Swine in Biomedical Research: Management and Models

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INTRODUCTION

For the last 2 decades, swine have been used with increasing frequency in biomedical research as replacements for dogs and primates, as well as models of human disease based upon their own unique anatomy and physiology (Stanton and Mersmann, 1986; Swindle, 1992; Tumbleson, 1986).

All of the domestic farm breeds and miniature breeds available in the United States are *Sus scrofa domestica*. Farm breeds have the disadvantage of a rapid growth rate, increasing from an average weight of 1 kg at birth to 100 kg at 4 months of age. Mature breeding stock typically reach weights of greater than 200 kg. Consequently, these animals are best used for non-survival or short-term projects of less than 3 weeks in duration.

Miniature pigs are more commonly used for long-term projects because of their smaller size and growth rate. Depending on the breed, miniature pigs grow from a birth weight of 0.5 kg to 12–45 kg. at 4 months of age. Breeding stock reach weights of 45-100 kg. Commercially available miniature pigs also tend to be more tractable than domestic breeds raised in an agricultural setting. The most commonly used laboratory breeds of miniature pigs are Yucatan miniature, Yucatan Micropig®, Hanford, Sinclair (Hormel), Pitman-Moore, and Goettingen (Panepinto, 1986).

The purpose of this article is to review the use of swine in biomedical research and to provide general information on the husbandry and management of the various breeds in a laboratory setting. If an institution seeks to raise swine in large numbers, it would be well advised to consult an agricultural scientist involved in swine production programs for advice on facility design and management.

BIOMEDICAL MODELS

Swine are commonly used in cardiovascular research because swine and humans share important anatomic and physiologic characteristics. Their hearts are approximately the same size, and coronary blood flow, hemodynamic and myocardial contractility, development of atherosclerosis are analogous (Stanton and Mersmann, 1986). Consequently, swine are used to study congenital heart disease (Gillette et al., 1991; Mitchell et al., 1994; Swindle et al., 1992), myocardial infarction (Bloor et al., 1992), hemodynamics and shock (Hannon, 1992; Hoban et al., 1992), development of interventional radiology devices including balloon catheters and intravascular stents (Gal and Isner, 1992; White et al., 1992), hypertension (Zambraski et al., 1992), cardiopulmonary bypass and anesthesia (Cameron et al., 1992; Weiskopf et al., 1992), heart failure (Hendrick et al., 1990), and atherosclerosis (Lee et al., 1986).

Swine are also used extensively for nutritional studies because their digestive physiology is similar to humans. Because they are omnivores, swine will readily consume a variety of nutritional supplements and test substances (Swindle et al., 1988). They have also been used for many other studies related to nutrition, including total parenteral nutrition, lipid metabolism, diabetes, alcoholism, gastric ulceration, and splanchnic blood flow (Cohen et al., 1992; Laber-Laird et al., 1992; Tumbleson, 1986).

Organ transplantation studies have been performed using the swine heart (Hall et al., 1986), liver (Flye, 1992), kidney (Pennington, 1992), pancreas (Koyama et al., 1986), and intestine (Pritchard et al., 1986). Many of these organ transplantation studies have been related to immunologic aspects of transplants, including the development of transgenic animals that would be immunologically accepted by humans (Sachs, 1992).

Other studies have involved wound healing and plastic and reconstructive surgery (Kerrigan et al., 1986), fetal surgery (Randall, 1986), and pharmacology and toxicology (Kurihara-Bergstrom et al., 1986; Feletou and Teisseire, 1992). Reproductive physiology and endocrine functions have also been studied (Tumbleson, 1986).

Swine are used extensively in surgical training classes for health care practitioners. Initially they were used to train medical students and residents in surgical skills (Swindle and Bobbie, 1983) but are now used extensively to train graduate physicians, nurses, and technical staff in endoscopic and stapling surgical techniques, laser surgery, and microsurgery.

When comparing studies using swine, the differences in physiology, genotype, and phenotype and in maturity at a

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Swine As Models In Biomedical Research

Austin J. Lewis,L. Lee Southern

Swine As Models In Biomedical Research:

Animal Models in Biomedical Research Cynthia Petrie Smith,1991 Animal Models in Biomedical Research Cynthia Petrie Smith,1991 **Sourcebook of Models for Biomedical Research** P. Michael Conn,2008 The collection of systems represented in Sourcebook of genomic programs although this work is certainly well Models for Biomedical Research is an effort to re ect the represented and indexed diversity and utility of models that are used in biomedicine Some models have been omitted due to page limitations That utility is based on the consideration that observations and we have encouraged the authors to use tables and made in particular organisms will provide insight into the gures to make comparisons of models so that observations workings of other more complex systems Even the cell not available in primary publications can become useful to cycle in the simple yeast cell has similarities to that in the reader humans and regulation with similar proteins occurs We thank Richard Lansing and the staff at Humana for Some models have the advantage that the reproductive guidance through the publication process mitotic development or aging cycles are rapid compared As this book was entering production we learned of the with those in humans others are utilized because individual loss of Tom Lanigan Sr Tom was a leader and innovator proteins may be studied in an advantageous way and that in scienti c publishing and a good friend and colleague to have human homologs Other organisms are facile to grow all in the exploratory enterprise We dedicate this book to in laboratory settings or lend themselves to convenient analy his memory We will miss him greatly

