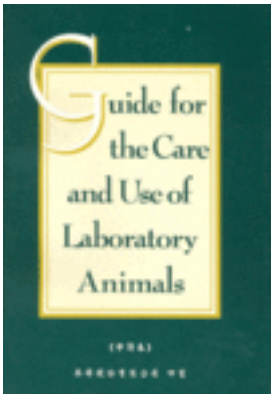

Guide for the Care and Use of Laboratory Animals -- Taiwanese Edition

Commission on Life Sciences, National Research Council

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Guide for the Care and Use of Laboratory Animals

Institute of Laboratory Animal Resources
Commission on Life Sciences
National Research Council

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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine.

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Note

The *Guide for the Care and Use of Laboratory Animals* was released to the sponsors and the public on January 2, 1996, in a prepublication form. After that, the Institute of Laboratory Animal Resources (ILAR) received comments from users and members of the Committee to Revise the *Guide*. The *Guide* has always been characterized as a living document, subject to modification with changing conditions and new information. That characterization results in a continuing emphasis on performance goals as opposed to engineering approaches. The use of performance goals places increasing responsibility on the user and results in greater enhancement of animal well-being; but performance goals require careful interpretation, whereas engineering goals leave no room for interpretation. With that difference in mind, the National Research Council and the appointed reviewers strove for accuracy and clarity. However, some errors and ambiguities were identified by readers of the prepublication copy. Some pointed out pagination, spelling, and reference errors. Others noted that some statements were being misinterpreted. After careful consideration, some changes have been made in this edition. For example, punctuation and spelling were corrected, and wording was changed to clarify meaning. An example of changes for clarification is replacement of the word "develop" with "review and approve" in descriptions of animal care and use committee (IACUC) oversight of housing plans, sanitation, and bedding selection; these are responsibilities of animal-care personnel, not of the IACUC, as the word "develop" might have implied. The discussion of monitoring of food and fluid restriction in small animals was clarified by addition of the phrase "such as rodents." Appendix B (Selected Organizations Related to Laboratory Animal Science) of the review copy that was sent to reviewers requested advice from reviewers regarding what organizations should be listed; some were added in the prepublication copy and others later. A footnote added to page 2 and referred to in three places reminds readers that the *Guide* is written for a broad international audience some of whom are not covered by either the Public Health Service Policy on Humane Care and Use of Laboratory Animals or the Animal Welfare Regulations but that those who are covered by these rules must abide by them even when the *Guide* recommends a different approach. That admonition is provided throughout the *Guide,* but its placement in the introduction was thought important. ILAR believes that each of these changes will help users to interpret and apply the recommendations as intended. *There was no substantial change in the content of the prepublication version.*

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

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The Institute of Laboratory Animal Resources (ILAR) was founded in 1952 under the auspices of the National Research Council. A component of the Commission on Life Sciences, ILAR develops guidelines and disseminates information on the scientific, technological, and ethical use of animals and related biological resources in research, testing, and education. ILAR promotes high-quality, humane care of animals and the appropriate use of animals and alternatives. ILAR functions within the mission of the National Academy of Sciences as an advisor to the federal government, the biomedical research community, and the public.

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Preface

The *Guide for the Care and Use of Laboratory Animals* (the *Guide*) was first published in 1963 under the title *Guide for Laboratory Animal Facilities and Care* and was revised in 1965, 1968, 1972, 1978, and 1985. More than 400,000 copies have been distributed since it was first published, and it is widely accepted as a primary reference on animal care and use. The changes and new material in this seventh edition are in keeping with the belief that the *Guide* is subject to modification with changing conditions and new information.

The purpose of the *Guide*, as expressed in the charge to the Committee to Revise the *Guide for the Care and Use of Laboratory Animals*, is to assist institutions in caring for and using animals in ways judged to be scientifically, technically, and humanely appropriate. The *Guide* is also intended to assist investigators in fulfilling their obligation to plan and conduct animal experiments in accord with the highest scientific, humane, and ethical principles. The recommendations are based on published data, scientific principles, expert opinion, and experience with methods and practices that have proved to be consistent with high-quality, humane animal care and use.

Previous editions of the *Guide* were supported solely by the National Institutes of Health (NIH) and published by the Government Printing Office. As an indication of its wide use, this edition was financially supported by NIH, the Department of Agriculture, and the Department of Veterans Affairs and was published by the National Academy Press.

The *Guide* is organized into four chapters on the major components of an animal care and use program: institutional policies and responsibilities; animal environment, housing, and management; veterinary medical care; and physical

plant. Responsibilities of institutional officials, institutional animal care and use committees, investigators, and veterinarians are discussed in each chapter.

In 1991, an ad hoc committee appointed by the Institute of Laboratory Animal Resources (ILAR) recommended that the *Guide* be revised. The Committee to Revise the *Guide for the Care and Use of Laboratory Animals* was appointed in 1993 by the National Research Council; its 15 members included research scientists, veterinarians, and nonscientists representing bioethics and the public's interest in animal welfare.

Before revision began, written and oral comments on the *Guide* were solicited widely from the scientific community and the general public. Open meetings were held in Washington, D.C., on December 1, 1993; in San Francisco, California, on February 2, 1994; and in St. Louis, Missouri, on February 4, 1994. Comments made at those meetings and written comments were considered by the committee and contributed substantially to this revision of the *Guide*.

The committee acknowledges the contributions of William I. Gay and Bennett J. Cohen in the development of the original *Guide*. In 1959, Animal Care Panel (ACP) President Cohen appointed the Committee on Ethical Considerations in the Care of Laboratory Animals to evaluate animal care and use. That committee was chaired by Dr. Gay, who soon recognized that the committee could not evaluate animal-care programs objectively without appropriate criteria on which to base its evaluations; that is, standards were needed. The ACP executive committee agreed, and the Professional Standards Committee was appointed. NIH later awarded the ACP a contract to "determine and establish a professional standard for laboratory animal care and facilities." Dr. Cohen chaired the ACP Animal Facilities Standards Committee, which prepared the first *Guide for Laboratory Animal Facilities and Care*.

The Committee to Revise the *Guide for the Care and Use of Laboratory Animals* expresses its appreciation to the Animal Welfare Information Center, National Agricultural Library, U.S. Department of Agriculture, for its assistance in compiling bibliographies and references. This task would have been quite formidable without their help. Appreciation is also extended to the reviewers of the volume, to Norman Grossblatt for editing the manuscript, to Carol Rozmiarek for providing exemplary secretarial assistance and preparing multiple drafts, and to Thomas L. Wolfle, who managed the process from beginning to end.

Readers who detect errors of omission or commission are invited to send corrections and suggestions to the Institute of Laboratory Animal Resources, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418.

Derrell Clark, *Chairman*
Committee to Revise the *Guide for the Care and Use of Laboratory Animals*

目　錄

序文

INTRODUCTION

本版之實驗動物管理及使用規章（簡稱規章），強調一個觀念，即對於關心或使用實驗動物於研究、教學、或測試目的之人員，應負起維護實驗動物健康福祉之責。本章程之內容僅適用於當決定使用實驗動物於研究、教學、或測試之際，而非以此作爲該否使用實驗動物之判斷依據之用；但對研究人員而言，維護動物福祉責任之執行實踐，當始於確定要使用動物之際。其他有關權利義務之相關規定乃詳列於第一章。

本規章之宗旨，在於推廣以人道管理方式，來對待動物，以進行生物醫學、行爲研究之教學及測試工作；其基本之任務，在於提供資訊，以改善動物健康福祉、生物醫學之水準、及增進動物及人類有關之生物學知識；在二十世紀中有許多重大之發現乃歸功於實驗動物之使用(Leader and Stark 1987)。儘管有些非動物之實驗模式可供研究、教學、測試之用，(NRC 1977; See Appendix A, "Alternatives")然而，這些模式始終無法完全模仿人體或動物個體複雜之生理系統。因而爲能持續對人類之健康及動物之福祉尋求更進一步之發展，活體動物實驗乃難以避免的。正因如此，尋求及開發動物實驗之取代方式、替代品及改善之實驗步驟及技術，以降低動物之使用量，更應積極努力持續進行。

本規章中所指之實驗動物，旨在研究、教學及測試工作中、被採用之任何脊椎動物而言，包含有一般之實驗動物、農場之動物、野生動物及水生動物等。針對農場動物之使用規定，一些較特例之狀況會在特定相關之章節中提出討論。本規章中對家禽、家畜之使用於農業研究及教學、野生及水生動物存在之自然環境條件中之研究、或使用於研究之無脊椎動物其使用規定，並不特別強調說明。然而，本規章中所列之通則，在很多場合之中應可適用在這些動物種類及其所處之環境。

規則，政策及原則

REGULATIONS, POLICIES, AND PRINCIPLES

本規章對於研究人員之職責與 IRAC 之規定要求是一致的 (IRAC 1985; see Appendix D)。確切的解釋及運用這類規定，需要具備專業之知識。總而言之，這些規範在闡揚：

- 實驗之設計及施行之目的乃與人類或動物之健康相關，有助知識之提升，

及與社會之福祉有關。

- 適切選用之動物種類、品質、及數目（以進行試驗）。
- 在操作施行完善之科學研究之同時，應盡力避免或減輕施於動物個體之不適焦慮及痛苦感受。
- 使用適當之鎮定劑、止痛劑及麻醉劑。
- 確立實驗終止之時機。
- 由符合資格之人員擔任並提供適切之動物飼養管理工作。
- 活體動物實驗需在具資格或經驗人員之監督或其親自操作下進行。

一般而言， 這些原則乃明確訂出研究人員所負有之職責，至於研究人員對於動物使用管理之操作則應受單位之動物管理及使用委員（IACUC）之督導 。

動物設施及計劃之操作及執行應符合下列之規定：如本規章之規定或 AWRs (CFR1985)；公眾健康服務政策中有關人道之管理及使用實驗動物之規定，PHS 政策(PHS1996)；及其他聯邦(附錄 C 和 D)、州政府及地方政府之法令，規則及政策之規定等。而有關某些特定品種之育種方式、飼養、管理等資料，可參考 ILAR 及其他機構之出版資料（詳見附錄 A）；本規章亦將資料之出處，不論是支持之言辭或反對之見解，均列在書後以爲讀者參考之用。

評估要項
EVALUATION CRITERIA

本規章僅責成實驗動物之使用者去完成(達成)特殊之操作成果(結果)而不對執行程序步驟作硬性規定。這種以成果爲評鑑之標準是較爲合宜地，因爲有些變因，如動物種類，乃其個體在使用前之經歷(遭遇)，機構設施，人員訓練經驗及研究之目的等，無法囊蓋於條例中，若加以限制時，則此一教條技術性(硬性)之規定會成爲不合實際需求。技術標準在建立基本規範時相當有用，然而其卻無法如同量尺標準般將特殊之目標，成果，如動物福祉，衛生條件及人員安全，定出一套可量化之評估標準(criteria)。

技術性之規章條款，在面對另種可用之方案或不尋常環境狀況時，往往無法提供彈性之作法或解說，成果標準(Performance)則可將結果詳細定義並可提供一套可驗收，評估之標準，而不需針對技術過程方式去加以規定，限制(以獲取相同之結果)。此種成果驗收方式，在重點時需要有專業指引及判斷，以

達到預期的成效。理想之狀態爲，技術性之條款與成效標準應相輔相成，共築一套互有變通之規則，能隨不同狀況而做出適切之判斷及需求。

有許多關於實驗動物管理方面之研究持續地在提供科學新知，這些均可作爲評估----標準之用。在某些情況下，一些有關動物使用及管理上之資訊依舊相當欠缺，爲此我們應鼓勵相關性實驗之進行。

本規章乃以一般性之原則來撰寫，以便其規定建議能適用在不同類之機構，環境標準及使用目的。因此，一般性及廣泛性之建議爲本書特色之一。正因如此，當依據本章節規定來訂定動物使用及管理標準時，往往需要使用者；動物使用管理委員會；獸醫師或生產供應商藉由其職業知識來做最適切之判斷。各種之動物使用管理委員會在詮釋，監督及評鑑機構內之動物使用及管理方法等，扮演整頓之主要角色。而在編寫新版 Guide 時，最常被詢問之問題爲，must，should，兩字，在書中如何使用，而 IACUC 又該如何去詮釋這兩個之優先順序及重要性能？一般而言，〝must〞這個動詞使用的時機，在一些比較基本之關念及作法上，全體委員都覺得是一定要遵循而不可違反的情況下來使用。而 should 這個動詞使用的時機，通常代表一種強烈之建議，以爲達成某種目標而言。然而，本編輯委員會也明瞭，對某些特殊場合下，經適切之說明後，則可採用取代性之方案。

農場之動物
FARM ANIMALS

基於政府之相關規定(AWRS)，研究機構之宗旨及政策，行政管理組織架構，研究經費之來源或使用者之目的等，農場動物(Farm animals)不論是爲研究教學或測試之目的，經常被歸納爲二大類，即生物醫學研究之用及農業上之用途兩種(Stricklin and Mench 1994)。這種分類方式，導致在動物管理及使用標準，產生兩種評估方式，有些情況，其分野尚屬明確，如動物之用於人類疾病，器官移植，及存活性手術等研究時，即屬生物醫學之用；另外，在於食物及維持生產之研究，如飼養試驗，則被認定爲農學性質。然而，並非所有的狀況都能有如此明確之區別，像在作營養或疾病之研究時，往往難以判定其屬，當管理者，或委員會在決定此種狀況時，往往會面臨左右爲難(dilemma)的困境(Stricklin and others 1990)。

當用禽畜作實驗時，應持有相同之道德標準觀念，如同使用其他種動物作實驗般，絕對不可因研究計劃目標或經費提供來源不同而有所差異(Stricklin

and others 1990)。然而，因研究目的之不同，往往導致生產及農業研究間有基本（需求，標準，規定）上之差異出現。農場動物爲能獲得研究之結果，其管理方式往往要依循 contemporary farm-production practices 來處置(Stricklin and Mench 1994)。例如自然之環境條件對農業研究可能較爲合適，而生物醫學之研究對環境氣候因子則要求較嚴謹以減少差異性之存在(Tillman 1994)。

生物醫學研究中供家畜，禽使用之房舍設施或許會與農業研究所採用的有所不同。不論是何種研究，農場之動物均可被放置在籠架，畜舍，牧場或牧草地中(Tillman 1994)。有些農業實驗可能也需要在條件相似之環境中進行，以減低環境引發之變異性；而有些生物醫學研究則可能需在農場之標準狀況下進行。因此，在決定評估實驗類型（農業或實驗動物）時，需依實驗所提之方案內容而定，而不可單就研究題目之分類來作決定。因此，當要對實驗性質作界定分類時，必需依使用者宗旨，計劃內容，動物福祉之觀點來作判斷。然而，不論研究計劃之種類性質爲何，各機構將被認定會對所有實驗動物加以審視，以確信加諸於其之痛苦及焦慮程度爲最輕微的。

本規章可適用於家畜（禽）之用於生物醫學之實驗中，包含動物被飼養在典型之農舍環境狀況之中的動物。農業研究動物之管理及環境標準，可參照 the Guide for the Care and Use of Agricultural Animals in Agricultural Rrsearch and Teaching (1988)，其他有關農業標準之下農場動物的房舍與管理規則可參考 Midwest Plan Service's Structures and Environments Handbook(1987)或由州政府之農業分支機構，大專院校中之農機及畜產專家學者以獲得資料協助。

稀有動物種類
NONTRADITIONAL SPECIES

在生物醫學研究中不常使用之種類，所以會被採用，往往是因爲其較特有之性徵。例如，冬眠之行爲僅能採用冬眠之動物。當使用較特殊之動物時，適合其生理需求之環境條件應給予之，對某些種類動物更需提供近似於其自然棲息之環境條件。在使用此類動物作研究時，對於其自然環境背景條件及行爲應徵求專家之建議。有鑑於種類及需求，本章節並無法針對各品種之飼養需求逐一提供資訊。但是，許多科學性機構，如 ILAR 及 SCAW，針對某些特定之特殊稀有之種類，編有一些規章，部份之名單列於本章附錄 A 中。

野外試驗
FIELD INVESTIGATIONS

有些時候，生物醫學及行爲研究需要進行野外觀察或試驗。在此情況下，雖然本規章中有許多建議事項並不適用在野外之中，但關於人道之管理及使用的基本要求（精神）依舊適用於自然環境條件之動物個體身上。

當使用動物進行野外研究時，研究人員應使管理委員確知實驗中樣品之採集或有任何侵入性(invasive)之操作步驟存在時，均應符合州或聯邦政府所定之規定(Appendix D)，及本規章之要求(see Appendix A, "Exotic, Wild, and Zoo Animals" and "Other Animals")。有關人畜共得疾病之防治及職業健康、安全等問題，均需交由委員會審議，以確信在執行野外試驗之間，不論是人或動物之健康及安全均不會受到傷害。

綜觀
OVERVIEW

爲提升本規章之助益性，並而於找尋適當之主題、章節，本書之編排方面乃異於前版。先前之第五章〝Special Considerations〞，的內容，被參插編入前四章之中。有關遺傳及命名則編入第二章之中。危險性之動物測試及所需設施之管理，職業健康及安全等主題則於第一章之中(considered in chapter1)。農場動物之相關建議事項則被編入本書之相關章節中。

本規章分爲四大章及 4 個附錄。第一章之重點在強調機構之政策及權責，含動物管理及使用之監督，特殊實驗步驟之參考因素評估，獸醫管理，人事資格及訓練，職業健康及安全（本章節摘要了 NRC 委員會之報告，並包含有危險性動物實驗之設施步驟資料）。第二章重點則放在動物個體及針對房舍及環境，行爲管理，飼養，及族群管理等事項作建議，其中亦包含有動物辨識方法，登錄，遺傳及命名等規則。第三章則討論獸醫、獸藥管理及獸醫人員之職掌權責；含動物之取得及運輸，預防醫學，手術，痛苦止痛及安樂死。第四章則討論硬體設施，含工作區及建築方針(指引)，另廣泛地探討 HVAC 系統及無菌手術區之設施。

本規章後所列之附錄內容與前版相似。附錄 A：按主題排列列出參考文獻資料。B：摘錄出與實驗動物之科學相關之組織機構。C：列出與動物使用及管理相關之聯邦法規。D：提供 PHS endorsement of the U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing，

Research，and training (IRAC 1985)。

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第一章

機構之政策及職責

Institutional Policies and Responsibilities

所謂合理的管理，使用，與人道方式處置實驗動物，其標準之認定，需依科學理論之基楚，專業知識之判斷，與對實驗動物之需求及計劃特異性試驗及訓練的認知而定。本章所述內容，旨在協助其機構擬定訂規章，以監控督導實驗動物之管理及使用得宜。

各機構除需訂定一套動物管理及使用方法，設置並提供相關資源設施，以利該辦法之推展實行。該方法之運作需符合本規章之要求及相關法令之規定，例如聯邦政府之 AWRs (CFR 1985)，PHS policy (PHS 1996)。爲能確實有效地履行本規章之建議事宜，各機構應成立動物使用及管理委員會 (IACUC)，以監督及評估該方法施行之成效。

監督此方法執行之權責，通常交予一個對於實驗動物科學有經驗或受過訓練之獸醫人員或者是符合資格之專業人士。每一計劃中，至少需具備一符合上述資格之獸醫人員。每一機構另外要負責保存所有關於動物使用及管理委員會活動記錄之維持。同時，各機構亦要負責職業衛生與安全方法之執行。

