 (July 1982).

Descriptors: neural afferent component, hyperpnea, humoral effects, respiratory minute volume, frequency, tidal volume, oxygen consumption, tachypneic response.

060

"Control of ventilation during graded exercise in the dog." P.C. Szylyk, B.W. McDonald, R. Pendergast, et.al. *Respiratory Physiology* 46(3):345-365 (December 1981).

NAL call number: QP121.A1R4

Descriptors: VE response, treadmill, VT response, frequency.

061

"Respiratory and circulating adjustments in evaporative heat loss of dogs at rest and exercise." K. Pleschka, K. Rockenfeller, C. Schaefer, et.al. In: *Contributions to Thermal Physiology: A Satellite Symposium of the 28th International Congress of Physiological Sciences*, Peces, Hungary, 1980. Z. Szelenyi and M. Szekely (eds.), Pergamon Press, Oxford, 1981, pp. 545-547.

NAL call number: QP1.I522 1980

Descriptors: lingual blood flow, respiratory rate, thermoregulation, treadmill, blood pressure, interplueral

pressure, electromagnetic flowmetry.

062

"Oxygen consumption and ventilation of dogs during passive and active exercise." A.K. Russo, J. Tarasantchi and M.A. Griggio.

Journal of Applied Physiology 42(6):923-927 (1977).

NAL call number: 447.8 J825

Descriptors: energy metabolism, ventilation, respiratory parameters.

ENVIRONMENTAL PHYSIOLOGY AND BEHAVIOR

063

"Influence of type of enclosure on exercise fitness of dogs."

J.D. Clark, J.P. Calpin and R.B. Armstrong. American Journal of Veterinary Research 52(7):1024-1028 (July 1991).

NAL call number: 41.3 AmA3

Descriptors: environment, treadmill, heart rate, enzyme activities.

064

"Psychologic Well-Being: Conceptual issues, behavioral measures, and implications for dogs." Suzanne Hetts. Veterinary Clinics of North America: Small Animal Practice 21(2):369-387 (March 1991).

Descriptors: Animal Welfare Act, regulations, history, physical and psychic well-being, measures, indicators, abnormal behavior, normal behavior, preference testing, caging, socialization.

065

"Environmental variables and animal care." E.L. Besch. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 53-57.

NAL call number: Q17337.C22C36

Descriptors: temperature, humidity, ventilation, contaminants.

066

"Research studies in exercise and behavior of dogs." J.D. Clark.

In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 61-65.

NAL call number: QL737.C22C36

Descriptors: confinement systems, housing, experimental design, EKG, muscle enzyme, behavior.

067

"Effects of primary enclosure size and human contact." H.C.

Hughes and S. Campbell. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp.66-75.

NAL call number: QL737.C22C36

Descriptors: housing, movement, distance, time, handling.

068

"Socialization and management of purpose-bred dogs." T. Carroll, D.A. Valerio and G. Pucak. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 33-37.

NAL call number: QL737.C22C36

Descriptors: whelping, neonatal care, social behavior program.

069

"Canine behavior." M.W. Fox. In: Canine Research Environment J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp. 21-31.

NAL call number: QL737.C22C36

Descriptors: ethology, socialization, exercise, housing, environment, psychological well-being.

070

"The effects of cage size and pair housing on exercise of Beagle dogs." H.C. Hughes, S. Campbell and C. Kenney. *Laboratory Animal Science* 39(4):302-305 (1989).

NAL call number: 410.9 P94

Descriptors: distance , activity patterns, movement, socialization.

071

"Some effects of limited exercise on purpose-bred Beagles." S.A. Campbell, H.C. Hughes, H.E. Griffin, et.al. *American Journal of Veterinary Research* 49 (8):1298-1301 (August 1988).

NAL call number 41.8 Am3A.

Descriptors: dogs, exercise, stress, lymphocyte transformation, cortisol, animal welfare.

072

"Activity and behavior of farmed raccoon dogs." H. Korhonen. *Scientifur* 12 (1):27-37 (1988).

NAL call number: SF402 S3

Descriptors: circadian activity, behavioral patterns, rhythms, eating, elimination, aggression, environmental conditions.

073

"Effects of cage size on growth, feed intake, fur quality and activity pattern of farmed raccoon dogs." H. Korhonen and M. Harri. *Zeitschrift fur Versuchstierkunde* 31 (2):49-54 (1988).