Advances in Swine in Biomedical Research L.B. Schook,M.E. Tumbleson,1997-01-31 Contains papers from the October 1995 symposium in sections on general aspects transgenics and immunology and infectious diseases Topics include ultrastructure of the liver in piglets fed dietary oils artificial surfactant as a vehicle for endotracheal epinephrine in pediatric porcine cardiopulmonary arrest transplantation and genetic manipulation in porcine systems assessment of public health aspects of porcine xenotransplantation cellular immune responses controlling infectious diseases and associations between stress susceptibility and immune status in pigs Annotation copyrighted by Book News Inc Portland OR **Swine as Models in Biomedical Research** M. Michael Swindle,Donald C. Moody,Lucy D. Phillips,1992 Swine as Models in Biomedical Research is based on the proceedings of the Seventh Charles River International Symposium which called upon recognised experts in the use of swine as animal models in various biomedical fields to present overview talks in their areas of interest They provide thorough coverage of the use of swine as animal models including immunology organ transplantation neonatology renal failure hypertension anaesthesiology cardiopulmonary bypass cardiovascular pharmacology atherosclerosis interventional radiology myocardial infarction congenital heart disease shock and wound healing Their writing also reflects the increased interest by biomedical researchers in the use of miniature pigs and micropigs instead of commercial farm breeds in the laboratory Of value both to established investigators familiar with swine as well as to junior investigators who are starting their careers of who are unfamiliar with the species this book will be useful to laboratory

researchers as well as to veterinarians and technical personnel involved with service functions related to research projects using swine **Animal Models in Biomedical Research** ,19?? **Animal Models in Biomedical Research** Cynthia P. Smith,1994-07-01 Swine have been utilized as a biomedical research model in a wide variety of disciplines the most notable being cardiovascular research The pig has been used as a model for diabetes alcoholism peptic ulcers and even transplant studies This bibliography is a sampling of the current literature and contains 556 bibliographic citations of articles and books obtained from a variety of scientific and agricultural sources dating from January 1980 to September 1990 Arranged by subject Author index **Swine in the Laboratory** M. Michael Swindle,2007-03-22 To diminish the learning curve associated with using swine as models Swine in the Laboratory Surgery Anesthesia Imaging and Experimental Techniques Second Edition provides practical technical information for the use of swine in biomedical research The book focuses on models produced by surgical and other invasive procedures supplying the ba Swine Nutrition Austin J. Lewis,L. Lee Southern,2000-12-21 With 42 chapters authored by leading international experts Swine Nutrition Second Edition is a comprehensive reference that covers all aspects of the nutrition of pigs Content includes characteristics of swine and the swine industry with emphasis on the gastrointestinal tract various classes of nutrients how these nutrients are metabolized by swine and the factors affecting their utilization the practical aspects of swine nutrition from birth through gestation lactation in sows and the feeding of adult boars and nutritional aspects of the various feedstuffs commonly fed to swine Rounding the book is coverage of various techniques used in swine nutrition research **The Experimental Animal in Biomedical Research** Bernard E. Rollin,1995-03-13 This volume focuses on considerations that maximize both scientific benefit and animal well being for major species of animals used in biomedical research Each species is discussed in terms of uses in research basic biology husbandry requirements proper handling disease control anesthesia analgesia and stress control natural behavior behavioral needs psychological needs and social needs and ideal environment for the animals This book is a must for anyone working with experimental animals **Swine as Models in Biomedical Research: Proceedings of the 7th Charles River International Symposium, Danvers, Mass., September 18-20, 1989** Charles River International Symposium,1992 *ILAR News* Institute of Laboratory Animal Resources (U.S.),1992 **Animal Models in Biomedical Research** Cynthia Petrie Smith,1992 *Immune Aspects of Biopharmaceuticals and Nanomedicines* Raj Bawa,Janos Szebeni,Thomas J Webster,Gerald F. Audette,2019-01-10 The enormous advances in the immunologic aspects of biotherapeutics and nanomedicines in the past two decades has necessitated an authoritative and comprehensive reference source that can be relied upon by immunologists biomedical researchers clinicians pharmaceutical companies regulators venture capitalists and policy makers alike This text provides a thorough understanding of immunology therapeutic potential clinical applications adverse reactions and approaches to overcoming immunotoxicity of biotherapeutics and nanomedicines It also tackles critical yet often overlooked topics such as immune aspects of nano bio interactions