動物管理及使用之督導

MONITORING THE CARE AND USE OF ANIMALS

機構之動物管理及使用委員會

Institutional Animal Care and Use Committee

各機構之相關行政管理部門需指派任命動物管理使用及委員會 (IACUC)，以督導評估該單位之動物管理方法，操作程序及設施環境，確信各項條件均合乎本規章；the AWRs 及 PHS 政策之要求。機構另一職責則在於對委員會之成員施予簡介教育，提供各項資料及給予適切之訓練，使各委員能了解其職責以利於未來評鑑工作之進行。

委員會成員應包含

- 一位獸醫師:此醫師需爲檢定合格者(認定之標準請參考附錄 B)或對實驗動物學及醫學具經驗或受過訓練者，或具該種動物使用經驗之專業人士。
- 至少一位曾實際參與動物實驗之研究人員。
- 至少一位社區民眾代表，以表達一般民眾對正確及合理之動物管理及

使用論題之看法。此一成員不得爲實驗動物使用者，且不得與機構或機構內各成員有直接關聯者。

委員會之成員數目及任期，依機構規模大小，工作任務性質而定。其他有關委員會組織規定可參照 PHS 中之規定辦理及 AWRs。委員會之職責在於審視及評估動物管理及使用辦法執行的成敗。其功能包含檢視硬體設施，評估方法及動物活動區，提交報告給機構內相關之職責官員，審查提案中之動物使用申請。

委員會應經常性地召開會議以執行上述職責，最低限度爲每 6 個月至少開一次。會議記錄及審議結果均需保存。委員會需審閱動物管理方法及檢視動物設施及活動區域，每 6 個月至少一次。每次並要做成報告，並經由 IACUC 多數委員簽字 (依據 AWRs, PHS policy (IRAC 1985; see Appendix D)，and this Guide (see footnote, p.2))。

動物管理及使用建議

Animal Care and Use Protocols

下列之議題在準備及審視動物管理及使用建議書中應列入考慮：

- 使用動物進行研究之理論根據及目的。
- 對建議使用之動物種類及數目所持之理由。可能的話，並以統計學之觀點計算動物使用之數量是否合理。
- 對方法之檢討，是否有較溫和，較不具侵害性之操作可以取代；或其他種動物，分離之器官，細胞或組織培養或電腦模擬模式可以利用取代？這些取代方案之適切性爲何 (see Appendix A, "Alternatives)？
- 參與計劃之技術操作人員是否都有足夠之相關訓練及經驗。
- 是否有不尋常之飼養方式及管理要求。
- 適當之鎮靜，止痛及麻醉程序；
  (see Appendix A, "Anesthesia, Pain and surgery)。
- 執行複合性重大存活手術程序。
- 定訂規範或程序以決定實驗之終止，動物移除之時機，是否需要對動物採用安樂死方式，如果痛楚及緊迫結果是可被預期的。
- 實驗後之照顧管理。
- 安樂死之方式及動物棄置方法。
- 人員工作環境之安全性。

有些時候，計劃草案中可能會包含有未曾操作過之技術、步驟、及這些步驟所預期會引發之痛苦及緊迫，又無有效可靠方式加以控制避免時，這些操作程序，如器械保定；複合性之重大存活手術；食物或飲水限制；實驗本身會導致動物死亡情形發生，使用有害刺激物，皮膚或眼角膜敏感性測試，過度腫瘤增生試驗，心臟或眼窩採血，異常環境狀況條件之進行實驗。相關人員應瞭解操作程序之功用及實驗目的，進而由文獻資料中去瞭解這些操作對動物會造成何種之影響，再做評估，若對特別的操作程序不明瞭時，且無很多資料可以取得時，則可在委員會的監督下，先設計一小規模之先期試驗，以了解評估此程序步驟之影響爲何，如此在人道之立場而言，其作法可能較爲妥當。上述提及之部份使用方式，於本章有一般性之規則可供參考，但並不適用於各種場合。

保定

Physical Restraint

所謂保定指使用手或以械器對動物個體之活動作部份或完全之限制，以便進行檢查、採樣、投藥、治療或進行實驗操作等之手段而言。在多數之實驗操作上，對動物僅施與暫短之保定，通常僅爲數分鐘之久。

通常可以用手或保定工具對動物之肢體活動作短暫之限制。所使用之保定裝置應考量其型狀大小，設計，及操作方式，使對動物所產生之不舒適或傷害程度減至最低。多數之犬，靈長類 (e.g., Reinhardt 1991, 1995)，及其他種動物通常可以正面誘導方式加以訓練，使其伸出四肢或維持靜止之狀態來配合實驗程序。

長時間之保定，如將靈長類保定在坐椅上，應避免，除非是爲達成某種研究之目的。且此程序是經委員會所認可的。若實驗許可的話，應採用限制較少之保定工具，使動物還能維持其正常之肢體形態，此類之裝置如用於靈長類之繫繩，家畜之柵柱等 (Bryant 1980; Byrd 1979; Grandin 1991; McNamee and others 1984; Morton and others 1987; Wakeley and others 1974)。保定裝置使用之時機，爲其必須專爲完成某實驗之目的而設計的，而採用其他方式時則無法完成實驗之目的，或其他方式不合實際；另外，因使用該裝置可以避免人員或動物受傷。

下列列舉者爲使用保定裝置的一些重要方針：

- 不可將保定裝置視同正常之飼養方式。
- 不可僅僅爲處理或控制上圖方便，而隨意使用保定工具。

・在可完成實驗目的爲前題下，需盡量縮短保定之時間。
・使用保定裝置前，應先訓練動物去適應該設備及操作人員。
・委員會應視狀況來決定是否要對保定之動物作定期之觀察探視。
・保定期間若觀察有受傷害或不適之情形時，則應提供獸醫照料。通常若有關於受傷，不適或行爲異常時，則應將動物暫時性或永久移離保定裝置。

複合性重大手術程序

Multiple Major Surgical Procedure

重大手術指侵入或暴露體腔之操作；或手術過程會導致物理或生理性機能之喪失而言，在同一隻個體上施行複合重大手術是不鼓勵的，以科學之論點來支持其必要性且經 IACUC 同意。但若證明複合性重大手術有下列之論點則可施行，爲相關性之操作實驗所必需，可減少對稀罕動物之使用量；爲臨床研究所必需者，就可被執行。一經許可後委員會必須特別留意實驗結果以確保動物福祉，光以費用多寡來判定其是否該執行是不可被接受的理由。

飼料、飲水限制

Food or Fluid Restriction

若實驗過程中有需要對食物或飲水作限制時，須供應少量或微量之食物飲水以維持幼小動物之發育爲維持動物長遠之健康著想。一般而言，若實驗過程需採限制措施時，其必需以科學論證加以說明。同時也需建立起規範以監視生理及行爲參數如定出何時應永久解除限制之規範（像失重或脫水情形）。通常飲食之限制應以採自由餵食每日攝取量百分比量或體重變化百分比多少爲標準來計算。

當對動物飲水做限制時，其過程需特別留意，以避免緊急或慢性之脫水情形發生。其措施可採用，記錄每日水分之攝取及至少每週稱重一次 (NIH 1990)，對體型較小之動物如嚙齒類，其頻率應增加。另外，應留意的事是限飲之動物往往攝量就會減少，因此對動物是否攝取到均衡之食物；應特別留意 (NYAS 1988)。研究人員應視實驗之需要，儘可能降低限制飲食之程度。若爲進行條件反射（反應）實驗時，可利用動物喜歡之食物，飲料爲正面獎勵物以取代限食。在第二章中會再提到有關一般飼養或臨床上之飲食控制。

獸醫管理

VETERINARY CARE

每一機構應有適切的獸醫管理措施，以便能接觸所有實驗進行中之動物健康狀況之評鑑。機構之設置宗旨，計劃之目的及動物數量之多寡等可決定一個機構需要專任、兼職之獸醫師，或僅需獸醫顧問就足夠了。若僅配置兼職獸醫或顧問，則其訪視之頻度必需要能滿足實際所需。有關獸醫師之職則在第三章中討論。

有時基於道德，人道或科學考量，對實驗之動物必需給予鎮定劑，止痛或麻醉藥品(附錄 A)。此時協助之獸醫人員應給予研究人員適當的建議，使此措施符合人道之需求，並能配合科學研究之要求。AWRS 及 PHS 政策規定要求參與計畫之獸醫人員有權審視有關動物之管理及使用之各項事宜是否備；這些包含動物之飼養管理，營養需求，衛生條件，人畜共通疾病之控制及危險物之擴散管制等。

人員之資格及訓練

PERSONNEL QUALIFICATIONS AND TRAINING

AWRs 及 PHS 政策規定機構內負責動物之管理及使用的人員均需具備資格。而於計劃中實際負責動物管理及使用之人員，其資格及數量乃決定於下列因素:機構之性質及規模，提出動物管理之行政組織架構，建築設備之特徵，所維持的動物種類及數目，研究，試驗及教學活動之性質。

管理動物之人員必需接受適當之訓練 (請參照附件 A，"Technical and Professional Education", 有關技術及專職訓練)，同時各機構亦應提供正規之資訊課程或在職訓練之機會，以加強動物管理及使用計劃執行之效率。根據研究性質項目之不同，參與計劃之人員則要接受其它不同領域之訓練，包含動物之飼養管理，實驗動物學及病理，職業衛生及安全，行爲管理，遺傳管理，及其它與研究相關技術之支援。

技術人員訓練方式可有許多種選擇。有些州內大學提供認可之獸醫技術方面選修課程 (AVMA 1995)，修業期限通常爲兩年，且可獲得專科學位之頒贈或修業四年而取得學士學位者，無學位之實驗動物專業技術員資格則可經由美國實驗動物學會(AALAS)認定取得。另外有些商業機構出版之教材亦適合自修之用。(附錄 B)目前已擔任動物之使用及管理之人員亦應不定期地參加與工作有關之職中訓練活動。各機構亦應鼓勵工作人員參與實驗動物相關組織之當

地或全國性之會議。參加在職訓練應視爲工作人員工作的一部分，各機構必需提供與其工作或所管理之動物相關之參考資料 (Kreger 1995)，討論及訓練事項以作爲教材之一部分。CCAC 及其他國家所有之指引方針亦有相當之參考價值，如 (AWIC) ILAR (NRC 1991) (CCAC 1993), (Appendix B)。

不論是研究人員，技術人員，受訓學員，訪問學人在執行動物之麻醉，手術及其他實驗操作之前，應先經由訓練或工作經驗以取得資格，使實驗過程得以在一符合人道及科學上可接受之程度中完成。

工作(職業)衛生與人員之安全
OCCUPATIONAL HEALTH AND SAFETY OF PERSONNEL

職業衛生與安全計劃亦應該爲動物使用及管理辦法中之一部分(CDC and NIH 1993; CFR 1984a, b, c, PHS policy)。此計劃之訂定應符合聯邦，州政府及地方政府所頒行之法規。而計劃內容訂定之重點則在於維持一安全及衛生之工作環境。而其訂定則需依據設施，研究性質，危險物品及動物種類而定。在 NRC 近將出版之書刊中包含有建立一有效且完備計劃的方針及參考資料。一個具成效之計劃依賴於行政管理措施之支持及其他部門或計劃間之相互支援而成的，諸如：研究之計劃(由研究者提出)，動物之照料及使用之計劃，環境健康及安全規範。職業衛生服務及行政管理，而工作場所的正常運作及日復一日之安全需依賴機構內每一份子之盡心盡力。

危險物品之標識及危險性之評估
Hazard Identification and Risk Assessment

執行參與含危險性物質(含生物性，化學性或物理性之危險物質，其中物理性又含離子化或非離子化之幅射線物質)的研究計劃的工作人員，必須符合資格並具能力以評估，判視計劃中相關危險爲何，及針對危險種類來採取選用適切之保護裝備。一套具有效力之職業衛生與安全措施可確信將任何伴隨著動物實驗之危險程度降至可接受之程度。使用動物過程中，可能產生的危害狀況，例如動物咬傷，化學性清潔物質，過敏源及人畜共傳的疾病等，也應該加以明確指出及評估。具專業學識背景之衛生及安全防護專家應直接參與危險工作程序之評估作業及危機處理之研擬作業。至於此措施中實際參與人數之多寡及參與程度，主要應由下列因素來判定，動物或物品所產生之危害物爲何？感染嚴重性及發生頻率；人員的感受度；在特定工作環境中曾發生過之職業傷害

程度爲何？(Clark 1993)

人員訓練
Personnel Training

實際從事具危害性之工作人員應提供一套明確指示的操作程序步驟以執行其職務，應明確告知所可能接觸到之危害物質其狀況爲何，且能很熟練地操作使用必要之安全防護裝備。

工作人員應該針對下列狀況給予適當的訓練，人畜共傳疾病，化學物質之安全，微生物及物理性之危害(包含放射性物質及過敏源)，與實驗程序相關之不尋常狀況及物品(例如基因轉植動物之使用或使用人體組織於免疫系統缺陷動物等)，廢棄物之處理，個人衛生及其他與危害工作場所有關之狀況，如人員處於懷孕，疾病或抵抗力較弱之狀況中，則要特別考量其工作環境及條件。

個人衛生
Personal Hygiene

所有工作人員隨時保持個人之清潔衛生爲一必要觀念。各機構應提供適當之衣服，以便穿著於動物房及實驗室中工作。所換洗之衣物並應由機構負責清洗。在有些情況下，衣服亦可交由商業洗衣公司處理，但對可能被危害污染之衣物必需先加以清除，才可委外清洗。有些情況應使用丟棄式之手套，口罩，外袍，連身工作服及鞋套等較爲適合。工作人員應經常地清洗其雙手及更換衣物，以保持個人之衛生。在動物房中穿著之直罩袍不應該穿離開動物房。工作人員嚴禁在動物房內進食，飲水，抽煙及使用化妝品。

設施，操作程序之監控
Facilities, Procedures, and Monitoring

在動物管理及使用辦法中執行之衛生及安全措施，其所需之設施會因環境狀況不同而有差異。一般而言，因爲工作人員須隨時保持個人清潔，因而各機構應盡可能提供相關之設備來配合其需求。例如計劃中若需要有清洗及淋浴設備時，則機構即應提供此類設施。各機構所需要之設施，設備及操作處理程序均應加以設計選擇以期能獲得低成本之正常之運作，且必需減低對工作人員可能產生之傷害。(例如，因重物、動物而受傷，或重覆性之動作)，若備置有

安全防護設備時，這些設備則需定期加以維修校正。

如何選擇一適當之動物房舍系統，需要專業知識之判斷，並需依危害物品之種類，使用動物之種類，實驗之設計等因素而定。實驗動物應被飼養在適當設計之房舍中，以便於處理具污染之可能有機物，如飼料及排洩物。各機構應提供適當地設備及步驟以便能處理污染之墊料。

若一環境污染源有超出其可容許之暴露極限(劑量 PELs)時，則應使用適切測量方法以評估潛在之生物性，化學性及物理性危害物質之存在程度(CFR 1984b)。

危險性處置之動物實驗

Animal Experimentation Involving Hazards

當在選擇特殊之防護設備，以進行具危險物之動物實驗時，應特別考量下列處理之完善性:動物管理及飼養之操作程序，試劑之儲藏及領取之程序，劑量之調製及給予方式，體液及組織之處置，廢棄物及動物屍體之處理及工作人員之保護措施。特殊防護設施之使用應與良好管理措施及安全之操作程序相配合。也唯有由受訓合格之人員嚴謹依循安全之操作程序來處理事物，才能確保工作之安全-----此爲一通則。

各機構對具危險性實驗，無論是生物性,化學性或物理性，其管制措施應明文規定。各單位亦應發展一套監控程序(如成立安全委員會),並由具專業知識之人員來擔任危險物評估判斷之工作。通常使用動物於危險物質測試之實驗都要有特殊之考量,因而在設立設施及程序以配合實驗時,務必要注意到其安全性。常規之安全評估計劃應建立起,以評量計劃之危險性質,決定何防護設備以對危險性作有效的控制,確信所有工作人員具備足以之訓練技巧,確信機構具有充分之設施以便能安全的完成實驗。應提供相關之訓練及技巧,以便能監督其過程,並確信一切之操作均符合安全政策之規定。

美國疾病控制及防治中心(CDC)及 NIH 出版有 Biosafety in Microbiolgical and Biomedical Laboratories (1993)。而 NRC 的出版品中建議機構設施在處理可能具有危險性之物質前,應先與 CDC 相關人員商討危險物控制措施及健康檢查等事宜。如：訓練操作步驟，安全設備及設施中之需求。

在進行動物實驗時，應使用特殊之設施及防護裝備，以避免實驗過程中所產生的生物性，化學性或物理之危險物品，污染動物飼養人員，研究人員，

機構內其他之工作人員，外界民眾、動物和環境。用作動物實驗之設施應該適當的做標示，並與其他之設施，如其他之動物房，工作區，研究及臨床實驗室，病患診療區設施等相隔離。對該區域亦需管制，僅被授權之人員才准進入該區工作。該設施在設計及建造時，需考量未來要易於清洗，且易於進行機械設備維修爲原則。適切之管理制度，配合雙走道設施或隔離進出系統，可將交互感染之情形減至最低程度。地面之排水系統應該隨時充滿水或使用其他方式以保持其封閉之狀態。使用自動充水系統，可確保管內隨時保有水量。

危險物品應該保存在工作研究區中。藉由氣流動向以形成一主要區域屏障，例如使用生物安全之操作台可有效之防治污染源之擴散漫延。因而在處理或施打危險物品時，或作屍解感染動物時(CDC 1995; Kruse and others 1991)，通常會使用此類設施，以爲主要之防範。其他較特殊之設備，如氣室，負壓，空氣過濾器，具自動轉換之雙重設施等；做爲次要之屏障，其功用則在防止意外洩露之物質擴散至設施或工作區以外之環境。

麻醉劑使用後空氣中殘存之廢氣應避免接觸，通常可使用空氣清除機來除去此類殘留之氣體。在使用乙醚時，該區域應該明確標示出來，且要使用適當之設備及操作程序來避免氣爆發生，以確保工作人員之安全。

個人防護
Personal Protection

個人保護性之裝備應由機構提供，若有需要時，其他保護性之方式措施亦需加以採用。動物管理人員應該隨時穿著由機構提供之保護性衣物，如衣服，鞋子，鞋套及手套。乾淨之衣物應隨時供應工作人員之需要，不應有不足之情況出現。在某些情況下，工作人員在離開工作房，操作區或施藥區時均應淋浴。保護性之衣服及裝備不應穿離危險物品工作區或動物房。對在具有潛在性之危險區之工作人員，應該針對危險物品之種類，性質，提供適當之保護措施(CFR 1984c)。例如在靈長類動物區中工作之人員，應供應手套，手臂保護裝備，面罩，臉部保護鏡片等。高噪音工作區之人員，則要提供聽覺保護設備。若工作區內含有空氣傳染之污染物或蒸氣時，則應提供適當之呼吸系統保護裝備(CFR 1984c)。