NAL call number: 410 Z36

Descriptors: breeds, cage size, cage rearing, growth rate, food intake, fur quality, animal behavior.

074

"Effects of indoor and outdoor maintenance of dogs upon food intake, body weight, and different blood parameters." G. Kuhn and W. Hardegg. *Zeitschrift fur Versuchstierkunde* 31(5):205-214 (1988).

NAL call number: 410 Z36

Descriptors: environment, red blood cell counts, packed cell

volume, hemoglobin, plasma enzymes, substrates, minerals.

075

"Physiologic basis and consequences of distress in animals." J.E. Breazile. *Journal of the American Veterinary Medical Association* 191:1212-1215 (1987).

NAL call number: 41.8 AM3

Descriptors: stress, eustress, feeding behavior, reproduction, ACTH, glucocorticoids, sympathetic nervous system, responses.

076

Laboratory Animal Husbandry: Ethology, Welfare and Experimental Variables M.W. Fox. State University of New York Press, Albany, NY; 1986, pp. 11-15.

NAL call number: SF406 F69

Descriptors: confinement effects, physical activity, stereotypies, cage size.

077

"Motor activity of mongrel dogs under three different housing conditions." H. Sigg and I. Tobler. *Zeitschrift fur Versuchstierkunde* 28(4):157-165 (1986).

NAL call number: 410 Z36

Descriptors: dogs, animal housing, movements, dark, light, kinetic energy.

078

"A socializing program for laboratory-raised canines." S.L. Vanderlip, J.E. Vanderlip and S. Myles. *Lab Animal* 14:33-36 (1985).

NAL call number: QL55.A1L33

Descriptors: behavior, temperament testing, selection and breeding.

079

"The effects of differential rearing on exploratory behavior in puppies." J.C. Wright. *Applied Animal Ethology* 10(1-2):27-34 (1983).

NAL call number: QL750.A6

Descriptors: hand-rearing, litter-rearing, stimulus, exploratory behavior, locomotor activity, novel objects, reactivity.

080

"Ecological behavior of free-ranging urban pet dogs." H.D. Rubin and A.M. Beck. *Applied Animal Ethology* 8(1-2):161-168 (1982).

NAL call number: QL750.A6

Descriptors: activity patterns, range, social interaction, roaming.

081

"Influence of living area space on agonistic interaction in Telomian dogs." T.F. Pettijohn, K.L. Davis and J.P. Scott. *Behavioral Neurological Biology* 28(3):343-349 (1980).

Descriptors: aggression, crowding, dominance, eating, spatial behavior.

082

"Concurrent exercise of dogs using carousel type treadmill." R.K. Martin and J.P. Albright. *Journal of Applied Physiology* 46(4):1205-1206 (1979).

NAL call number: 447.8 J825

Descriptors: treadmill development, banked track, construction, design, speed, maintenance, diagram.

083

"Effect of cage size on patterns of activity and health of Beagle dogs." M. Hite, H.M. Hanson, N.R. Bohidar, et.al. *Laboratory Animal Science* 27:60-64 (1977).

NAL call number: 410.9 P94

Descriptors: weight gain, activity patterns, standing, lying, sitting, sleeping, electrocardiograph, examinations, ophthalmic, hematologic, biochemical measurements.

084

"Cage activity in the laboratory Beagle: A preliminary study to evaluate a method of comparing cage size to physical activity." J. Neamand, W.T. Sweeney, A.A. Creamer, et.al. *Laboratory Animal Science* 25:180-183 (1975).

NAL call number: 410.9 P94

Descriptors: physical activity, specific activity measurements, body weight, blood chemical and urine values.

085

"An evaluation of the effects of various degrees of long term confinement on adult Beagle dogs." W.M. Newton. *Laboratory Animal Science* 22:860-64 (1972).

NAL call number: 410.9 P94

Descriptors: calcium-47 kinetic analysis, myofibrillar enzymes.

086

"Effect of person and environment on heart rates in two strains of pointer dogs." K.J. Thomas, O.D. Murphee and J.E. Newton. *Conditional Reflex* 7(2):74-81 (April/June 1972).

Descriptors: petting, human presence, bradycardia, genetics.

087

"Effects of rearing conditions on the behavior of laboratory animals." M.W. Fox. In: *Defining the Laboratory Animal* National Academy of Sciences, Washington, DC; 1971, pp. 294-312.

NAL call number: SF406 I52

Descriptors: selective breeding, genotype, handling, socialization, temperament, isolation, exercise.