current FDA regulatory guidances complement activation related pseudoallergy CARPA advances in nanovaccines and immunogenicity testing of protein therapeutics **The Clinical Chemistry of Laboratory Animals** David M. Kurtz,Gregory S. Travlos,2017-10-18 Key features Serves as the detailed authoritative source of the clinical chemistry of the most commonly used laboratory animals Includes detailed chapters dedicated to descriptions of clinical chemistry related topics specific to each laboratory species as well as organ class specific chapters Presents information regarding evaluation and interpretation of a variety of individual clinical chemistry end points Concludes with detailed chapters dedicated to descriptions of statistical analyses and biomarker development of clinical chemistry related topics Provides extensive reference lists at the end of each chapter to facilitate further study Extensively updated and expanded since the publication of Walter F Loeb and Fred W Quimby s second edition in 1999 the new The Clinical Chemistry of Laboratory Animals Third Edition continues as the most comprehensive reference on in vivo animal studies By organizing the book into species and organ class specific chapters this book provides information to enable a conceptual understanding of clinical chemistry across laboratory species as well as information on evaluation and interpretation of clinical chemistry data relevant to specific organ systems Now sponsored by the American College of Laboratory Animal Medicine ACLAM this well respected resource includes chapters on multiple laboratory species and provides pertinent information on their unique physiological characteristics methods for sample collection and preanalytical sources of variation for the particular species Basic methodology for common procedures for each species is also discussed New Chapters in the Third Edition Include The Laboratory Zebrafish and Other Fishes Evaluation of Cardiovascular and Pulmonary Function and Injury Evaluation of Skeletal Muscle Function and Injury Evaluation of Bone Function and Injury Vitamins Development of Biomarkers Statistical Methods The Clinical Chemistry of Laboratory Animals Third Edition is intended as a reference for use by veterinary students clinical veterinarians verterinary toxicologists veterinary clinical pathologists and laboratory animal veterinarians to aid in study design collection of samples and interpretation of clinical chemistry data for laboratory species **Building Strategies for Porcine Cancer Models** Tiago Collares,Fabiana K. Seixas,Laurie Rund,Lawrence B. Schook,2018-12-05 The eBook Building Strategies for Porcine Cancer Models presents a series of articles demonstrating the state of the art developments in pig models for cancer research Renowned researchers dedicated to the reproduction genomic and biological engineering of the pig model for biomedicine contribute to this special research area Although advances in these areas are occurring at surprising speeds they are still far from realizing all the potential benefits that this biological model could provide to science The current biomedical models may limit the frontier of knowledge in the cancer research *The Minipig in Biomedical Research* Peter A. McAnulty,Anthony D. Dayan,Niels-Christian Ganderup,Kenneth L. Hastings,2011-12-19 The Minipig in Biomedical Research is a comprehensive resource for research scientists on the potential and use of the minipig in basic and applied biomedical research and the development of drugs and chemicals Written by acknowledged experts in the

field and drawing on the authors global contacts and experience with regulatory authorities and **Anesthesia and Analgesia in Laboratory Animals** Richard Fish,Peggy J. Danneman,Marilyn Brown,Alicia Karas,2011-04-28 Anesthesia and Analgesia in Laboratory Animals focuses on the special anesthetic analgesic and postoperative care requirements associated with experimental surgery Fully revised and updated this new edition provides the reader with agents methods and techniques for anesthesia and analgesia that ensure humane and successful procedural outcomes Provides researchers with the most comprehensive and up to date review of the use of anesthesia and analgesia in laboratory animals Thoroughly updated with new material on ferrets birds reptiles amphibians fish and invertebrates Includes hot topic areas such as pain research ethical issues legal issues and imaging studies Energy Research Abstracts ,1987 **Cancer Models** Michael Breitenbach,Jens Hoffmann,2019-02-05 Cancer research like research on other diseases highly depends on representative and reliable model systems In the Research Topic Cancer Models we collected original papers and review articles addressing the topic of tumor modeling from molecular biology biochemistry microorganisms cells and organoids fishes animals and xenografts up to computational cancer models and patient data analysis This representative eBook describes that there is not a single molecular defined tumor but rather a heterogenic and highly variable complex of different individual diseases This is what makes research on cancer so difficult expensive and explains the broad number of models needed for research Our authors describe new next generation sequencing based methods to analyze complex patterns of chromosomal aberrations in order to understand the molecular biology of tumorigenesis as well as the role of cellular senescence and dormancy in the aetiology of tumor formation and development of therapy resistance of tumors The current developments on 3D cultures are thoroughly reviewed as these models help to overcome the current limitations of cell cultures and allow a more accurate mimicry of the native cancer tissue including cellular heterogeneity and restore specific biochemical and morphological Reviews about tumor models in zebrafish different transgenic mouse strains and pigs conclude the book In the final two chapters of this volume the authors discuss the theoretical and mathematical models developed in cancer research

Swine As Models In Biomedical Research Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has be more apparent than ever. Its capability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Swine As Models In Biomedical Research**," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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