人員醫療評估及預防醫學

Medical Evaluation and Preventive Medicine for Personnel

發展及執行醫療評估計劃及預防醫學之使用，應由專業之衛生醫療人員擔任，其中牽涉到保密性及其他醫療及法律因素之考量，則需與州、聯邦及當地法令相配合。

利用職前之健康病例檢查報告來對每位員工其潛在之危害作評估乃爲明智之防範。對於從事具危險性之工作人員進行定期之健康檢查亦爲合情合理。適切之預防接種時間表亦必須被實施。動物管理人員接受破傷風注射是相當重要之事項。至於針對有機會感染到傳染性疾病，如狂犬病及 B 型肝炎之工作人員，亦須事先接種該種疫苗。有關特殊建議事項可參考 CDC 及 NIH 之出版品。另外，對就職前或對感染前血清保存與否，則可由職業健康及安全專業人員來決定。若有必要保存時，則血清樣品之標記，來源，保存期限及儲存之環境條件都須加以考慮，另各種血清之使用目地亦須一致，其使用亦要符合相關之法律規定(Federal Register 56(117):28002-28032, June 18, 1991)。

對於人畜共傳疾病之監控亦爲職業健康計劃中之重要項目之一(CDC and NIH 1993; Fox and others 1984; NRC In press)。工作人員亦被教導當有可能或已知暴露於感染物時，或遭危害健康及生命時，即應立即向主管報告，針對意外事件發生，含動物之咬傷，抓傷及過敏反應等的明確處理程序在每個單位中均應建立(NRC inpress)。

可傳染給人類的一些非人類之靈長類動物所帶有的疾病是相當危險的。動物操作技術員，醫師，研究人員，博士班學生及博士後研究人員，研究助理，顧問，維修人員，安全人員(警衛)及其他可能接觸到非人類之靈長類動物之工作人員，及有機會進出此類動物之飼養區域之人員，均應經常性的做疾病篩選，以確定無遭受肺結核病(tuberculosis)之感染。另外對於與短尾猿(macaques)有接觸之工作人員，因有極高之可能性會被感染到
Cercopithecine herpesvirus 1，因此應告知並教導其使用設置之緊急救護站。(Holmes and others 1995)，以便對於咬傷或抓傷之部位能作及時之處置。同時也應建立起一處理程序以確實咬傷及抓傷部位均受到適當之醫療處理。

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第二章
動物的環境，房舍及管理

Animal Environment, Housing, and Management

對維護動物健康福祉而言，合宜之房舍設施及適當之管理方式爲必要之條件。而對需使用到實驗動物的一些活動，如教學，研究及測試工作等，其結果之優劣，也與這兩項因子有極大之關聯，同時對工作人員之健康與安全也有極大的關係。一個良好的管理措施下所提供之環境，房舍及照顧，有利於動物發育，成熟，繁殖及維持健康之狀態；基於動物之福祉而來考量設計；也能將一些變異因子對實驗結果之影響程度減至最小程度。特定之操作方式乃決定於許多因素，而這些因素取決於不同機構之性質及不同之狀況而定。訓練有素且善盡職責的工作人員往往爲導致高品質之動物管理之必要因素，就算在設施較差之機構中，工作成果品質亦不會被打折扣。

在設計規劃硬體設施及營造群居環境空間及管理措施，以提供一適切之生活環境時，則需考慮下列幾個因素：

- 動物種類，品系(種) ，及個體之特徵，如性別，年齡，體型大小，行爲，經歷及健康狀態。
- 同種動物個體之間可藉由視覺，氣味或肢體之接觸形成群居狀態的天性，不論這類動物是獨居或群飼。
- 房舍之設計及建築。
- 房舍內裝飾品(配件)之適合性及可否取得。
- 計劃之目的及實驗設計(例如:繁殖，育種，研發，測試，及教學等)。
- 試驗設計中對動物操控之頻度及操作程序對動物個體之侵害性。
- 有無危害物質或疾病感染源之存在。
- 動物暫存飼養之時間。

當設計房舍豢養動物時，應考慮以能增進種間特有之行爲表現，並減少因環境緊迫而引發異常行爲表現原則。對群居動物而言，應將可相容之個體配對或群飼。理想狀態下，良好飼養方式設計應由負責動物飼養管理人員來參與，經 IACUC 委員審視再咨詢研究者、獸醫師意見以求達到對實驗之動物種類在其健康及福祉等條件上，有著更專業、實際的考量標準。當房舍的設計被定案後，接下的目標則爲提供適當的動物環境，適當的管理及經營。動物所飼養之環境該適應於其品系，生活史及其將被從事之用途。對某些品系而言其應於符合自然環境條件下來繁殖及飼養。在某些實驗中其特殊的儀器或使用動

物，亦應咨詢(如：感染物之使用，行爲學的研究及免疫缺陷動物，農場動物及一般實驗動物)專業之建議。在下列章節中，我們將討論一些常用實驗之硬體環境考量。

硬體環境
PHYSICAL ENVIRONMENT

微環境與大環境
Microenvironment and Macroenvironment

對動物而言，所謂之微環境(micro environment)是指其直接之周邊硬體環境設施而言，亦即指主要圍籬而言，在這環境中有其特定之環境溫度，濕度，特有之空氣中氣體及微粒成分。次要圍籬之硬體環境，例如動物房，穀倉或戶外棲息處所等，則定義爲大環境(macro environment)。雖然，微環境和大環境間之氣候條件可因對流而使兩圍籬相連通，然主要圍籬內之環境條件與次要圍籬還是有很大之差異，且會因設計不同而改變。

要測量一小規模中主要圍籬內之微環境的各項參考值可能會比較困難。現有之資料顯示就氣溫，濕度，氣體濃度及粒子含量而言，微環境內的數值均要比大環境者爲高(Besch 1980; Flynn 1959; Gamble and Clough 1976; Murakami 1971; Serrano 1971)。微環境內之條件會直接影響到代謝及生理機能，另外亦會影響到動物對疾病之感受性(Broderson and others 1976; Schoeb and others 1982; Vesell and others 1976)。

飼養籠舍
Housing

主要圍籬
Primary Enclosures

主要圍籬提供了動物生存活動之直接界限，通常指飼育盒，欄舍。主要圍籬之可接受狀況條件爲

- 可滿足動物正常生理及行爲活動需求，如排糞、尿、維持體溫之恆定、自由之活動、姿勢之誰隨意調整及繁殖之需。
- 允許同種動物間進行社會行爲(群體)及位序之建立。
- 可保持動物乾爽。
- 通風良好。

- 可讓動物自由地獲取飲水及食物，且易於補充，更換操作，清洗。
- 提供一堅固，安全之環境，使動物不易逃脫或肢體無陷於縫隙之可能。
- 無尖銳之邊緣或突出物，造成動物之傷害。
- 允許進行動物之觀察而不干擾到動物。

主要圍籬製作之材質應兼顧動物之需求及衛生條件之維持。所使用之材質爲光滑不透氣堅固之表面，少有轉角折邊以免藏污納垢，同時使清洗，消毒之工作也較易於進行。選用之材質需耐磨蝕，碰撞時不會碎裂或生銹。至於較不耐久之材料，如木質品，較適使用在某些場合中(例如圈舍及戶外之畜欄)，或用來製造平台，攀爬物，休息區及作爲主要圍籬之柵欄。木製品因易損壞且不易維持乾淨，故應經常更換。

主要圍籬之狀況，要經常維持在最完善之狀態，以避免動物之逃脫，增進舒適性，且使清洗及維修容易。被銹蝕或氧化之設備，若會維害到動物之健康，安全時則應立即修復或更換。

有些之飼育系統採用較特殊之飼育盒及換氣設備，如具隔離罩之飼育盒，隔離飼育箱及小室等。通常這類設備設計之用途在於降低空氣傳染病原在盒間傳播擴散之機會。同時這類器具在飼育上具有不同之管理方式，如墊料更換頻率之判斷次數，採用無菌操作之程序，特殊之清潔，消毒或滅菌方法，以避免病原體由空氣以外之媒介感染到動物個體。

雖然一般使用懸掛式網底籠子配合底盤之使用，便於清除糞及尿。但有些資料顯示 Rodent 往往較喜歡鋪有墊料之實底飼育盒(Fullerton and Gilliatt 1967; Grover-Johnson and Spencer 1981; Ortman and others 1983)。因此，後者應爲一般推薦使用。對犬及靈長類動物，則較常使用乙烯樹脂鋪設之地面。IACUC 在審核評估動物飼養環境對其健康福祉之影響時，亦要兼顧到實驗之需求中是否有良好符合的特殊要求條件。

有遮蔽之房舍及室外飼養場地

Sheltered or Outdoor Housing

對某些品種動物而言，穀倉、畜欄、放牧場及森林地帶，爲認可之主要圍籬且適用多種場合中。多數情況下戶外飼育場所多採群飼方式來管理、照料動物。

飼養在戶外場所之動物，應妥善加以保護，以免受到極端惡劣之氣溫或其他氣候因子之侵襲。對馴服之動物則應提供足以保護及防脫逃之設備。這些

可藉由下列措施來達成，如防風林，遮蔽物，遮蔭處，強制通風處，散熱結構物，或可撤離至具空調之處所，如室內之畜舍。遮避場所之設置要足供所有動物使用，充分之通風且要避免污物及溼氣堆積之情形發生。畜舍建材之選擇要符合畜牧實際使用情形，且當過髒或破損時易於清洗及更換。

室外圈舍之地面可鋪較易更換之材料，如泥土，吸收性之墊料(absorbent bedding) ，沙，卵石，革等，使更易於清潔之維持。必要時，設置具有落差或排水之表面，以避免過量之動物排泄物及死水(Stagnant Water)之汙積。其他之表面如屋頂，需能抵抗氣候因素且易於清洗維持。

成功之戶外飼養需考慮到下列八點因素：

- 對初次放牧之動物，應給予充分之時間以適應氣候之變化。
- 訓練動物能順從配合獸醫師或研究人員之需求，習慣運輸或固定用之斜道或籠舍。
- 種間特異性之群居環境。
- 群飼相容性之動物(Grouping of compatible animals)。
- 藉助圍籬及其他設施之使用以提供充分之安全性。

自然的環境

Naturalistic Environments

牧地或森林地帶等區域可做爲維持，生產動物或進行某些研究之適當場所。唯使用時，可能會使管理者喪失對動物之營養需求，健康照料，監視觀察或育種管理之絕對控制。然而不可因顧慮到這些限制之存在而剝奪動物生存於較自然之環境的權利及從中獲取之益處。另外，利用此種環境飼養動物時，應評估其對變異族群所可能產生之影響。充分之食物，新鮮之飲水及天然或人造之遮避物需確實供應。

需求空間

Space Recommendations

動物對空間需求之評估是相當複雜地，而不能單就體重或體表面積來考量此一問題。然而本章之動物空間需求建議表乃基於專業之判斷及經驗累積而形成的，其適用於一般實驗動物房舍條件中。動物所使用之空間大小取決於垂直高度，結構空間及內部其他陳設。部分種類之動物對空間之需求除了地面面積外，尚需使用到其它類型之空間；例如牆面空間之多寡，遮蔽物或籠舍之複

雜性行爲(貓，人猿)等之不同棲息之需求(Anzaldo and others 1994; Stricklin 1995)。因而單就地面空間來考量籠舍大小是不正確的。本章節對空間需求之考量可能有異於 the AWRs 之規定(see footnote 1, p. 2)。

空間之分配應就動物個體飼養狀況及其需求來重新評估，規劃如產前及產後照顧需求，肥胖動物之需求或獨居與群飼之需求差異。居住空間是否充足，可由一些動物行爲舉止參數來評估考量，如健康狀況，繁殖性能，成長，行爲表現，活動力，及空間使用情形等。最低限度，給予之空間應足夠動物進行自由地轉身，變換姿勢，很容易地攝食飲水，及足夠之乾淨區域作爲休息場所，且不受到干擾。對貓而言，較高棲息之表面應含在籠舍空間之中。相似之構造往往亦爲犬及靈長類動物所需。比地面略高之休息區，若其下方不足讓動物舒服地生活其中時，亦需視爲地面空間之一部份。食物，飲水器皿，盒，及其他非作爲運動或休息之裝置，這些設備所佔據之空間，應從地面面積中扣除。

對所建議之空間需求表有修正時，需經由 IACUS 維持成員認可，評估依前述所列之參數爲原則。其他如專業知識判斷，文獻資料依據與其現實操作之考量，另外，如動物個體身體，心理及群居環境中之需求，實驗設計之需求等，這些因素在衡量空間需求時都應考慮(see Crockett and others 1993, 1995)。對動物空間需求評量應經常性地執行。另外地面空間及高度需求亦需視實際狀況而適時加以修正。

本規章並不針對所有之實驗動物之飼養需求條件提供建議，對未提及之動物種類，使用者可依其動物相似之體型大小，活動力，行爲型態等爲基本依據係數，再針對該動物之品系維持及需求修正以獲得適宜空間需求值。

在可能情況下，對群居動物而言，飼養時應成對或成群而不應獨居，如果如此飼養管理方式並不違背研究計劃執行且不會造成動物個體之危害(Brain and Bention 1979)。依據不同之生理及行爲因素，群體飼養之動物其空間之需求可能會比單獨居處者要多或少。建議之數值乃基於群居比單獨飼養較佳之情況而定，縱使群居中之個體所得之平均空間需求要比單一個體所需者爲小。例如，群居之動物可以彼此分享所分到的空間。另外，如嚙齒類之動物及豚會找尋所好之伙伴而並靠在牆邊休息躺在一起或成群地進出(White 1990; White and others 1989)。牛，山羊及綿羊具有成群之習性，往往尋求群眾及身體碰觸。相反地，有些動物，諸如部份之靈長類品系，當群居時可能需要較大之個體環境空間以降低彼此間仇敵之行爲。

爲維持正常之行爲及姿態調整時，高度空間對某些品系乃相當重要。飼育盒高度考量時，應以動物正常之行進姿態爲考量，且對盒中一些組成，如飼料盒，飲水，容器與地板之高度足夠讓動物通行無阻。部分 primate 對於垂直高度需求較高，因此在設計時，除考慮棲息之空間外，也應有足夠之高度使其得以直立行動以維持其健康。

動物空間之分配應依據附表所列之標準而計算，若有修正時，則需經 IACUC 之許可，並依前所列之可變性參數作評估。

Table 2.1 爲實驗室常使用之嚙齒類動物群居時之空間需求。若單獨飼養或體重超過表列標準時，則需求空間需增加。

Table 2.2 爲其他種動物之空間需求，此分配數值是根據單一動物之需求來推算的。若房舍中有其他陳列之設備或動物體重超過表列之標準時，則空間大小應重新評估。群飼時其空間之需求計算法不等於個體需求之總和。因爲飼養時之考量因子除了個體需求外，另外如行爲，動物相容性，動物數量及飼養之目的而定。

TABLE 2.1 Recommended Space for Commonly Used Group-Housed Laboratory Rodents

Animals	Weight, g	Floor Area/Animal, in^2 [a]	Height, [b] in [c]
Mice	<10	6	5
	Up to 15	8	5
	Up to 25	12	5
	>25[d]	≥ 15	5
Rats	< 100		17
7			
	Up to 200	23	7
	Up to 300	29	7
	Up to 400	40	7
	Up to 500	60	7
	>500[d]	≥ 70	7
Hamsters	< 60	10	6
	Up to 80	13	6
	Up to 100	16	6
	>100[d]	≥ 19	6
Guinea pigs	≤ 350	60	7
	>350[d]	≥101	7

[a] To convert square inches to square centimeters, multiply by 6.45.

[b] From cage floor to cage top.

[c] To convert inches to centimeters, multiply by 2.54.

[d] Larger animals might repuire more space to meet the performance standards (see text).

TABLE 2.2 Recommended Space for Rabbits, Cats, Dogs, Nonhuman Primates, and Birds

Animals	Weight, kg [a]	Floor Area/Animal, ft ^{2} [b]	Height [c] in [d]
Rabbits	< 2	1.5	14
	Up to 4	3.0	14
	Up to 5.4	4.0	14
	>5.4 [e]	≥ 5.0	14
Cats	< 4	3.0	24
	>4 [e]	≥ 4.0	24
Dogs [f]	<15	8.0	—
	Up to 30	12.0	—
	>30 [e]	≥ 24.0	—
Monkeys [g, h] (including baboons)			
Group 1	Up to 1	1.6	20
Group 2	Up to 3	3.0	30
Group 3	Up to 10	4.3	30
Group 4	Up to 15	6.0	32
Group 5	Up to 25	8.0	36
Group 6	Up to 30	10.0	46
Group 7	>30 [e]	15.0	46
Apes (Pongidae) [h]			
Group1	Up to 20	10.0	55
Group2	Up to 35	15.0	60
Group3	>35 [i]	25.0	84
Pigeons [j]	—	0.8	—
Quail [j]	—	0.25	—
Chickens [j]	<0.25	0.25	—
	Up to 0.5	0.50	—
	Up to 1.5	1.00	—
	Up to 3.0	2.00	—
	>3.0 [e]	≥ 3.00	—

TABLE 2.2 Continued

[a] To convert kilograms to pounds, multiply by 2.2.

[b] To convert square feet to square meters, multiply by 0.09.

[c] From cage floor to cage top.

[d] To convert inches to centimeters, multiply by 2.54.

[e] Larger animals might require more space to meet performance standards (see text).

[f] These recommendations might require modification according to body conformation of individual animals and breeds. Some dogs, especially those toward upper limit of each weight range, might require additional space to ensure compliance with the regulations of the Animal Welfare Act. These regulations (CFR 1985) mandate that the height of each cage be sufficient to allow occupant to stand in "comfortable position" and that the minimal square feet of floor space be equal to "mathematical square of the sum of the length of the dog in inches (measured from the tip of its nose to the base of its tail) plus 6 inches; then divide the product by 144."

[g] Callitrichidae, Cebidae, Cercopithecidae, and *Papio*. Baboons might require more height than other monkeys.

[h] For some species (e.g., *Brachyteles, Hylobates, Symphalangus, Pongo,* and *Pan*), cage height should be such that an animal can, when fully extended, swing from the cage ceiling without having its feet touch the floor. Cage-ceiling design should enhance brachiating movement.

[i] Apes weighing over 50 kg are more effectively housed in permanent housing of masonry, concrete, and wire-panel structure than in conventional caging.

[j] Cage height should be sufficient for the animals to stand erect with their feet on the floor.

TABLE 2.3 Recommended Space for Commonly Used Farm Animals

Animals/Enclosure	Weight, kg [a]	Floor Area/Animal, ft [2] [b]
Sheep and Goats		
1	<25	10.0
	Up to 50	15.0
2-5	> 50[c]	20.0
	< 25	8.5
	Up to 50	12.5
	>50[c]	17.0
>5	< 25	7.5
	Up to 50	11.3
	>50[c]	15.0
Swine		
1	<15	8.0
	Up to 25	12.0
	Up to 50	15.0
	Up to 100	24.0
	Up to 200	48.0
2-5	>200[c]	≥ 60.0
	<25	6.0
	Up to 50	10.0
	Up to 100	20.0
	Up to 200	40.0
>5	>200[c]	≥ 52.0
	<25	6.0
	Up to 50	9.0
	Up to 100	18.0
	Up to 200	36.0
	>200[c]	≥ 48.0

TABLE 2.3 Continued

Animals/Enclosure	Weight, kg [a]	Floor Area/Animal, ft [2] [b]
Cattle		
1	<75	24.0
	Up to 200	48.0
	Up to 350	72.0
	Up to 500	96.0
	Up to 650	124.0
	>650[c]	≥144.0
2-5	<75	20.0
	Up to 200	40.0
	Up to 350	60.0
	Up to 500	80.0
	Up to 650	105.0
	>650[c]	≥120.0
>5	<75	18.0
	Up to 200	36.0
	Up to 350	54.0
	Up to 500	72.0
	Up to 650	93.0
	>650[c]	≥ 108.0
Horses	—	144.0
Ponies		
1-4	—	72.0
>4/Pen	≤200	60.0
	>200[c]	≥ 72.0

[a] To convert kilograms to pounds, multiply by 2.2.