088

"Behavioral effects of rearing dogs with cats during the critical period of socialization." M.W. Fox. *Behaviour* 35(3-4):273-280 (1969).

NAL call number: 410 B393

Descriptors: intra-species socialization, intra-species identification, avoidance, recognition, bonding.

089

"Neurochemical and behavioral effects of isolation rearing in dogs." H.C. Agrawal, M.W. Fox and W.A. Himwich. *Life Sciences* 6:71-78 (1967).

NAL call number: 442.8 262

Descriptors: social interaction, environment, electrophysiology, electroencephalography, chemical analysis.

090

"Environmental factors influencing stereotyped and allelomimetic behavior in animals." M.W. Fox. *Laboratory Animal Care* 15:363-370 (1965).

NAL call number: 410.9 P94

Descriptors: review, normal behavior, abnormal behavior, social stimulation, crowding.

091

"An evaluation of an outdoor kennel for dogs." A.C. Anderson and M. Goldman. *Journal of the American Veterinary Medical Association* 137:129-135 (1960).

NAL call number: 41.8 AM3

Descriptors: housing, economics, design, welfare.

HUSBANDRY AND MANAGEMENT

092

"Policy, program and people: The three P's to wellbeing." T.L. Wolfle. In: *Canine Research Environment* J.A. Mench and L. Krulisch (eds.), Proceedings from a conference held by the Scientists Center for Animal Welfare, June 22, 1989. SCAW, Bethesda, MD; January 1990, pp.41-47.

NAL call number: QL737.C22C36

Descriptors: psychological well-being, exercise, socialization, management, performance vs. engineering standards.

093

Laboratory Animal Husbandry: Ethology, Welfare and Experimental Variables M.W. Fox, State University of New York Press, Albany, NY; 1986.

NAL call number: SF406 F69

Descriptors: behavior, care, management, wellbeing.

094

Guide for the Care and Use of Laboratory Animals U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD; NIH Publication No. 86-23, 1985, pp. 11-31.

NAL call number: SF406 N32 1985

Descriptors: guidelines, policy, husbandry, facilities, laboratory management.

095

Comfortable Quarters for Laboratory Animals Animal Welfare Institute: Washington, DC; 1979, pp. 52-57.

NAL call number: SF91.A5

Descriptors: housing, facilities, site visits, requirements, indoor, outdoor.

096

Dogs: Standards and Guidelines for the Breeding Care and Management of Laboratory Animals ILAR (Institute of Laboratory Animal Resources) Subcommittee on Dog and Cat Standards, Committee on Standards, National Academy of Sciences, Washington, DC; 1973, 48 pp.

NAL call number: SF407 D6N38

Descriptors: selection, conditioning, procurement, facilities, husbandry, restraint, euthanasia, disposal.

097

The Beagle as an Experimental Dog Iowa State University Press, Ames, IA; 1970, pp. 10-15.

NAL call number: QL737 C22A5

Descriptors: caging, housing, indoors, outdoors, husbandry.

098

"Housing for research dogs." N.R. Brewer. Federation Proceedings 20:917-918 (1961).

NAL call number: 442.9 F31P

Descriptors: pens, cages, space, confinement, survey.

099

The Dog in Medical Research K.S. Grimson. Public Health Service, Washington, DC. PHS Publication No. 312. 1961.

Descriptors: husbandry, management, health.

BIOLOGICAL REFERENCE VALUES

100

"Age dependency of haematological values and concentrations of serum biochemical constituents in normal Beagles from 1 to 14 years of age." S. Fukuda, N. Kawashima, H. Lida, et.al. Japanese Journal of Veterinary Science 51(3):636-641 (1989).

NAL call number: 41.8 J27

Descriptors: red blood cell count, hemoglobins, hematocrits, corpuscular volume, proteins, glucose, urea, enzymes.

101

"Gastric emptying of a radionuclide-labeled test meal in healthy dogs: A new mathematical analysis and reference values." W.E. van den Brom and R.P. Happe. American Journal of Veterinary Research 47(10):2170-2174 (1986).

NAL call number: 41.8 Am3A

Descriptors: mathematical analysis, ^{99m}Tc-sulfur colloid, ^{99m}Tc-diethylenetriaminepentaacetic acid.

102

"Electroneurographic examination of the ulnar and radial nerves in the dog: Reference values, biological variation and reproducibility." J.J. van Nes and W.E. van den Brom. Research in Veterinary Science 40(2):189-196 (1986).