[b] To convert square feet to square meters, multiply by 0.09.

[c] Larger animals might require more space to meet performance standards (see text).

TABLE 2.4 Recommended Dry-Bulb Temperatures for Common Laboratory Animals

Animal	Dry-Bulb Temperature ℃	Dry-Bulb Temperature °F
Mouse, rat, hamster, gerbil, guinea pig	18-26	64-79
Rabbit	16-22	61-72
Cat, dog, nonhuman primate	18-29	64-84
Farm animals and poultry	16-27	61-81

表 2,3 指家禽畜等農場動物以實驗場所來定訂之需求標準。無論單獨飼養或群飼，若體重超過標準，則空間需求要加大。群飼時，足夠之飲水及進食空間要供應(Larson and Hegg 1776；Midwest plan service 1987)。

溫度及濕度

Temperature and Humidity

將體溫調節維持在適當之變異範圍，對恆溫動物健康之維護是極重要地。一般而言，若將動物移至高溫(＞29.4℃，85°F)或過低溫(冷)(＜4.4℃或 40°F)之環境，而未經過適當之調適，該動物往往會有臨床症狀之產生(Gordon 1990)甚而有致死之慮。動物可藉由行爲、生理或型態機制之改變，以適應極端惡劣之氣候環境。然而這種適應過程爲長期性之變化，而其結果也可能造成實驗結果之變異或影響個體之表現(Garrard and others 1974；Gordon 1993；Pennycuik 1967)。

環境之溫度及相對濕度之變化與房舍之設計及飼養管理有極大之關連。主要及次要棲息環境間其變化之差異性更明顯。造成差異之原因有建築材料之選用及建築方式、過濾性隔離蓋之使用、飼養密度、強制換氣、墊料之種類及更換之頻度等。

某些狀況下需將環境溫度提升，如手術恢復區之溫度、初生孵化之雛雞其飼養環境、無毛之嚙齒類、無母獸伴隨之初生仔獸飼養環境等。調升之幅度則依需飼養之條件而定；有時僅需針對主要圍籬內之環境做過度性調整，即可符合需求，而不需變更次要圍籬之環境設定。

目前並無直接之實驗資料數據，可明確指出動物生存之最適宜溫度及濕度範圍；然而，由經驗及專業知識累積而整理出表 2.4 之建議數值。

一般而言，對被飼養在一限制區域之動物，其環境溫度每日之變異幅度不應太大，以減少動物反覆地改變代謝速率或行爲舉止來拮抗環境溫度之改變。動物對相對濕度之要求，則較不嚴謹，可接受之範圍在 30% ～70% 之間。表 2.4 並不適用於被捕獲之野生動物，因爲生活在天然環境中之野生動物或戶外棲息處所之動物能適應較廣泛之氣候條件，主因該動物個體有機會能調適其身體狀況以對應自然氣候條件。

換氣

Ventilation

換氣之目的在於提供定量之氧氣；移去由動物呼吸、光源、機器設備產生之熱源；稀釋室內氣體性及微粒性之汙染物質；調節室內空氣中濕度；在某些情況下，且用以產生不同區域間之靜壓壓差(static-pressure difference)。值得注意的是，室內有足量之換氣率時，並不表示動物之主要棲息處所(微環境)也具有足夠之換氣。因而微小環境(如 Cage 內)之空氣品質需藉由其他標準來考量。

對所有種類之動物，關於空氣流通方面問題所造成之不適或生理機能之變異，目前並無太多之資料。進氣之品質及流通擴散之形式與動物主要棲息所之換氣品質有直接之關係。微小環境狀況優劣，取決於兩個因素(1)進氣和排氣設備之種類及放置的位置有關，與(2)動物房內主要棲息容器種類、數量、放置位置有關。爲使微小環境獲得最佳之換氣狀況時，可考慮使用電腦模擬程式將上述因子與熱負載及氣體流通擴散等因素來一併考慮(for example，Hughes and Reynolds 1995；Reynolds and Hughes 1994)。

大環境中每小時 10～15 次新鮮空氣換氣率，爲多年來被認可之一般標準則。雖說，此一標準通用於許多動物房之設計。然而此一標準並無明確指出可能適用之代謝熱能累積(heat loads)之範圍；環境內動物種類、大小及總數；墊料使用之種類及更換頻度；房間大小；空氣由次要圍籬流通至主要圍籬效率如何？若無將上述因子列入考量，則每分鐘 10～15 次換氣率，在某些情況下，諸如對存放少量之動物房而言，可能有過度換氣之可能發生，而致使能源之浪費，或當動物數過於龐大，而造成換氣不足之情形，致使熱及惡臭之堆積。爲能更精確決定實際之換氣需求，可請專業之空調技師依房內動物釋出之代謝能多寡求得最低之換氣率(ventitation rate，CFM: cubic feet per minute)。動物所產生代謝能之計算方式則可依 ASHRAE，1993. 提供之 average-total-heat-gain fomula 程式來計算。此一程式可適用於各個品種之動物。最低換氣率之計算方式乃依據以除去房內熱源之總冷房需求(total cooling lood)值而定。動物房內熱源來源有動物本身，非動物來源如人，設備等及牆面傳導而來之熱。同一公式亦可用來計算特定空間之房舍，其最大之動物飼養量爲何，當其房間之換氣率已被固定時。

利用上述計算方式雖可算出最低之換氣需求以避免廢熱之堆積，但對其他空氣中之污染源，如氣味控制，過敏源控制，粒子產生及代謝性氣體之控制

等，這些因素排除之值可能均要高過最低需求值。當計算值小於每小時 10 次換氣率時，如果確定調低頻率不會使主要圍籬內之有害氣體，氣味及粒子濃度升高至危害動物的程度時則將次要圍籬之換氣頻率降低，是正確地作法。相同地，若計算值高於每小時 15 次時，則該環境換氣頻率似應提高，以有效清除不良之因素。有些狀況之下，若換氣頻率已固定無法作修正時(如舊有之設備建築)則可改變衛生清潔程序或減少動物之飼養量以維持一定之環境條件。

一般而言，若主要圍籬依賴次要圍籬之氣候條件來控制其內部之狀況時，則需依上述之方式來考量。而對有獨立性之氣體供應系統之飼育籠舍而言如具強制換氣之飼育盒則不需如此強調換氣頻率。儘管如此，次要圍籬之環境依舊需要有足夠之換氣頻率以便能將主要圍籬內之熱氣移除。另外，若飼養容器機體本身具備有氣體及粒子之過濾器來清除污染之可能性，此時在次要圍籬則可考慮循環空氣。

不具輔助換氣設備之隔離飼育盒其換氣效果往往極差。爲補償此一缺陷，則可由調整飼養管理操作步驟，如衛生設備之改善，飼養密度或將盒子置於輔助換氣之容器中，以改善小環境之品質及熱的消散。

使用環境性之氣流去排換動物房內之空氣雖然可以節省能源，但也有相對之危險性存在。因爲很多動物病源體存在空氣之中附著於微粒，粉塵上移動，當含有病媒之循環氣體被引入其他區域時，則造成此區域之被污染若要使用循環氣體系統，則應使高效能過濾網以除去空氣中含有之微粒。HEPA 過濾網(High-Efficiency Particulate Air-filtered)之使用則可減低此種危險性(Ashrae 1992, 1993)。HEPA 過濾效率分多級，選用標準可依動物房排出之空氣乾淨程度而定。由非動物區輸送出之氣體例如:部分之人員活動區域，飼料，墊料及耗材之儲存間等區域，可再輸入動物區利用，而不需像動物房內排出循環再利用空氣般經嚴謹之過濾，稍加改善處理即可。另外，像由靈長類動物區或生物危害區排放出之廢氣，因含有污染源之機率過高，因而不考慮再循環使用。

動物房內有毒或惡臭性之氣體(例如氨氣)，可藉由換氣系統排除及新鮮空氣之替換使之濃度維持在可接受之範圍內。

雖然循環空氣中之不良氣體可利用化學物質吸附或淨化處理而被再利用，然而，動物飼養區域之換氣則以新鮮之空氣補充爲原則，通過 HEPA 而無經氣體清淨系統。如活性碳濾罐過濾之循環氣體僅能有限度地使用在：

- 循環空氣之混合比例不超過 50% (即新鮮空氣需至少佔 50%)。
- 有了處理過之循環空氣，配合著飼育管理作業，如墊料之更換及飼育

盒清洗足以降低有毒氣體及惡臭之濃度。

- 循環空氣僅能被排放回原來之房間或區域。若此循環空氣非來自動物飼養區域者不在此限。
- 循環空氣品質經改善調節且與新鮮空氣混合後，可以供應該區動物適當之溫度，濕度需求時。

墊料及飼育盒經常之更換清洗，房內動物飼養密度之降低，溫，濕度之調降等措施均有助於減低，改善房內有毒及惡臭氣體之濃度。一般而言，用來清除空氣中之污染物質，氣體或微粒的系統，其維持費用都很昂貴，若無適當地保養維護制度，該系統即可能失去其效用。因此擁有此系統者應經常性之維護，以增加其效率。

一套零缺失之 HVAC 系統要靠經常性之維修制度及性能評估來組成，評估報告亦需含次級環境(secondary enclosure)之品質數據。測驗項目亦應包含供氣，排氣量及靜壓，壓差等數值。

照明
Illumination

光源會直接影響到不同動物之生理，形態及行爲舉止(Brainard and others 1986; Erkert and Grober 1986; Newbold and others 1991; Tucker and others 1984)。潛在性之光害包含不正常之光週期，光照強度，光線之光譜品質。動物對光之需求受到多重因素影響，因而在建立照明度時，均要加以考慮。這些因素包含:光強度，光照期之長短，光照之波長，動物之光照史沿革，動物眼內色素之有無，24 小時週期之照明時段，體溫，內分泌素狀態，年齡，種類，性別及品種(Brainard 1989; Duncan and O'Steen 1985; O'Steen 1980; Saltarelli and Coppola 1979; Semple-Rowland and Dawson 1987; Wax 1977)。

一般而言，光源應均勻擴散至房內四處，來確保動物之健康，方便動物房內之操作管理，及動物視察，包含對下方動物之檢視工作，並能確保人員之工作安全。動物房內之光源其明亮度應足夠讓動物能獲得清晰之視覺，且使其內分泌調節有日夜間之區別(Brainard 1989)。

對很多品系動物而言，光週期對繁殖行爲而言爲一重要之調節因子(Brainard and others 1986; Cherry 1987)，同時也會影響體重增加及飼養攝食量(Tucker and other 1984)。在黑夜中應避免(減少)不經意之光照。另外，有些品系動物，在昏暗處或黑暗中根本不進食；在此狀況下，光照之時間表就宜調整

在不影響動物正常作息之中。應使用定時器以確保一規律之光照週期，此定時器亦需經常檢查，以確信其功能之正常。

許多常見之實驗動物是爲夜行者。白化鼠因較易受到光害而造成視網膜之病變，因此也被常用來建立動物房內之光照標準之指標(Lanum 1979)。就其他種之實驗動物而言，目前並無研究資料建議其對室內光照亮度之需求。光照強度在離地面一公尺處若爲 325 lux(30 ft-candles)，其明亮度應足供工作時之需，也同時對 albino rat 而言不會造成視覺之病變(Bellhorn 1980)。有些資料顯示若配合適當之飼養管理措施，在空房內離地一公尺處之光線強度甚至可高達 400 lux 而不會造成白化鼠之視網膜病變之發生(Clough 1982)。然而就正常情況而言，動物對光亮造成損害之敏感性，往往會因其過去對光照經驗之不同而有所差異。對一正常飼養之 albino rat 而言，當光強度高過其平時光照度之 130～270 lux 時，此光度已造成病變之臨界值，此乃根據組織學，形態學及電子生理學之資料而得之結論(Semple-Rowland and Dawson 1987)。某些原則則建議，若以盒中爲測量點，最小之光照強度僅需 40 lux 就可滿足動物所需(NASA 1988)。年輕之 albino 及有色素之小鼠比成鼠要求較低之照明度(Wax 1977)，但在此狀況中所造成之病變往往是可復原的。因此，對現有視網膜病變之動物種類，建議之光照強度在飼育盒之高度，應介於 130～325 lux 之間。

管理上之措施，如輪調盒子之位置，或提供一些遮蔽物，如隧道或其他配件物品，使動物得以躲藏來避開光源，如此則可以減輕不正常光源對動物的刺激(Greenman and others 1982)。另外可調式光強度控制裝置爲一種方式，可同時兼顧工作上及動物之需求和節省能源。此種控制器應具有類似遊標尺之標示及可設定功能，以方便調節。但不可用此來作爲能源開關之用，北美照明電機協會(IESNA)所提供之小冊子內之建議可做爲選擇光源種類品質之參考(Kaufman 1984, 1987)。

噪音
Noise

噪音，無論來自動物或操作過程，在動物房中乃無可避免的事(Pfaff and Stecker 1976)。因而在設計規劃動物房舍之初或在運作期間均隨時要注意噪音之防範(Pekrul 1991)。當評估噪音對動物之影響程度時，要考量幾個因素:噪音強度，頻率，發生之速度，持續之期間聲音造成之共振波動，音頻，暴露在噪音之經驗，不同品種種類動物對噪音之感受性等。

人員工作休息區應與動物飼養區分隔，以減低彼此間之相互干擾。較吵雜之動物，如犬，豬，山羊及靈長類動物應與較安靜之動物分隔，如嚙齒類動物，兔子，貓等。環境之設計應著眼於調適動物以減少噪音之產生，而非僅求於降低噪音之音量。當暴露在 85 分貝以上之環境時，同時會有聽覺及非聽覺之影響(Fletcher 1976; Peterson 1980)，包含紅血球減少腎上腺體增重的情形(Geber and others 1966; Nayfield and Besch 1981)及降低受孕率等(Zondek and Tamari 1964)，而在 primate 中，則有血壓上升之情形(Peterson and others 1981)。許多品種動物能接受到比人類更寬廣之音域(Brown and Pye 1975; Warfield 1973)，因而對一些可能製造出噪音而爲飼養動物所能聽到之機器設備，如放影設備螢幕等(Sales 1991)，均需謹慎加以評估。另外，對會產生噪音的一些活動，應安排在與動物房較遠之房間，以減少對動物干擾之出現。

暴露在不同程度及種類之噪音對不同種動物會有不同之影響(Armario and others 1985; Clough 1982)。因而工作人員應極力避免不必要之聲響之產生。極度地及間斷性之噪音往往是可以減輕地，如果訓練工作人員採用不同之操作方式或工作習慣，另外附有墊片，防撞片之推車，台車，亦有助於降低，減少噪音之產生。收音機，警報器及其他會發出聲音之設置不應存放在動物房中，除非是實驗步驟中所必須的且被許可者，或者是一種環境潤飾行爲 enrichment program。

行爲管理
BEHAVIORAL MANAGEMENT

結構環境
Structural Environment

結構環境主要圍籬之組成物所形成，包含盒內配件、環境之充實物、動物操控玩弄之物品、及盒內之複雜物品。結構環境內擺置之物品應依照動物種類及飼養目的而定，一般可有休息用之木架、層架或棲木、玩具、供糧設施、築巢材料、隧道、鞦韆、及其他能刺激動物本能之活動力或行爲姿態的物品，以增進動物之健康。我們從最近幾年的研究資料中，學習到許多有關動物之天性及對環境之需求，縱然如此，這方面的知識依舊十分欠缺，因此應積極鼓勵研究人員從事這類型之研究工作。有關如何來增添動物房內之擺設，以改善動物健康福祉之相關文獻，均列在附錄 A 中及 AWIC 登載之文獻集內(AWIC 1992; NRC In press)。

社會環境

Social Environment

動物個體群居環境之需求亦需加以考慮。群居環境通常包含有同 種動物間之肢體接觸及溝通行爲，有時溝通方式可爲非肢體性之交談，例如藉由視覺性、聽覺性、嗅覺性之訊息來談溝通。在條件許可之下，群居性之動物應給予同種間肢體接觸之機會。例如，將有群居性之靈長類動物或canids放在同一個房間舍中，以增進彼此間接觸之機會，這對其生活、成長及心理健康有極大之幫助。對許多動物而言，適度的社交行爲有助於正常之發育及成長。而一個社交夥伴也可作爲緊迫環境之緩衝劑(Gust and others 1994)，可減輕異常行爲舉止之產生(Reinhardt and others 1988, 1989)，增加活動之機會，增進種間特有行爲表現及認知的刺激(Whary and others 1993)。這類因素，如族群密度、逃避之自主能力、動物間原始之熟悉度、及社會位序之存在與否等，在群飼動物之前都應先加以考量(Borer and others 1988; Diamond and others 1987; Drickamer 1977; Harvey and Chevins 1987; Ortiz and others 1985; Vandenbergh 1986, 1989)。在選擇社交環境時，應先考慮動物是否有領域性(territorial)或爲群居性(communal)，應獨居、配對或群居。瞭解種間特異之群居行爲對群飼結果之成敗有極大之關係。但並非所有群居性動物即可採群居飼養管理。有時基於實驗、健康或有行爲上的因素而減低群飼模式之效益。群飼會增加因打架而受傷之機會(Bayne and others 1995)、增加對代謝疾病之感受性(如 atherosclerosis)(Kaplan and others 1982)、及改變行爲或生理功能(Bernstein 1964; Bernstein and others 1974a,b)。另外，在許多種動物中，性別差異也會造成相容性之差異(Crockett and others 1994; Grant and Macintosh 1963; Vandenbergh 1971; vom Saal 1984)。上述因群飼所造成之危害，可因共處性及組成穩定後而降低發生率。如前述，群居動物以群飼爲佳，但若因需求而必須將動物單獨飼養時，則應在環境中增添其他物品，以補償無夥伴存在之空虛感，例如與工作人員進行安全且正面之接觸及佈滿結構環境內之物品種類。

活動力

Activity

動物之活動力傳統而言乃指肌肉神經之活動力而言。但也包含如認知之活動力及社交活動。被飼養在實驗室中之動物，比被飼養在放牧狀態中之動物，其活動力受到較多之限制。在考量房舍之舒適性或在質與量之觀點來評估動物行爲表現時，其活動力之表現與否，包含垂直空間之利用情形，應要特別注意。若非因治療上之需要或被批准之實驗方案的要求，強迫性之活動應加以避免。對多數動物而言，若其身體活動爲重覆性、無目的、並排斥其他行爲者，此爲種情形往往被視爲不適切的(AWIC 1992; Bayne 1991; NRC in Press; see also Appendix A, "Enrichment")

動物應有機會表現其種間特有之活動模式。如貓、狗及其他馴服之動物，可由與人類正面之接觸而獲得益處(Rollin 1990)。對狗而言，可藉由下列方式來給予活動之機會，如溜狗，使用運動場、或移至其他房舍，使其可進行群居之接觸、嘻戲及探索。通常籠子只適合作爲短期暫養，以便進行獸醫管理或實驗目的之用；而如籠舍、運動場及籠子外之區域，因有較大之空間作爲活動之用，此類之設施往往被建議使用(Wolff and Rupert 1991)。另外如漫布區、活動廣場及牧場則適合大型動物使用，如羊、馬、牛。

飼育

HUSBANDRY

飼料

Food

除因特殊之實驗需求以外，動物應每日供與適口，無污染及營養充足之食物或依其特殊需求來給予。NRC 建議之動物營養需求(NRC 1977, 1978, 1981a,b, 1982, 1983, 1984, 1985a,b, 1986, 1988, 1989a,b, 1994, 1995)，其考量之主要因素有飼料品質之確認，無化學藥劑或微生物之污染，原料中不含有天然之毒物，營養成份之可利用率及適口性。管理者在飼料購買，運輸，儲存及處理過程中，因極精明考量，以避免如疾病，寄生蟲，病媒介或化學物質由飼料中帶入動物族群中。購買者應重視製造商在在確保飼料之品質時所採用之措施及流程爲何(如儲存場所、害蟲控制、處理程序) ，各研究機構應定期性地要求製造商提供主要營養成份之分析報告。使用者應明確知道製造日期及影響到飼料儲存期限長短之因素爲何。腐敗的，或運送儲存不當之飼料會造成飼料中營

養成份之缺失。每批進口之飼料數量應明確清點登記，對存貨位置亦需作調整，以便先購進之飼料先使用。

作爲飼料或飼料原料存放，處理之區域應經常保持乾淨，且應密閉以免害蟲之進入。飼料儲存時應使用棧板，架子或台車，以架離地面。開啓後，未使用完畢之飼料並放於防害蟲侵入之容器內，以避免污染而傳播疾病。暴露在高溫(21℃，70°F)高濕，污穢之環境，光照，氧氣，昆蟲及其他害蟲，會加速飼料之變質敗壞。若餵食較易敗壞之食品如肉類，水果及蔬菜時要特別小心，因爲儲存場所爲一潛在之污染源之出處，極易導致食物之變質。污染之食物有時因程度不是很嚴重，雖不會有臨床症狀出現，但往往會使動物生化上或生理過程造成顯著之影響。例如有些污染源會使肝細胞酉每之產生而終至改變動物對藥物反應之變應(Ames and others 1993; Newberne 1975)。某些實驗則要求將餵食動物飼料中之生物性或非生物性之污染物種類及含量先行測得，大多數採用天然原料之製成之乾性飼料，含有防腐劑如儲放適當的話，出廠後可以使用到六個月之期限。一般飼料中之微生素 C 只有 3 個月存放期，若是使用較穩定型式之 Vit C 則可延長其保存期。若以過期之含 Vit C 飼料餵食 Vit C 必須之動物時，則補充性 Vit C 之供應是必要的。雖然冷藏可以延長飼料之儲藏期限，但實際操作宜縮短飼料之儲藏期以保新鮮度，而製造商之建議事項亦需注意。純化的或化學成份定義之飼料較不穩定，其使用期不應超過 6 個月(Fullerton and others 1982)且應存在 4℃或更低之溫度環境中。可滅菌之飼料應調整其營養成份含量，原料種類及製造方式以承受滅菌時成份之分解(Wostman 1975)。每次滅菌之時間，日期需記載清楚且要即刻使用完畢，可以考慮使用放射線照射處理飼料以取代 autoclaved diets。

飼料槽之設計及放置位置應方便動物餵食及避免糞、尿之污染。對群飼之動物，餵食時要有足夠之空間使每種動物均能自由取得食物，亦可減少搶食爭鬥的情形，對實驗需要而加以限制食量之動物更要注意此點。飼料儲存容器不可四處移動，以發生污染之危機，亦應定期清洗消毒之。

由臨床及飼養管理之觀點進行研究證實，適度對熱能及蛋白質之採食量作限制，對某些動物而言，可以延長其壽命，降低肥胖，繁殖性能及癌症之發生率(Ames and others 1993; Keenan and others 1994)。此種限制之效果，可由減少飼料中之代謝能含量、蛋白質濃度(density)或兩者，或改變餵食之方式來達到其目的。熱量限食措施之選擇需依動物種類而定，其會改變生理之適應性及代謝機制之反應(Leveille and Hanson 1966)。能量限制爲某些長期飼養之動物其

可接受的方法，例如對嚙齒類動物及兔子等或配合，臨床或外科手術實施。

在某些動物(如靈長類動物)及場合中，給予不同之飼料，或獎賞性之食物，如新鮮之蔬菜等，是適當的，且可增進動物之健康。但給予不同種飼料時亦需注意，給予之飼料其營養成份應是均衡的，因爲很多動物不會在多種食物中挑選體內所需之食物，來平衡營養需求，而往往採食高熱量低蛋白之食品而導致肥胖(Moore 1987)。突然的改變飼料種類應避免，因其會導致消化上及代謝上之不適症狀。這種情形多會發生在雜食性及食肉性動物上，但對草食動物而言，其對此種改變特別敏感(Eadie and Mann 1970)。

飲水
Water

正當而言，動物應該依其需求而隨意獲得適合飲用且無污染之水質。水之品質及可適合飲用之水之定義會因地區不同而改變(Homberger and others 1993)。經常性之水質監測是必要的，其項目應含 PH，硬度、微生物及化學物質之污染以確保水質之乾淨度，尤其已知水質會影響實驗結果時。若實驗計劃需要高品質之純水時，水可經由處理或純化以除去污染物，有些型式之水處理方式會導致生理異常，微生物狀況之改變，或影響實驗結果(Fidler 1977; Hall and others 1980; Hermann and others 1982; Homberger and others 1993)，因此在選擇處理方式要謹慎。例如氯處理之水可用於某些品種，對某些則有毒性如水生動物。

供水設備，如吸水管，及自動給水器，應每日檢查以確信其乾淨且正常運作中。有時候動物需加以訓練使其適應自動飲水器。更換整個水瓶要比僅再填充水來的好，因可避免微生物之交互污染。若一定要使用再填充方式，則要將水瓶放回原有之盒子。戶外飼養之動物，有時還可獲得給水系統以外之水源，如下雨後之溪流。但需注意額外獲取水的性質，有無含有危害物質，但不需刻意去避免此種水源。

墊料
Bedding

動物使用之墊料爲一可控制之環境因子，同時對實驗結果與動物健康也有極大的關聯。獸醫人員或機構管理者，應與研究人員商討，研究以便選擇一最適用之墊料材質。對某一品種動物而言，沒有任何一種之墊料可適用在不同

之管理方式及實驗環境；相同地，也沒有一種可適用於各種動物的(例如，適用於作窩洞穴之墊料只推薦給某些種類動物使用)墊料。許多作者(Gibson and others 1987; Jones 1977; Kraft 1980; Thigpen and others 1989; Weichbrod and others 1986)曾描述出一些令人滿意之特徵及評估墊料之方法。Softwood 類之墊料常爲人所使用，然未經處理之 softwood 墊料(shavings 及 chips) ，因爲影響動物之代謝機能，故對某些種類之實驗是不適用的。Cedar 刨片亦不建議使用，因其有排放出芳香性碳水化合物，此會引發肝微小粒酵素及具細胞毒性(Torronen and others 1989; Wrivhbtof snf oyhrtd 1986, 1988)，同時也被報導會增加癌之發生(Jacobs and Dieter 1978; Vlahakis 1977)，經熱處理之墊料其芳香性碳水化合物之含量會因而降低，上述問題可因此而加以避免。在購買墊料時，爲確保其品質，因而對於供應商之製造流程，監測及儲存方式都應特別加以留意。

爲維持墊料之品質及減少被污染之機會，墊料在運輸及儲存過程中均宜用棧板，架子或台車來與地面隔離。而在高溫蒸汽滅菌之過程中墊料會因爲吸收濕氣而失去了其吸水性之性質，而此種潮濕之墊料也提供微生物一極加之生長環境。因此對滅菌過程之墊料，應有足夠之乾燥時間及良好之儲存條件。

墊料之使用量要充足，以確保動物在墊料更換間隔內都能保持乾爽。而對小型實驗動物而言，尤其要注意水瓶之飲水頭要避免與墊料接觸，否則會造成嚴重之漏水。

衛生管理
Sanitation

衛生之改善指環境條件之維持以助益健康狀況，其內容包含有墊料之更換(當必要之時) ，處理及消毒等工作。清理(cleaning)指掃除過量之塵土(dirt)及屑片(debris) ，而消毒指減少或除去無法接受之微生物密度。

清理及消毒之頻度多寡，應以給予動物一健康之環境爲原則而訂定，同時也需參照其正常之行爲及生理特徵來決定。消毒方式及頻率則依下列因素而定:

---區域之種類，物理特質及大小而定
---盒中動物之數量，大小，年齡及繁殖狀態
---有否使用墊料及其種類
---溫度及相對濕度

---造成骯髒而需消毒之致因爲何

---動物正常的生理及行爲特徵爲何

---盒內污染程度之速率爲何

某些飼養與實驗需要特殊之飼養管理方式，如無菌操作或需更改墊料更換之頻率。

一般用以除動物氣味之藥品不可用在飼養動物之房舍中。因爲此類物質並無法取代好的清潔(sanitation)方式或取代良好之換氣，而且暴露動物於揮發性氣體時，亦可能改變動物之生理及代謝過程。

墊料更換

Bedding Change

污穢之墊料應隨即更換以確保動物之乾爽。決定墊料更換之頻度，爲管理者除依專業知識之判斷外，及與研究者之商議，並依下列因素而定，如主要區域內動物之數量及大小，容器之大小，排尿變化量，墊料之外觀及潮濕程度，實驗之條件，例如因手術或體力衰弱(debilitation)而導致動物無行移至較乾淨之區域。一般而言，墊料更換並無所謂之最低次數，往往每日或每週都有所不同。有些狀況下，過度之墊料更換爲有害的，如在產前或產後期間，或費洛蒙(pheromones)之存留有助於繁殖效率，或因實驗之需要而不能更換墊料。

主要圍籬之清理及消毒

Cleaning and Disinfection of Primary Enclosures

對畜舍(pens and runs)而言，經常用水沖，同時定期使用清洗劑或消毒劑，往往有助於維持表面之清除。若是用沖水方式以清除動物之排泄物，則每天需清理一次。而沖洗時，應保持動物之乾燥。沖洗之時段應考慮動物正常之生理及行爲習性反應。例如對被餵食之動物，餵食後往往會引發胃腸之反射蠕動及排糞之動作發生。

關於飼育盒，籠架及相關配件，如飼料槽及給水設備等之清潔，消毒頻率，往往決定在飼育盒之種類及飼養管理措施，這其中包含有使用經常性更換之墊料(接觸性或非接觸性者)，懸掛式之沖洗糞盤，或使用網底之盒子等。一般而言，主要之飼育器及其配件，如蓋子，至少每 2 週要清洗一次，而對實底之盒子，水瓶及吸水管，則每週至少要清洗乙次。有些種類之盒子及架子可能不需要清理的如此頻繁，例如使用較大之容器但僅養數少之動物，在無菌狀況

下飼養動物，獨立式換氣之飼育盒而其墊料更換次數頻繁者，及其他較特殊之使用狀況。

兔子及其他種嚙齒類動物，如天竺鼠及倉鼠，其尿液中往往含有較高濃度之蛋白質及礦物質。這些被排出之礦物質及有機化合物往往會吸附在盒內壁上而不易除去，因而在清洗之前應先用酸性清洗液處理。

主要圍籬之消毒方式可採用化學藥劑或熱水或兩者兼用。清洗之次數及條件要以能夠殺死 vegetative 型態之一般性細菌及其他之微生物。若使用熱水作消毒之工作時，則應同時要考慮到熱水之溫度及給予充分之沖洗時間，使特定溫度之水在此時間範圍中，得以因浸泡來殺死微生物，而這滅菌之功能，這種特定溫度之選定，可經測試來得到。即求得可將微生物暴露在高溫但極短之時間條件或較低溫狀況但較長之暴露時間(Wardrip and others 1994)。利用水溫爲華氏 143-180 度或更高溫度之熱水來進行消毒清潔工作是爲一有效之方式。過去一般採用之攝氏 82.2 度(或華氏 180 度)作爲沖洗之標準，其乃指水槽或支流管內之水溫。

清潔劑及化學消毒劑可加強熱水之殺菌效果，但若使用，則需將徹底沖洗乾淨，避免殘留在器材表面上。

若是以人工方式持熱水及清潔劑或消毒劑來清洗飼育盒及籠架，必需要特別留意細微之步驟。例如要特別注意表面之化學物質是否有殘留，同時對工作人員也要提供適當之保護器具，以避免直接接觸到熱水及消毒劑。

水瓶，吸水管，瓶塞，飼料槽及其他較小之配件，清洗時務必要使用清潔劑，熱水，或適宜之化學物質來消滅微生物。

若是使用自動飲水系統時，則需建立一特殊之操作步驟以確保微生物或碎屑不會堆積在管內部。例如定期性用大量之水去沖洗或使用特殊之化學藥劑處理再用水澈底沖洗乾淨等。而對循環式之管路系統而言，若有使用維護良好之過濾器，紫外線，或其他方式來抑制菌再循環，則此裝置也是很有效的。

對多數之動物飼養設備而言，傳統之清潔及消毒方式是足夠的。但若所飼養之動物，爲具有致病性之微生物，具特定之微生物種類或爲免疫性失調之動物時，則所使用之飼育盒及配件在清洗消毒後，應該再經滅菌處理。則所使用之滅菌機器應定期地加以校正維修，監控，以確保其安全性及效能。

次要圍籬之清理及消毒

Cleaning and Disinfection of Secondary Enclosures

動物房舍中的所有範圍，含動物房及輔助區域，例如儲藏區，籠舍清洗設備，走道及操作室等，應該經常加以清理並對該環境加以消毒。其頻率則依該區域之使用情況及污染源物性爲何而定。

清潔用具應專屬於某一指定區域，而不可四處移走，以減少交互感染之危機。其器具本身應需隨時清理，其材質亦需選用抗腐蝕之材料。磨損之器具要隨時更新，器具要放置在整潔處且擺放整齊，以加速其乾燥之時間且避免污染。

清潔效率之評估

Assessing the Effectiveness of Sanitation

監測清潔操作應依過程及清除物性質而定，包含有：目視檢測，水溫之監控，及微生物監測等。在作評估時，絕對不可僅依動物房內氣味，例如氨氣之輕重，以爲判定清除效果之依據。若要改變墊料更換或盒子清洗之頻率時，則可依氨之濃度，盒子之外觀、墊料之狀況及動物數目而定。

廢棄物之棄置

Waste Disposal

一般生物性的或有危害性的廢棄物之移棄作業，必須爲經常性地，且要考慮其安全性(NSC1979)。有多種有效之棄置方法可以選用。交與商業性之廢棄物處理機構來處理，往往可提供其合法性及安全性。另外以就地焚燒之方式來處理時則應符合聯邦，州及當地之規定作業。

足數且妥善標明之廢棄物儲存桶應準確地放置在有需要之各樓層之中。此容器必須爲防漏且要有密合之蓋子。筒內應使用丟棄式之襯裡，並應經常清理容器及相關器具，此乃爲一良好之作法。每一機構應選一特定區域以作爲廢棄物之儲放地點，此一地區亦需避免有昆蟲及其他害蟲之出沒。若是用冷藏區來存放廢棄物，該冰箱，冰庫或冷藏室應明確標示。

對有危險性之廢棄物，需先經滅菌，隔離或其他方式處理，在無安全顧慮之時，方可運離機構(US EPA1986)。對放射性廢料而言，則應保存在明確標明之容器中。其丟棄處理步驟應與安全專人相配合，並應符合聯邦或州之設定作處置。聯邦政府，多數之州政府及自治區均有相關之規定以管制危險物品之

棄置。履行有關危險物之使用及處置規定爲各機構之職責。具感染之動物屍體可就地燒毀或交與有執照之合約商處理。對於就地包裝，標記，運輸，儲藏廢棄物之作業流程規定，應涵蓋在職業健康及安全規定中。

若危險物爲具有毒性，致癌，易燃，腐蝕性，反應或不穩定之物質，其應存放在標示清楚之容器內並依職業健康及安全專員指示來丟棄。某些狀況之下，這些廢棄物可以壓縮(consolidated)或混合(blended)。

害蟲控制

Pest Control

在一個動物環境中，一套用以防治，控制及清除害蟲之存在或蔓延的周延計劃，是必需要的。定期公告之害蟲防治方案應該要能確實施行。一套理想的計劃應可避免害蟲之侵入也可消除其在機構內藏身。飼養在外之動物，亦需考慮到其被害蟲感染或獵食者侵害之危機。殺蟲劑會引發毒發性效用，而影響到實驗結果(Ohio Cooperative Extension Service 1987 a,b)，因此僅能用在必須之時。研究者之動物若有暴露在殺蟲劑的可能時，則在處理前應先與其溝通，經同意後方可施行。使用殺蟲劑一定要登記，並與管理者商討配合，並要符合聯邦政府，州及當地政府相關規定處理。若有可能的話，應該使用非毒性之蟲害控制方法，如昆蟲成長調節劑(Donahue and others 1989; Garg and Donahue 1989; King and Bennett 1989)，及其它非毒性物質(如：黏膠)。若使用捕蟲器，則其方式要符合人道精神。經常去巡視，抓到活的害蟲，應以人道方式處死。

緊急事件，週末及例假日之管理

Emergency, Weekend, and Holiday Care

動物每日均應由合格人員加以檢視，這其中亦應包含週末及例假日，以確保動物健康福祉，並滿足研究需求。儘管在下班後，週末或例假日，獸醫管理措施亦需存在，以應付突發之狀況。

當遭遇緊急狀況時，機構之安全人員，消防或警察人員應該能夠與單位負責動物管理人員直接聯繫。這種雙方聯繫功能之加強，可藉下列方式實行，如將緊急操作流程，人員姓名及聯絡電話張貼在機構內。安全部門中或交與電話轉接服務中心。對特殊設施或特殊操作之緊急處理步驟應張貼在明顯處。

針對人員及動物之災害防治計劃應事先加以規劃，並應納入整個機構的安全計劃中。各個動物族群之負責人或獸醫師應爲機構安全維護委員之當然成

員。其需直接參與災害處理工作(Casper 1991)。

群體管理
POPULATION MANAGEMENT

動物之辨識及記錄
Identification and Records

動物辨識的方法可將一些資料，如房間，台車，欄，棚及籠盒之位置號碼利用文字書寫或號碼條記載於卡片上或標記於下列方式上，如頸圈，條碼，名牌及標籤；有顏色之染料；打耳洞或耳上之標記；紋身；皮下傳訊器；冷烙等。有時在沒有其他方法可資利用時，對較小之嚙齒類動物會採用切除趾足節作爲標記辨識的方法，但此方法只允許施行在 altricial 出生鼠身上。辨識資料中若有可能的話，應包含動物來源，動物品種及品系，負責人之姓名及工作場所位置，相關的日期資料及計劃編號等。動物之資料卡有時是非常有用的，其型式變化也有多種，簡單地如一般使用之辨識卡片，僅能存放有限之資料；複雜的則爲利用電腦來記錄動物所有之資料。