NAL call number: 41.8 R312

Descriptors: electrophysiology, velocity, amplitude, peaks, nerve action potentials.

103

"Baroreceptor reflex cardiovascular control in mongrel dogs and racing Greyhounds." R.H. Cox, R.J. Bagshaw, D.K. Detweiler, et.al. *American Journal of Physiology* 249(3):H655-662 (1985).

NAL call number: 447.8 AM3

Descriptors: hemodynamic variables, vagal afferents, hypertension, regional blood flow.

104

"Variance estimates and individuality ratios of 25 serum constituents in Beagles." N. Liessing, R. Rizzo, H. Sargent, et.al. *Clinical Chemistry* 31(1):83-86 (1985).

NAL call number: 396.8 C61

Descriptors: pretreatment values, reference intervals, experimental design, analytical methods, variance.

105

"Normal values of coagulation of canine blood." A.C. Zondag, A.M. Kolb, et.al. *Hemostasis* 15:318 (1985).

NAL call number: SF601 V523

Descriptors: thrombokinetics, screening techniques, plasma, clotting factors.

106

"Normal values of canine M-mode echocardiogram." C.W. Lombard. *American Journal of Veterinary Research* 45:2015 (1984).

NAL call number: 41.8 Am3A

Descriptors: measurements, correlations, body weight.

107

"Echocardiographic indices in the normal dog." J. Boon, W.E. Wingfield and C.W. Miller. *Veterinary Radiology* 24(5):214-221 (1983).

NAL call number: 41.9 AM37

Descriptors: m-mode echocardiography, amplitude, dimensions, aortic and atrial measurements.

108

"Basal levels of plasma epinephrine and norepinephrine in the dog." P.A. Bridle, K.B. Brosnihan et.al. *Hypertension* 5:V128 (1983).

Descriptors: conscious and unconscious dogs, catecholamine, hemodynamic variables.

109

"Sensory nerve conduction velocity of cutaneous afferents of the radial, ulnar, neroneal, and tibial nerves of the dog: Reference values." R.W. Redding, J.T. Ingram and S.B. Colter. *American Journal of Veterinary Research* 43(3):517-521 (1982).

NAL call number: 41.8 Am3A

Descriptors: mean conduction velocities, sensory action potentials, average evoked response technique.

110

"Normal biochemical values of canine blood." P. Schoning and A.C.

Strafuss. Canine Practice 9(6):16-18 (1982).

NAL call number: SF991.A1C3

Descriptors: hematology, biochemical profiles, normal reference values.

111

"Hematology reference values for dogs of Beagle stock." J.

Berger. Zeitschrift fur Versuchstierkunde 23(5):278-283 (1981).

NAL call number: 410 Z36

Descriptors: hematology, red blood cell counts, leukocyte counts, blood profiles.

112

"Hematology of the normal dog and cat." H.W. Tvedten. Veterinary Clinics of North America 11(2):209-217 (1981).

NAL call number: SF601.V523

Descriptors: hematology, blood profiles, review.

113

"The normal electrocardiogram of the conscious Beagle dog." A.

Eckenfels and G. Trieb. Toxicology and Applied Pharmacology 47(3):567-584 (1979).

NAL call number: RA1190.S627

Descriptors: methods, aging, sex, heart rate, body weight.

114

"Canine hematology and biochemistry reference values." J.H.

Lumsden, K. Mullen, et.al. Canadian Journal of Comparative Medicine 43:125 (1979).

Descriptors: hemodynamics, calcium, magnesium, standards.

115

"Normal laboratory values in Beagle dogs of twelve to eighteen months of age." J.E. Jordan. American Journal of Veterinary Research 38:509 (1977).

NAL call number: 41.8 Am3A

Descriptors: spinal fluid variables, urinalysis, creatine phosphokinase, urine 5-hydroxyindoleacetic acid, urine vanillylmandelic.

116

"Serum chemistry values of normal dogs (Beagles): Association with age, sex and family line." L.V. Kaspar and W.P. Norris.

Laboratory Animal Science 27:980 (1977).

NAL call number: 410.9 P94

Descriptors: serum component analysis, age, sex and familial effects.

117

The Beagle as an Experimental Dog A.C. Anderson and L.S. Good (eds.), Bailliere, Tindall & Cassell, London, (1970).

NAL call number: QL737 C22A5

Descriptors: husbandry, management, experimental variables, reference values.

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