動物個體的一些臨床資料也會有相當之價值。尤其對狗，貓，靈長類動物及家畜(NRC 1979a)。臨床資料中應包含有臨床及診斷資料，接種記錄，外科手術程序及手術後之照料記錄，實驗執行之資料等。基本之族譜資料及臨床病歷之建立，對動物個體而言，無論用在育種繁殖或研究用途上，都可提增動物應用之價值，這份資料亦應讓相關人員易於取得利用。另外，一些有關養育，配種及行爲記錄，在某些動物之管理操作上，會有很好之參考價值，尤其是靈長類動物。對較大型且壽命長之動物而言，應對每一動物個體建立起一套敘述性之資料(Dyke 1993; NRC1979a)。資料內容應含有種類，動物識別，父，母之識別資料，性別，出生或取得日期，來源，移離日期，及最後處理日期等。這類型之資料對於遺傳管理及族群歷史之評估是必須要有的。當進行機構間之動物交換運送時，相關之資料應伴隨動物移交。

遺傳及命名
Genetics and Nomenclature

遺傳之特徵，對動物之選拔及管理以應用在族群之育種及生物醫學研究上是相當重要地(參考附錄 A)。族群系譜資料有助於配對種之選拔並可得知實驗用動物間之親源關係。

雜交品種動物普遍被運用在生物醫學研究中。用以建立族群之動物種源數目要夠龐大，以確信經長期交配後，其遺傳上依舊得保有其異源性。爲方便比較經由雜交動物獲致之實驗結果，其實施配種時，需應用遺傳學理技術，以維持遺傳雜交優勢之存在，同時每一後代均能由親代處獲得等量之遺傳特性(for example; Lacy 1989; Poiley 1960; Williams-Blangero 1991)。遺傳之變異性可藉由多種方式加以監控，如電腦模擬，生化標誌，DNA 標誌，免疫標誌，或利用生理變因作計量遺傳分析(MacCluer and others 1986; Williams-Blangero 1993)。

許多純品系之實驗動物，尤其是嚙齒類動物，往往應特殊研究需要而開發形成(Festing 1979; Gill 1980)。純品系動物因具有較高比例之同合型基因表徵，此對提高研究資料之再現性及結果比較有極大之助益。其遺傳監測方法亦開發有多種，如免疫，生化或分生技術等(Cramer 1983; Groen 1977; Hoffman and others 1980; Russell and others 1993)。在管理制度中應訂出措施(Green 1981; Kempthorne 1957)以免因突變或錯誤之配對而造成遺傳物質之污染。

基因遺傳動物意指至少有一對外源基因被轉移至動物體內，然而被整合重組之位置或其被重組複製幾套時並無法有效地加以控制掌握。當被整合植入之基因若能與原有基因或環境因子彼此間相互作用，成爲基因之一部份，此時；此種基因轉植動物即可視爲一獨特之動物資源。在保存此種資源時，應藉由正規之遺傳管理措施來操作維護，例如系譜資料之建立與維護，及利用遺傳監測來辨識轉植基因之存在與否。胚胎，卵或精子之冷凍保存方式應考慮採用，以因應基因特性因年代久遠而喪失之可能性，或因意外而致使整個族群之喪失。

利用標準命名規則將各品系或支系或各動物之遺傳背景資料詳實記錄爲一極重要之工作(NRC1979b)，由國際委員會針對各類動物而開發出之標準命名規則，可在多類出版物中查到，包含有雜交之嚙齒類及兔子(Festing and others 1972)，純品系大鼠(Festing and staats 1973；Gill 1984；NRC 1992a)，純品系小鼠(International Committee on Standardized Genetic Nomenclature for Mice 1981a，b，c)，和基因轉植動物(NRC 1992b)。

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第三章
獸醫管理
Veterinary Medical Care

獸醫管理在實驗動物管理及使用方案中爲一必要的部份，其應含有下列具體實效之計劃：

- 預防醫學。
- 疾病(包含人畜共傳疾病)之監控，診斷，治療及控制。
- 與研究計劃有關之疾病，殘障及併發症的管理及處置辦法。
- 麻醉及止痛。
- 手術前後之管理措施。
- 動物健康福祉之評估。
- 安樂死。

參與計劃之獸醫人員應負有獸醫管理方案督導執行之職責。此獸醫人員之資格需爲 ACLAM 所認可(參考附錄 B) ，對實驗動物學，實驗動物醫學或照顧管理動物品系具學理及實務經驗人士。在某些狀況之下，有些計劃中之事項可由非獸醫人士擔任執行，但需建立起一套制度，以確信在執行操作過程中，任何與動物健康，行爲及其福祉相關之疑點，均能確實並及時地與駐站之獸醫所溝通，以獲適切之協助。另外，獸醫師亦應提供一套操作方針，以教導研究人員及參與動物實驗之工作人員，正確地對動物施行操控，保定，鎮靜，止痛，麻醉及安樂死等操作步驟。另外，對於手術前後準備及執行流程加以督導並建立評鑑制度。

動物之取得及運輸
ANIMAL PROCUREMENT AND TRANSPORTATION

實驗採用之動物需以合法之方式取得。動物取得之機構也應在合理範圍內去了解並確保動物之取得程序爲合法的。由防治所(USDA Class B dealers or pounds)取得之貓狗，在使用前需檢視動物身上有無可辨識之紋身記號或皮下詢答器。若動物具上述特徵，顯示其可能爲走失之寵物，此時即應對此動物之擁有者加以確認。對稀少性或瀕臨絕種之動物，在使用前則應先了解該種類目前族群之數量，(相關資料可由 Fish and Wildlife Service, DOI50 CFR17 處取得)。若爲研究，試驗及教學目的許可範圍，則應利用專業繁殖飼養(purpose-bred)之實驗動物爲佳。

對實驗動物之供應商應加以評估以了解所供應動物之品質。按理來說，合格之動物供應商(例如:USDA Class A dealers)都會定期提供與動物遺傳及健康狀況之相關報告。各機構可利用這份資料來作爲動物簽收與否之依據。機構間之動物交換取得，例如基因轉植動物亦應附有類似之文件報告。不論何種之動物運送方式，類別，包含機構間之運輸，應詳盡規劃，以降低運送所需之時間及人與動物間之相互感染機率，另外需考量之因素有，避免動物暴露於極端惡劣之氣候或過度擁擠之環境中；若有需要時，則應依指示來供應飼料及飲水；避免肢體之受創損傷。運輸過程本身對動物造成之緊迫是無可避免的，但若可對上述因素事先加以留意，則當可減輕緊迫之程度。對每批運抵之動物需依採購之規格詳加檢視，同時留意有無臨床疾病之徵狀出現；檢疫方式及適應期間之長短則須依動物種類及當時之狀況而定。所有訂購及接送動物之協商過程均需知會動物管理人員，以確信工作人員事前能將各設施作好充分之準備工作，使動物能被妥善接取。有關動物運輸過程之詳細規定均明列在 AWRS 及洲際間活體動物航空運輸法規(IATA)規定中。另外，有關靈長類動之進口事宜則由 PHS 管制(CFR Title 42)，尤其對結核菌素試驗有特別之指示規定。有關非洲綠猴 cynomolgus 及恆河猴之進口及運輸規定請參考 FR1990，CDC1991 之文件。

預防醫學
PREVENTIVE MEDICINE

疾病之預防爲獸醫管理計劃中極重要的一環。具成效之預防醫學計劃可藉由維持保證動物之健康及避免與計劃無關之疾病及感染所造成研究成果之誤差(變異)，以提升動物實驗之價值。本計劃由不同的政策規定、步驟程序及技術組成；而這些規定與檢疫、適應及如何將動物依種類、來源及健康狀況加以隔離等程序有關。

檢疫適應及隔離
Quarantine, Stabilization, and Separation

檢疫指將新抵達之動物與既有之動物暫時分隔，直至新進動物的健康情形及微生物狀況被確實評估且合格爲止。落實的執行檢疫程序可減少病源菌被引入已建立之舊有動物族群中之機率。獸醫人員應定出一套檢疫流程，以評估新引進動物之健康情形及病源微生物狀況。此流程需符合獸醫學實務及聯邦、

州政府對於人畜共通疾病防治之相關法令規定(Butler and others 1995)。對靈長類動物之檢疫更應定出具效力之步驟，以避免人員感染到人畜共同之疾病。最近因爲在靈長類動物中發現 Filoviral 及 mycobacterial 之感染情形，因而對靈長類動物之檢疫及處理方式需定出較特殊之規定(CDC1991，1993)。獸醫人員可憑藉供應商所提供之動物品管監測報告，來決定下列事項:檢疫期之長短，是否會對工作人員或既有之動物族群有潛在之危機，動物是否需接受治療後方可被釋出檢疫區，對嚙齒類動物而言，是否要藉由帝王切開術或胚胎移植方式將某類特定之病源由某種動物品系中去除。若供應商能提供最新之健康報告，且於運送途中無感染病源菌之可能，則對該批嚙齒類動物可省去檢疫之程序。若檢疫措施是必要的，則不同批次之動物應分開檢疫，以避免相互感染之機會。

不論檢疫期之長短，任何新引進之動物在使用之前，都需給予一段時間，使其生理，心理及營養需求狀態均能得以適應新的環境。適應期之長短可視下列因素做調整；運輸之方式及時間，動物種類及實驗之動物用途而定。研究資料顯示，小鼠，大鼠，天竺鼠及山羊等均需要一段時間來適應新的環境。資料顯示其他種動物也有相同之需求(Drozdowicz and others 1990; Jelinek 1971; Landi and others 1982; Prasad and others 1978; Sanhouri and others 1989; Tuli and others 1995; Wallace 1976)。

依品種來分隔動物，可預防種間疾病之傳播，並減少因種間衝突而引發焦慮，生理或行爲上之變異。通常的作法是將不同種之動物飼養在不同之房舍中，其他如小型之籠舍，供氣式籠架，強制換氣之飼育盒及隔離操作箱等均可考慮用來取代房舍之使用。有些時候，亦可將兩種動物飼養在同一間房舍中，如果兩者之病源菌狀態相似，且行爲上爲相容者。有些動物本身帶有無臨床症狀之潛在性傳染病，當傳染給其他動物時則會引發臨床症狀。下面列舉之例證可作爲是否需要因種來分隔飼養之參考：

- 兔子感染 Bordetella bronchiseptica 時並無臨床之症狀出現，而於天竺鼠則會導致嚴重呼吸道疾病(Manning and others 1984)。
- 依規定，新世界(南美洲)，非洲舊世界及亞洲舊世界之非人類靈長類必須分開飼養於不同房間。猿猴出血熱(Palmer and others 1968)及猿猴免疫缺陷病毒(Hirsch and others 1991; Murphey-Corb and others 1986)對非洲種靈長類動物僅造成不顯示之傳染症狀態卻會對亞洲種引發臨床疾病。

- 有些種類之動物雖然來自同一地理區域，依舊需要在不同房間隔離飼養。例如松鼠猴可能會潛在性地感染者 Herpesvirus tamarinus，同一病毒則會對貓犬鷹猴(Hunt and Melendez 1966)及某些 marmosets 及 tamarins (Holmes and others 1964; Melnick and others 1964)導致致死性之流行性疾病。

不同來源之同種動物不論由供應商或其他機構獲得，或具不同之病源菌狀態者最好也分開飼養，例如大鼠之 sialodacryoadenitis virus，小鼠之 mouse hepatitis virus，兔子的 Pasteurella multocida，macaque 之 Cercopithecine herpesvirus 1，及豬的 Mycoplasma hyopneumoniae 。

疾病之監視，診斷，治療及控制
Surveillance, Diagnosis, Treatment, and Control of Disease

動物必須經常加以觀察檢視有無疾病，受傷之徵兆或異常之行爲出現。此工作需由受過訓且能夠辨認前述徵兆之人員來擔任。依規定，檢視工作需每日進行，但在某些情況下，如對手術復原中之動物，生病或肢體缺陷之動物，則檢視頻度宜增加。當然在有些情況下，如動物被飼養在戶外時，則每日檢視工作之要求可能就不切實際了。因而檢視頻度多寡可依專業知識及經驗來判定，且以不危及動物之安危爲前題。

運用適切之方式來監視及診斷病疾是必要的。當觀察到非預期之死亡，疾病或焦慮症狀，或異常之行爲時，應立即回報，使該動物能獲得適切的照料。動物若呈現傳染病感染之徵象時，需立即與健康動物隔離。若整個房舍之動物被證實或相信暴露於某種病源感染時，則該群動物在診療，控制之過程中，均不可加以移動。

疾病防治，診斷，治療之方式，應採用目前可被接受之務實方法來處理。實驗室診斷之服務將有助於獸醫師醫學管理工作之推展。目前採用之診斷方式有肉眼及組織病理學，臨床病理學，血液學，微生物學，臨床化學及血清學等。對感染之動物是否需要服藥或進行治療，需由獸醫師與研究人員協商後來決定。處理方式除要具療效外，且不能引發不必要之干擾而使實驗結果產生變異。

不顯性之微生物感染，尤其是病毒性，經常出現在飼養於一般環境中之嚙齒動物上。同樣狀況偶而也會發生在無病源菌隔離區之動物，若該微生物屏障被破壞或管理不當時。一些嚙齒類動物之病源菌，如 Sendai，MHV，LCMV，

MP，KRV 等，雖不會引發臨床症狀，但感染後往往會致使免疫系統產生極大的變化，而影響到生理，藥理或毒理性之測試反應結果。如何來訂定動物品質之等級或建立一套符合需求之健康監測評鑑計劃，各機構可依下列因素來考慮，計劃之需求，動物品系感染之後果，污染源對機構的其他研究計劃所會造成負面之影響等。

對病毒性感染主要監測方式爲血清測試。其他微生物感染之監測方式，包含有細菌培養，組織病理學，PCR 之 DNA 分析。在進行診斷時可配合實驗及臨床需求，交互採用這些方法。生物材料，如移轉性腫瘤，雜交細胞，細胞株及其他生物性物質都可能帶有感染嚙齒類之病毒(Nicklas and others 1993)。爲此，可採用小鼠，大鼠或倉鼠之抗體產生方式(MAP，RAP，GAP)來檢視篩選生物材料(de Souza and Smith 1989; NRC 1991c)，以避免其造成對動物之感染。

手術
SURGERY

手術成功與否，取決於下列因素:事前之規劃，人員之訓練，無菌，手術操作技術之演練，動物之健康狀況及動物在計劃執行中之生理狀態等(see Appendix A, "Anesthesia, Pain, and Surgery")。而這些因素之影響程度又隨手術程序之複雜性及動物品系而有所不同。手術操作若採團隊方式進行，往往因有各方專家之參與，而使其成功率提高(Brown and Schofield 1994; Brown and others 1993)。

對手術結果作持續性之觀察及評估，以確信各步驟均依規定之方式操作，而對不合宜之程序能適時的提出改善措施。在某些狀況下，如對嚙齒類動物或在野外施行手術時，必須對正常規定之手術操作流程提出修正措施，此權宜之計是可被接受的，甚至是必須的。然而此種修正不應該對動物個體會造成危害。對已修正程序之評鑑作業要更確實，並要訂定評估規範，而不能單以臨床上之病症罹患率或死亡率爲判定之標準。

手術前之規劃應由所有工作人員參與訂定，包含外科醫師，麻醉師，獸醫人員，手術助理，動物管理人員及研究人員。計劃中應列出個人掌職，所具備之背景專長，所需之器械耗材清單(Cunliffe-Beamer 1993)；手術進行之場所及其性質；動物手術前之健康評估及手術後之照料程序等(Brown and Schofield 1994)。某些狀況中，例如因手術之需要而會將體內某些部份暴露出或操作步

驟會造成免疫系統之反應時，則手術前宜考慮使用抗生素(Klement and others 1987)。但在觀念上，不可以偏向使用抗生素來省略了無菌操作程序。

人員之訓練關係到某些技術操作之精純度，如無菌操作觀念，外科手術之動作細膩與否，切劃精確，器械之正確使用，有效之止血技術及縫合材料之選用等有密切之關係(Chaffee 1974; Wingfield 1979)。通常一個計劃中，往往由不同學歷背景之人員參與外科手術的實行，因此，如何給予他們適切之訓練，以利手術之進行是很重要的一件事。例如，對人體外科手術專精之醫師，則可能需加強對動物與人體之間在解剖、生理學上差異之了解，麻醉劑及止痛劑之效用及手術復原期之需求。ASR 1989; 提供有針對不同經歷人員的外科手術訓練指南，來協助機構適用之訓練課程。依照 PHS 政策及規定而言 AWRS 授權各機構之 IACUC，負有對參與外科手術人員之資歷作評估審查之責。

一般而言，外科手術程序可區分爲主要及小手術兩種。而依實驗室之標準，可再細分爲存活性及非存活性兩類。主要存活性手術之定義爲貫穿或暴露體腔之手術或對物理或生理機能造成永久性之損傷者。例如剖腹手術，胸腔手術，頭顱手術，關節更換及肢體切除等手術。小型存活性之外科手術指不侵入體腔或對身體機能不會造成永久性之損害者;例如傷口之縫合,體表血管插(導)管，農場上一些例行性之操作如去勢，去角，脫腸之診療程序等。及一些獸醫臨床上以門診方式來處理一些經常病歷者。與主要性之手術相比較，小型之手術通常可在較不嚴謹之條件中進行，但對步驟及器械無菌之要求和適切之麻醉處理還是要注意的。通常腹視鏡之使用是以門診方式來進行，但因其已侵入體腔內故依舊要留意無菌程序之要求。

非存活性之外科手術，指手術後之動物不讓其從麻醉中恢復而以安樂處死之程度而言。對此類操作，本章所提之各項程序或許是非必要性的，但一些基本之操作如剃毛，手套的使用，器械及手術部分之清潔等還是需要的(Slattum and others 1991)。

緊急狀態所作之搶救措施，其條件往往無法與正常者相比較。例如，放牧之動物臨時狀況急需施行手術時，此時若堅持要將動物移至手術室內處理，則此想法可能就不合宜，會因時間之延誤而使個體遭受喪命之威脅。在此情況，手術後之照料工作務必要加強，同時可預期的是手術後併發症發生機率之提升。類似突發事件之處理程序，則需依獸醫師之專業知識來作判斷，處理。

實施無菌操作之目的在於降低動物在操作中被微生物感染之機率(Cunliffe-Beamer 1993)。無法以單一之程序，器械或消毒劑使用，來達此目的

(Schonholtz 1976)，惟有靠參與手術之全體，詳思構，密切合作來完成。每一程序本身所代表之意義及重要性往往因不同之手術而有所不同。

無菌技術，包含病患之準備，如剃毛及手術部位之消毒(Hofmann 1979)；外科醫師之準備，如無菌之手術衣物之提供，手術之刷洗物品，及滅菌手套等(Chamberlain and Houang 1984; Pereira and others 1990; Schonholtz 1976)；手術器械，耗材及埋植物品之滅菌處理(Kagan 1992b)；及運用外科手術之技術以降低感染之機率(Ayliffe 1991; Kagan 1992a; Ritter and Marmion 1987; Schofield 1994; Whyte 1988)。

滅菌方式之選定，需依物品之材質而定(Schofield 1994)。一般常用之方式爲蒸氣高壓滅菌及氣體滅菌。滅菌過程要配合者指示之使用，以確信滅菌過程之完整效果(Berg 1993)。若使用液體殺菌藥水處理時，則要注意浸泡時間要充足，浸泡之物品在使用前則務必要使用滅菌水或生理食鹽水徹底沖洗乾淨。酒精本身不是殺菌劑，所以並非很好之消毒劑(Rutala 1990)。

一般而言，非囓齒類動物之無菌外科手術必須在一指定之專用場所實施，除非是因爲實驗之需求，且必須經過 IACUC 批准之特例案子，方得在其他處所進行。因爲多數之細菌可藉由空氣中之微粒而四處傳播，因而外科手術區應減少非相關人員之進出，且要經常性地維持該區之清潔(AORN 1982; Bartley 1993)。有時若將該處用作其他用途時，則必須將之恢復至原有之乾淨度後，才可再使用作手術區。

嚴謹之手術監控及危機狀況之掌握，對手術成功率提升大有助益。監控項目包含麻醉程度之深淺，生理機能之觀察，臨床症狀之評估等。體溫之維持則可避免因麻醉劑所引發之心血管或呼吸系統障礙之發生(Dardai and Heavner 1987)，因而此項監控格外重要。

動物種類之不同直接影響到手術計劃之組成及強度。囓齒類動物對手術所造成感染之耐受性往往是較具爭議之話題，現有資料顯示有些潛在性之感染會造成不良之生理或行爲反應(Beamer 1972; Bradfield and others 1992; Cunliffe-Beamer 1990; Waynforh 1980, 1987)，這些則會影響到手術之成功及實驗之結果。一些常在實驗室執行之囓齒動物的外科手術，所擁有之特徵，如較小之傷口，較少手術成員，同一場所實行多次動物手術，簡短之操作程序等。與較大型動物手術比較下，相對於正規手術操作之程序及規定其修正是必須或可爲人接受的(Brown 1994; Cunliffe-Beamer 1993)。一些需要特殊技術之囓齒類動物外科手術需知可於書本中參考(Cunliffe-Beamer 1983; 1993)

一般而言，對於生物醫學研究材料之禽畜個體，施行手術時，其處理程序及環境需求，應與實驗動物之標準相當。然而，對於一些常爲臨床獸醫或商業機構，採行之一些小手術或緊急處理程序，其處理方式與生物醫學研究之標準相比較，則不需要如此嚴謹。但是，就算是以農場標準來執行，對用以減低對動物健康及福祉危害程度之措施，如無菌操作，鎮靜，止痛，麻醉物之使用及其他條件還是需要的。惟所要求之手術標準，設備及步驟，就不需如此之深入(繁複)。

手術前之規劃書中應詳列出手術後之監控項目爲何，動物之照料需求及記錄之登記等，其中亦應指明將由何人來擔任這些職務。研究人員及獸醫師應共同擔負起監督之責，以確信動物於手術後受到適切之照料。手術後另一項重要工作爲在復甦期對動物之視察及視察頻度之決定。由麻醉狀態中復甦時，動物應保持在乾爽之環境中，並給予適當之關照。同時，也要留意動物體溫調節變化情形，心臟血管及呼吸系統之功能，及手術後引發之疼痛或不適等狀況。其他如是否要藉由腹腔注射來供應維持體內水份及電解質之平衡(FBR 1987)，止痛劑及其他藥物之供應等，還有如傷口之照料，醫療記錄之持續等。

於麻醉狀態中甦醒之動物，可減低被檢視觀查之頻度。然而對於其他之狀況依舊要加以留意，如攝食及排泄之基本生理功能，疼痛引發之行爲徵兆，手術感染之跡象，傷口之檢視，包紮之狀態，及適時地將縫線，釘針去除等(Ufaw 1989)。

疼痛，止痛及麻醉

PAIN, ANALGESIA, AND ANESTHESIA

獸醫管理要項之一爲對於因實驗操作及手術處理而在動物個體上引發之痛苦的感受，應加以避免或減輕其程度。疼痛是種複雜之經驗，通常其產生之原因爲當組織因外界刺激而受損時，或組織感受到潛在危機時。所有動物均具感受疼痛之能力，且能對之產生對應之反應。痛覺之刺激會引發退縮及規避之反應。疼痛爲一緊迫因子，若未加解除，則可對動物產生相當程度之緊迫及焦慮。正確地使用麻醉劑或止痛劑於實驗動物身上，不論在道德上或科學角度而言，都是絕對必要的。NRC 出版之 Recognition and Alleviation of Pain and Distress in Laboratory Animals(NRC1992)針對痛之形成及如何控制痛之感受提供有關的資訊。(附錄 A 中亦列有相關文獻資料)

要減輕或解除動物痛楚的感受，基本上是要能辨識出各類動物對痛所表現

出臨床特徵爲何(Hughes and Lang 19863; Soma 1987)。也因爲每種動物對痛之反應不盡相同(Breazile 1987; Morton and Griffiths 1985; Wright and others 1985)，因此當我們對不同動物之痛覺作評估時，其依據之規範標準當然不同。目前一些因種而異之特有行爲舉止可以用以作爲疼痛或痛苦程度之指標，如發聲吼叫，精神不振，行爲上之改變或異常之表情或姿態，或靜止不動等。因而熟悉並能利用不同動物之行爲，生理或生化特徵，以辨視動物之心理狀態，對動物管理者或研究人員而言，都是必須要學習的(Dresser 1988; Dubner 1987; Kitchen and others 1987)。一般而言，除非有已知相異之情形存在，否則我們常會假設下列之敘述是正確的，即相同之操作程序會對人類引發痛苦，則其亦會引發痛苦在動物個體身上(IRAC 1985)。

選用適切之止痛劑或麻醉劑爲一專業知識之判斷。而其所代表的意義在於除需注意到臨床及人道之需求考量外，亦需同時兼顧到實驗之需求，即不因藥物之使用而干擾到實驗的結果。手術前或進行中使用止痛劑，可能可以加強手術後之止痛效果。藥物之選擇需考量下列因素:動物之品種及年齡，疼痛種類及程度，某類藥物對特定器官之功能影響，，手術過程之時間，藥物對動物之安全性，尤其當手術或實驗過程本身已造成動物生理機能異常時，更要留意藥物使用對動物之影響。對較小型動物和嚙齒類動物，如果配置有精確微調之麻醉機及呼吸器以配合吸入性麻醉氣體之使用，則當可提高用藥之安全性。

有些種類之藥劑-----例如鎮定劑，抗焦慮劑，神經肌肉鬆弛劑等，本身並非爲止痛劑或麻醉劑，故無解除疼痛之效果。然而，因實驗之需要往往會與其他止痛或麻醉劑配合使用。神經肌肉鬆弛劑(如 pancuronium)有時會與全身麻醉劑配合使用，以麻痺骨骼肌之之活動力(Klein 1987)。當此種藥劑在外科手術或其他會引發疼痛之操作過程中使用時，許多麻醉深度之生理特徵則會因此類藥劑對系統癱瘓之效用而完全喪失。縱然如此，一些自主神經系統之變化徵症，如心跳及血壓之突然改變，還是會存在。這些特徵則可加以利用以監控麻醉之深度。若有使用到類似之藥品(鬆弛劑)或狀況時，通常之作法爲先了解正常狀況下之麻醉劑量爲何，再與該類藥劑併合使用，如此當可增加用藥之安全性(NRC 1992)。

除了麻醉劑，止痛劑及鎮定劑以外，使用非藥理性之方法來控制疼痛也有相當之效果(NRC1992；Spinelli1990)。

如前述，神經肌肉鬆弛劑並無法消除疼痛。其使用之目的在於對全身麻醉之動物的骨骼肌加以麻痺癱瘓。這類藥物可允許被使用在清醒輔助性呼吸之

動物個體上，以進行某種無痛覺之神經生理方面研究，然而此類研究務必要經IACUC 委員對動物健康福祉作審慎之評估後方可施行。因爲，一般人深信由藥物引起癱瘓之狀態，對意識清醒之動物會引發強烈之緊迫刺激。若同一狀態發生在清醒的人身上時，則會引發苦惱(distress)之經驗(NRC 1992; Van Sluyters and Oberdorfer 1991)。

安樂死
EUTHANASIA

安樂死爲一種處決的方式，藉此可使動物在瞬間昏迷致死，而不會對動物造成疼痛及痛苦之感受。一般來說，除非是有科學或醫學上論點以支持其採用方式，否則動物安樂死採用之方式均需合乎 1993 Report of the AVMA Panel on Eathanasia (AVMA1993 or later editions)之規定施行。就方法之適切性其評估上，應考慮到下列幾個標準：能否有效地昏迷致死動物，且不會(對動物)產生不適，疼痛，焦慮的感受；可靠性；不可恢復者；引發昏迷所需的時間；品種及年齡上之限制；與實驗性質是否有衝突；對執行人員之安全性及其情緒上之影響。

對某些實驗而言，因實際之需求或因實驗操作致使動物感受到極度之痛苦且無法以藥物來控制時，則安樂死之處置應爲唯一選擇了。在實驗計劃書中，應明確定義出實行安樂死之時機，例如研究者或獸醫師可藉由身體機能或行爲能力喪失之程度，或腫瘤大小以迅速作出判斷，進而對動物適時地施以人道之處置，同時也能獲致實驗之結果。

在執行安樂死之際，亦應避免對動物造成不安之情緒。例如，一些動物在面臨死之時會爭扎且發出聲音，或釋放出費洛蒙(pheromones)。若有類似狀況發生，則應將等待之動物移離現場，避免接觸所產生之不安情緒(AVMA 1993)。

安樂死所使用之材料及方式，需依賴動物種類及實驗之性質目的而定。一般而言，使用吸入性及非吸入性之化學物質(如 barbitarates，無爆炸性之吸入性麻醉劑，或二氧化碳)要比物理性質之方法(如頸椎脫臼法，斷頭法或頭顱穿刺法)爲佳。有時，因基於某些科學因素之考量，部分安樂死之化學藥劑可能不適用於實驗之計劃。所有安樂死之方式均需經 IACUC 委員審視及批准。

動物之安樂死應由技術熟練的人來負責執行，執行時則要以專業手法而不殘忍之心態來進行。動物死亡之判定應由專業人士藉特有生命跡象之有無來

判定。另外，對部分之管理人員，獸醫師及研究人員而言，對動物實行安樂死之處置，可能會造成心理上之困擾。尤其當某些人必須經常性地執行此項工作時，或對將處決之動物有感情存在時，則情緒性之反彈會更強烈(Arluke 1990; NRC 1992; Rollin 1986; Wolfle 1985)，因而在工作分配時，主管人員應事前考量此潛在之問題。

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第四章
房舍設施
Physical Plant

一所經過精心規劃，設計，建築及妥善經營的動物設施，對實現一完善之動物管理及使用規範而言，是極爲重要之因素。其同時也促成一具效率，經濟考量及安全之操作環境。(相關文獻資料，請參閱附錄 A "Design and construction of animal facilities")。動物設施之設計及規模大小需依據機構研究方針，動物種類，與機構內其它房舍間關係，及地理相關位置。要獲取一具有效率規劃及設計，在計劃之初就應徵詢具動物房舍設計，操作有經驗之人士和將使用到此設施之人士意見。如能利用到 CFD 來模擬新的設施及籠舍之設計，則會更有效益(Reynolds and Hughes 1994)。任何動物設施之設計及施工，均需與相關之法令規章相配合。而建築體內之每一結構組成均需符合本章所敘之建築。

若要有一好的動物管理，且注重人員之舒適及個人健康之維護，則必須將動物設施與人員活動區，如辦公室或會議室區隔開。採用方式如將動物區設置在另一棟建築物，側翼，不同樓層或房間。若是經細心規劃，其有可能將實驗室設置在動物飼養區附近，而利用隔離設施如 entry locks，走道及樓層來加以分隔。實驗動物一定要置放在特定之設施區域中，決對不可圖方便而將動物飼養在實驗室中。但若是因實驗之需要，而必須將動物存放寄養在實驗室內，則必須將該區加以整理使之適合動物之居留且易於管理。若有必要，則需建立起防護措施，以避免人員因暴露，接觸動物而產生之工作上危害。建材之選用要考慮到提高工作效率及衛生維護。動物房舍內部材質宜採用堅固耐用，防潮，防火及無縫隙之材料爲最佳選擇。表面材質也需經得起如清潔劑之浸蝕，刷洗，高壓噴槍之沖洗及抗碰撞等而不易破損。與動物接觸到之器械設施表面，若要上漆料需採用無毒性者。對屋外設施而言，其表面材質之選擇，則要考慮能耐氣候因素，且要易於清洗維持者。

作業區
FUNCTIONAL AREAS

就動物管理及使用之目的而言，往往需憑藉專業知識之判斷來規劃一實用，功能完備及作業方便之房舍設施。一個單位是否需具備特殊之設施及持續性功能，需依照單位任務規劃案中之規模大小，性質及使用頻度等方面來考量。對一些規模較小之單位，或飼養較特殊環境條件下之動物，如無菌動物

(Gnotobiotic)、無特定病原(SPF)動物、或動物飼養在戶外場所如欄，舍等，則下列所提及的作業區可能就不太須要，或可考慮設置在一共同區域中。一般應具備之作業區有下列各種：

- 動物飼養，管理及清潔消毒區域。
- 接收，檢疫及隔離動物之區域。
- 依動物品種而做分隔或依實驗計劃需要而能單獨分隔動物之區域
- 儲存區域。

另外，若爲一多功能之動物設施機構，則亦需具備下列的作業區：

- 鄰近動物飼養區的特殊性質之實驗室，以使進行如外科手術，加護管理，屍體解剖，X 光攝影，特殊飼料之製備，實驗操作，臨床治療及診斷實驗等特殊工作者。
- 操作使用危險性生物，物理及化學藥劑應隔離防護之設施。
- 飼料，墊料，藥品，生物製劑及耗材之接收及儲存區。
- 設備，器械清洗及消毒滅菌區，空間大小則依工作量及用以清洗飼育盒，水瓶，玻璃器皿，台車及廢棄物容器等機型大小而定；清洗水槽；用以消毒滅菌設備。飼料，墊料之高壓滅菌機；及分別存放污穢及乾淨設備的空間。
- 未焚化或移除之廢棄物之儲存空間。
- 冷藏及屍體棄置之空間。
- 行政行事及監督管理人員之辦公區，亦應包含教育人員使用之區域。
- 淋浴車，盥洗台，更衣室，廁所及人員休息區。
- 保全系統，例如門禁卡片系統，電子監控及警報系統。

建築指南
CONSTRUCTION GUIDELINES
走道
Corridors

走道寬度之設計以方便工作人員及設備工作爲原則。一般而言，寬度在 6～8 英呎，應可滿足大部份工作上需求。地板及牆面交接處之設計應考慮到清洗情況之方便性。通向狗或豬之飼養區，清洗區或其他吵雜之工作區的走道，應考慮設置雙門式之玄關或其他阻隔噪音之設施。其他如水管，排水管，電線管路及其他設施應設有維修孔道，並將其置於動物房外之走道，以便管理維

修。警鈴，滅火器，電話等設備應置於壁櫥或較高處，避免因設備搬動而碰損。

動物房門

Animal-Room Doors

基於安全上之考量，動物房門應開向內側，若需開向走道，則應設置玄關。門上若能設置玻璃視窗可能會更合適。所附加之視窗本身應有可關閉之性能，以便使用在某些特殊之狀況中，如要避開光照影響或走道活動之干擾等。門應夠寬(大約在 42×84 英吋)以便台車及設備得以進出。門與門框要能密合，以避免害蟲侵入動物房或藏身其中。門的材質選用要能耐腐蝕。備有內藏式之手把的自動門爲較適用之型式，另外升降柵門及踢腳板之設置也應考慮。

外部窗戶

Exterior Windows

對有些動物房而言，是可允許有窗戶的，甚者有些動物，如靈長類動物，狗及其他農業動物，動物房內的窗戶，往往成爲一種環境之充實物。當設置窗戶之前，應先考慮窗戶的存在對室內溫度，光照及安全性之維持是否會造成影響。如果熱源會從窗戶進出造成室溫之變化，或透入之光源會影響到動物生理週期時，(如種鼠之繁殖性能)光照週期無法控制時，此時就不宜設窗子。

地板

Floors

地板必須爲防潮，無吸收性，耐撞擊，且要相當之平坦。這些爲設計時之基本考量因素。在比較潮濕之地區或對某些種類動物而言，如農場動物，地面要弄得較粗糙，以防滑。採用之材質必須不會與尿或其他生物性物質起反應，而且要能抗拒熱水或清潔劑之不利效果。並須能承受台車，設備和儲藏物的重壓，而不會有凹痕，裂縫或破洞產生。而就其使用特性而言，地面施工設計時應採一體成型方式來處理，或要減少接合點之存在。有些材料，如高分子聚合酯，高硬度混泥土接合劑，及橡膠成份之聚合物等已被證實爲鋪設地面的極佳材質。而正確的施工方式也爲確保表面持久不壞的另一要素。若要安裝門檻，則要注意物品設備進入之方便性。

排水

Drainage

動物房內若設有排水設施，則地面鋪設時要考慮斜坡設計，以配合排水。排水彎管處亦應隨時充滿水。爲減低濕度，排水系統必須能迅速將水排除，使地面保持乾燥(Gorton and Besch 1974)。排水管之口徑至少要大於 4 英吋(10.2 公分)。有些房舍，如狗舍或農場動物的設施，排水管之口徑更要加大。設立地板式排水槽或大量污物處理系統對固型廢棄物之排放可能較有效果。對長期不使用之排水系統，應加蓋，密封起，以避免污水或其他污染物之倒流，如加鎖之排水孔蓋就適合此一狀況使用。地面排水設施並非爲每一動物房必須之設備，尤其是對嚙齒類動物而言。無排水設計之動物房，可利用濕式真空吸塵器或拖把配合清潔劑或消毒藥水之使用來清潔地面。

牆面

Walls

牆面必須爲光滑平坦，防潮，無吸附性，必可耐撞擊。必須要無縫隙存在，不能有無密封之管線通道，且與門框，天花板，地面或轉角處之接縫要平滑密合。表面材質要能耐清潔劑，消毒藥水之清洗，及耐高壓水柱之沖洗。可使用防撞片來保護牆面及凸出之牆角。

天花板

Ceilings

天花板之設計必須密封平滑，抗潮，且無不平整之接合處。表面選用之材質需耐清潔劑及消毒藥水之清洗。石膏板或防火灰泥板所組成之天花板，其縫隙需用耐洗之漆料修補密封。採用混泥土作成之天花板，若經適當之修平，密封或油漆處理，也是種很好的選擇。一般而言，懸掛式之天花板爲較不適合，除非其材料是選用防水性的且無不平整之接合處者。露於天花板外之水管，管道，線路是不適合的，除非其表面容易被清理。

加熱，換氣及空調設備

Heating, Ventilation, and Air-conditioning (HVAC)

空調設備之功用在於使室內溫，濕度不會隨外界氣候變化或動物房內動物種類及數量增減而有較大之起伏變異。HVAC 設計原則爲可靠、易於維修及

節省能源三項。所設計之 HVAC 系統必須要能滿足動物對環境氣候因子之需求。動物房所採用之 HVAC 系統應具備調整乾式球溫度計溫度在±1℃(±2℉)之能力，且對相對濕度經常維持在 30-70% 。爲使室溫能獲得最佳之控制，溫度調節器應獨立安裝於每間動物房內，而不宜採用〝區域監控式〞。當每間動物房內之飼養密度不同，或每間動物房經由排氣管道之熱增減效率不同時，採用區域監控系統時，往往會使各動物房之溫度差異增大，而失去溫控之效果。

經常性之監控 HVAC 系統之運作情形是極重要之工作，且執行上應以每個房間爲單位。前面所述之溫度，濕度範圍可依不同種動物之特殊需求來加以調整。一般而言，動物房在氣候因素控制規劃也以同類具相同需求之動物放一處來考慮。

一般實驗用之動物均可承受短暫性，偶發性之小幅度之溫度及濕度變化，而不會造成生理機能之變異。而 HVAC 之設計規劃時，也會以當地氣候變化之最高及最低變化數值爲參考依據，使其處理能力維持在標準值之±5%誤差範圍內(ASHRAE 1993)。當外界氣候有極端異常之情形出現，且超出 HVAC 設計之能力範圍時，則對系統操作作適度之變更，以維持輸出溫濕度之恆定是必要的。此種變更之手段有如，啓用額外主機設備，全換氣改爲部份循環，改變換氣率使用輔助設備等。HVAC 系統在設計時，亦需考慮到，若有部份機器故障時，該系統依舊能以較低之輸出來維持內部之需。系統設計需具備應變能力，以避免因系統當機而引發室溫異常使動物致死之情形發生。除了在某些較特殊之場所，如生化危險區域，同樣之設備安置數套是不需要。對於遮棚區或戶外之房舍，則可考慮使用輔助之設施以達短暫換氣通風之目的。

在某些情況之下，動物房(飼育及操作區) ，手術房宜採用 HEPA(高效能微粒濾網)處理過之空氣。在不同之區間(域) ，如手術區，操作區，豢養區及工作區，亦應考慮具靜壓壓差之存在。例如，檢疫區，豢養區，靈長類動物飼養區，危險物品使用及工作區等地方應維持在負壓之狀態。而如手術區，SPF 動物飼養區，乾淨之器械儲存區等地方，則應維持在正壓之狀態。區域間之正負壓差之維持，並非是主要或唯一的區域間交互感染的控制手段，當然也不應該僅仰賴此方來作爲管制汙染之唯一方法。當房門開啓時，局部性之氣旋，亂流會出現在區域之間，爲使區域間之壓差一直存在，則可採用具備維持壓差之空氣處理系統來達成其效果。

汙染源之圍堵方式，需要使用到生物安全性之操作櫃(biological-safety

cabinets)，exhausted airlocks 及其他相關之設備。相關細節在第一章有所說明過。

使用循環空氣時，其空氣之質與量之要求標準要符合 Chap2 之建議。而所採用之空氣處理形式及其效果應依汙染源之種類及數量配合考量，另外污染源可能造成之危害程度亦應一併考慮。

電力與照明

Power and Lighting

電力系統規劃時要注意其安全性，且能提供適當之照明度，足夠之電源插座及提供正確之安培數以供特殊儀器使用。當停電時，備份之電力供應系統或緊急發電系統，必須能提供足額之電力使動物房內，手術室及其他區域內之關鍵性之設施，如 HVAC 系統。或支援性之功用，如冰櫃，強制換氣籠架及隔離操作箱等，得以繼續運作。

動物房內之燈具，定時器，開關及插座等設施應妥善加以密封，以避免害蟲藏身其內。內藏式之省能螢光燈爲動物房舍中最常使用之照明設備。動物房內亦應採用定時控制之燈源，以提供一正常光照週期之照明。對定時器也要定期檢視，以確保功能正常。燈泡及燈具應具備保護之罩子以確保動物及人員之安全。在較潮濕之區域，如清洗區或水生動物飼養區，所使用之開關，插座應具防潮設施，並要有斷電跳脫之保護設備。

儲藏區域

Storage Areas

要有足夠之區域以存放設備，耗材，飼料，墊料及廢棄物。人員及設備所使用之走廊、通道不應將之作爲儲存物品之場所。當所需物品供應來源充足且穩定時，則不須預留過大之儲存空間。飼料及墊料應與有毒害危險物品分別存放。廢棄物亦要與其他物品分開堆放(參考第二章規定)。死亡動物的屍體及臟器殘骸應存放在 7℃以下之冷藏室內，以減緩腐壞之速度；屍體殘骸不可以與其他物品儲藏在一起。

噪音防治

Noise Control

噪音防治在動物房中爲一重要之工作(參考第二章之規定)。在規劃時應考

慮將會產生噪音之設備，例如飼育盒清洗機，該與飼育區及實驗室分隔開來。混凝土牆，因其密度可減低聲音之傳導，故而在隔絕噪音之效果要比金屬或石灰泥牆要好得多。一般而言，將隔音材料直接塗抹在動物房之天花板上時，往往造成衛生及蟲害控制上之問題，故不建議使用。然而，若採用可清洗消毒之滅音材質，直接砌合在牆上或天花板上，在某些狀況下是可採行的。過去之經驗顯示若走道上的門裝置良好，或採用隔音門或雙門式玄關，在控制走道傳遞之噪音防治上，頗具效果。

一些由設備產生之噪音尤其要加以注意。如火警，環境監控警報系統及播音系統之種類需加以選擇且裝設地點也需考慮，以減低對動物之干擾。對會發出超高音頻之設備，更需考慮其設置之地點，以避免干擾到特定種類之動物。

機械清洗設施

Facilities for Sanitizing Materials

一個指定之共用區域作爲清洗消毒飼育盒及其配件是必要的。機械式之籠舍清洗設備爲必須之設施，種類型式則需依籠舍及配件規格而定。另外考慮因素有；

- 設置地點與動物房，廢棄物存放區及儲物室間之關係。
- 方便進出，如門要夠寬以方便設備之移動。
- 足夠空間以 staging (存放)及操控設備。
- 一套妥當墊料棄置方式及前洗工作的規定。
- 乾淨區域及骯髒區域間動物及設備之動向流程應分開。
- 絕緣(對有必要之牆面及天花板作絕緣處置)。
- 隔音。
- 冷、熱水，蒸汽，地面排水系統及電源供應之設計。
- 通風(排風)設施之裝置，及排除消毒作業時殘留之蒸汽及氣體之裝備。

無菌手術設施

FACILITIES FOR ASEPTIC SURGERY

外科手術設施之規劃必須依據手術之動物種類及手術程序之複雜性而定。(Hessler 1991; Appendix A，Design and Construction of Animal Facilities)。

對多數囓齒類動物的手術而言，所需要之設施可能爲一小而精簡式之形態，例如在實驗室中劃定出一特定之區域，並配合著適當地管理制度來降低於手術中因房內其他之活動而對動物造成感染。一般而言，手術設施之規模往往會因動物之數量，體型，手術複雜性之增加而增加，例如大量之操作程序，使用特殊保定設施，液壓昇降之手術操作台。農場動物外科手術時所需之排水系統，若程序上需額外之技術人員及設備配合時則對空間要求也會增加。當對手術設計之複雜性作全面之規劃時，主要手術設施與其他支援單位，如診斷實驗室，X光照像室，動物房，工作人員辦公室等等的相關位置亦需詳加考慮。手術作業區應與其他區域完全隔離，以減少不必要之人員進出及減少感染之可能性(Humphreys 1993)。將手術設施集中管理的優點在於節省設備之投資，所需之空間，人力，減少動物運送之工作，並可增強對設施及程序之專業監督工作。

對多數之手術計劃而言，無菌外科手術作業組成包含有外科手術供應區，動物準備室，外科醫師準備室，手術房，和復原室等。這些區域在規劃時，應安排行徑動向以減少不必要之交錯，且要將相關但與手術操作無直接關聯之活動隔離在手術房外。隔離的最好方法是用硬體屏障(AORN 1982)，但有時也可用緩衝區域作分隔，或定時在各項操作程序中安排清理及消毒的工作。資料顯示細菌感染程度及手術後傷口感染之病例與手術參與人數及活動頻度呈正相關(Fitzgerald 1979)。人員進出手術房之頻度可藉不同措施來降低，如設置視察視窗，通訊系統(如內部通話系統) ，或詳加考量大門設置之地點等。

手術設施在規劃時，主要考量之因素爲如何有效地控制汙染源及容易清理兩大項。手術區內部表面之建材應使用一體成型者，且具不透水性。藉由通風系統以供應過濾處理之空氣且建立房內之正壓狀態，如此可大大減低手術後感染之機率。亦有資料建議，進風口及排氣管道設置的地點及適度之房間換氣率也可減低汙染發生之可能。爲了方便清理，手術房內的各項設備應盡量避免固定，而要能活動(移動)爲原則。其他應考慮注意之事項包含有足夠手術照明設備，足量之電源插座以方便輔助儀器之使用及廢氣清除之能力。

外科手術供應區間(support area)應被設計作爲器械清洗，消毒和耗材，器械儲存之用。消毒滅菌鍋通常置放於此。而在動物準備區內通常設置有一大型水槽，以便對動物及手術部份作清理準備之工作。更衣室則給工作人員更換手術罩袍之用。多用途之更衣室即具備此種功能。外科醫師之刷洗室應配有以足，膝或電眼啓動之刷洗水槽。爲避免因刷洗過程中之飛沫導致感染，此刷洗區通常設置在手術室外。

手術復原區應提供一硬體環境，以滿足動物在麻醉狀態中及甦醒時之需求，允許對動物進行充分的觀察照料。對於監控及供應系統所需之電力及機械需求亦應加以考慮。手術區內之飼育及供應系統的形式雖需依動物之種類及手術程度而定，但基本上其設計之概念應以易於清洗且足以支援生理之功能爲主，例如體溫之調節及呼吸等。對農場動物而言，在某些狀況下，尤其是在野外，手術復原區之型態可能被修改過之方式，或根本不存有；在此狀況下，工作人員應更加小心照料動物以減低復甦之動物受到傷害之機率。

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APPENDIX

A

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APPENDIX B
Selected Organizations Related to Laboratory Animal Science

American Association for Accreditation of Laboratory Animal Care (AAALAC), 11300 Rockville Pike, Suite 1211, Rockville, MD 20852-3035 (phone: 301-231-5353; fax: 301-231-8282; e-mail: accredit@aaalac.org).

This nonprofit organization was formed in 1965 by leading U.S. scientific and educational organizations to promote high-quality animal care, use, and well-being and to enhance life-sciences research and education through a voluntary accreditation program. Any institution maintaining, using, importing, or breeding laboratory animals for scientific purposes is eligible to apply for AAALAC accreditation. The animal-care facilities of applicant institutions are visited and the program of animal care and use thoroughly evaluated by experts in laboratory animal science, who submit a detailed report to the Council on Accreditation. The council reviews applications and site-visit reports, using guidelines in the *Guide for the Care and Use of Laboratory Animals*, to determine whether full accreditation should be awarded. Accredited institutions are required to submit annual reports on the status of their animal facilities, and site revisits are conducted at intervals of 3 years or less. The Council on Accreditation reviews the annual and site-revisit reports to determine whether full accreditation should continue.

Fully accredited animal-care facilities receive a certificate of accreditation and are included on a list of such facilities published by the association. Many private biomedical organization strongly recommend that all grantees be supported by an AAALAC-accredited animal program. Full accreditation by AAALAC is accepted by the Office for Protection from Research Risks of the

National Institutes of Health as strong evidence that the animal facilities are in compliance with Public Health Service policy.

American Association for Laboratory Animal Science (AALAS), 70 Timber Creek Drive, Suite 5, Cordova, TN 38018 (phone: 901-754-8620; fax: 901-753-0046; e-mail: info@aalas.org; URL: http://www.aalas.org/).

AALAS is a professional, nonprofit organization of persons and institutions concerned with the production, care, and study of animals used in biomedical research. The organization provides a medium for the exchange of scientific information on all phases of laboratory animal care and use through its educational activities and certification. AALAS is dedicated to advancing and disseminating knowledge about the responsible care and use of laboratory animals for the benefit of human and animal life. AALAS publishes *Laboratory Animal Science* (bimonthly journal), *Contemporary Topics* (bimonthly journal), training manuals for laboratory animal technicians, an annual membership directory, a directory of certified technologists, and occasional pamphlets on special subjects. AALAS answers inquiries; conducts certification program for laboratory animal technicians; conducts annual scientific sessions at which original papers are presented, with seminars and workshops on laboratory animal science; distributes publications; lends film and slide sets; and makes referrals to other sources of information. Services are available to anyone.

American College of Laboratory Animal Medicine (ACLAM), Dr. Charles W. McPherson, Executive Director, 200 Summerwinds Drive, Cary, NC 27511 (phone: 919-859-5985; fax: 919-851-3126).

ACLAM is a specialty board recognized by the American Veterinary Medical Association (AVMA). It was founded in 1957 to encourage education, training, and research; to establish standards of training and experience for qualification; and to certify, by examination, qualified laboratory animal specialists as diplomates. To achieve these goals, the college seeks to interest veterinarians in furthering both training and qualifications in laboratory animal medicine.

The annual ACLAM Forum is a major continuing-education meeting. ACLAM also meets and sponsors programs in conjunction with the annual meetings of AVMA and the American Association for Laboratory Animal Science. It emphasizes and sponsors continuing-education programs; cosponsors symposia; cosponsors about 30 autotutorial programs on use, husbandry, and diseases of animals commonly used in research; and has produced 14 volumes on laboratory subjects, such as *The Laboratory* Rat and *The Mouse in Biomedical Research.*

American Humane Association (AHA), 236 Massachusetts Avenue, NE, Suite 203, Washington, D.C. 20002 (phone: 202-543-7780; fax: 202-546-3266).

AHA is a professional, nonprofit organization of organizations and individuals concerned with the exploitation, abuse, and neglect of children and animals. AHA was founded in 1877 and was the first national organization to protect children and animals.

AHA supports the 3 R's in biomedical research: refinement, reduction, and replacement where possible. AHA informs its members of issues in biomedical research through its magazine, *Advocate*, which is published quarterly.

American Society of Laboratory Animal Practitioners (ASLAP), Dr. Bradford S. Goodwin, Jr., Secretary-Treasurer, University of Texas, Medical School-CLAMC, 6431 Fannin Street, Room 1132, Houston, TX 77030-1501 (phone: 713-792-5127; fax: 713-794-4177).

ASLAP, founded in 1966, is open to any graduate of a veterinary college accredited or recognized by the American Veterinary Medical Association (AVMA) or Canadian Veterinary Medical Association (CVMA) who is engaged in laboratory animal practice and maintains membership in AVMA, CVMA, or any other national veterinary medical association recognized by AVMA. Its purpose is to disseminate ideas, experiences, and knowledge among veterinarians engaged in laboratory animal practice through education, training, and research at both predoctoral and postdoctoral levels. Two educational meetings are held annually, one each in conjunction with the annual meetings of AVMA and the American Association for Laboratory Animal Science.

American Society of Primatologists (ASP), Regional Primate Research Center, University of Washington, Seattle, WA 98195 (URL: http://www.asp.org).

The purposes of ASP are exclusively educational and scientific—specifically, to promote and encourage the discovery and exchange of information regarding primates, including all aspects of their anatomy, behavior, development, ecology, evolution, genetics, nutrition, physiology, reproduction, systematic, conservation, husbandry, and use in biomedical research. The ASP holds an annual meeting, sponsors the *American Journal of Primatology*, and publishes the ASP Bulletin quarterly. Any person engaged in scientific primatology or interested in supporting the goals of the society may apply for membership. Membership and information about the International Primatological Society can be obtained from ASP.

American Veterinary Medical Association (AVMA), 1931 North Meacham Road, Suite 100, Schaumburg, IL 60173-4360 (phone: 800-248-2862; fax: 708-925-1329; URL: http://www.avma.org/).

AVMA is the major national organization of veterinarians. Its objective is to

advance the science and art of veterinary medicine, including its relationship to public health and agriculture. AVMA is the recognized accrediting agency for schools and colleges of veterinary medicine. It promotes specialization in veterinary medicine through the formal recognition of specialty-certifying organizations, including the American College of Laboratory Animal Medicine. The AVMA Committee on Animal Technician Activities and Training accredits 2-year programs in animal technology at institutions of higher learning throughout the United States. A list of accredited programs and a summary of individual state laws and regulations relative to veterinarians and animal technicians are available from AVMA.

Animal Welfare Information Center (AWIC), National Agricultural Library, 5th floor, Beltsville, MD 20705-2351 (phone: 301-504-6212; fax: 301-504-7125; e-mail: awic@nal.usda.gov; URL: http://netvet.wustl.edu/awic.htm or http://www.nalusda.gov).

AWIC, at the National Agricultural Library, was established by the 1985 amendments to the Animal Welfare Act. It provides information on employee training, improved methods of experimentation (including alternatives), and animal-care and animal-use topics through the production of bibliographies, workshops, resource guides, and *The Animal Welfare Information Center Newsletter.* AWIC services are geared toward those who must comply with the Animal Welfare Act, such as researchers, veterinarians, exhibitors, and dealers. Publications and additional information are available from AWIC.

Animal Welfare Institute (AWI), P.O. Box 3650, Washington, DC 20007 (phone: 202-337-2332; fax: 202-338-9478; e-mail: awi@igc.apc.org).

AWI is a nonprofit educational organization dedicated to reducing the pain and fear inflicted on animals by humans. Since its founding in 1951, AWI has promoted humane treatment of laboratory animals, emphasizing the importance of socialization, exercise, and environmental enhancement. The institute supports the "3 R's": replacement of experimental animals with alternatives, refinement to reduce animal pain and suffering, and reduction in the numbers of animals used. Educational material published by AWI includes the *AWI Quarterly*, *Comfortable Quarters for Laboratory Animals*, *Beyond the Laboratory Door*, *and Animals and Their Legal Rights* and is available free to scientific institutions and libraries and at cost to others. The institute welcomes correspondence and discussion with scientists, technicians, and IACUC members on improving the lives of laboratory animals.

Association of Primate Veterinarians (APV), Dr. Dan Dalgard, Secretary,

Corning Hazleton, 9200 Leesburg Turnpike, Vienna, VA 22162-1699 (phone: 703-893-5400 ext. 5390; fax: 703-759-6947).

APV is a nonprofit organization whose missions are to promote the dissemination of information related to the health, care, and welfare of nonhuman primates and to provide a mechanism by which primate veterinarians can speak collectively on matters regarding nonhuman primates. The organization developed after an initial workshop on the clinical care of nonhuman primates held in 1973 at the National Institutes of Health. Six years later, bylaws were adopted to formalize the missions and operation of the group. Members of APV are veterinarians who are concerned with the health, care, and welfare of nonhuman primates. The association meets annually, publishes a quarterly newsletter, and contributes to other scholarly and regulatory efforts and issues concerning nonhuman primates.

Australia and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART): ANZCCART Australia, The Executive Officer, PO Box 19, Glen Osmond, South Australia 5064, (phone: +61-8-303-7393; fax: +61-8-303-7113; e-mail: anzccart@waite.adelaide.edu.au; URL: http://www.adelaide.edu.au/ANZCCART/); ANZCCART New Zealand, The Executive Officer, C/- The Royal Society of New Zealand, PO Box 598 , Wellington, New Zealand (phone: +64-4-472 7421; fax: +64-4-473 1841; e-mail: anzccart@rsnz.govt.nz; URL: http://www.adelaide.edu.au/ANZCCART/).

ANZCCART was established in 1987 in response to concerns in both the scientific and the wider communities about the use of animals in research and teaching. ANZCCART is an independent body that has been developed to provide a national focus for these issues. Through its varied activities, ANZCCART seeks to promote effective communication and cooperation between all those concerned with the care and use of animals in research and teaching. ANZCCART's missions are to promote excellence in the care of animals used in research and teaching and thereby minimize their discomfort, to ensure that the outcomes of the scientific uses of animals are worthwhile, and to foster informed and responsible discussion and debate within the scientific and wider communities regarding the scientific uses of animals.

Canadian Association for Laboratory Animal Medicine/L'Association canadienne de la médecine des animaux de laboratoire (CALAM/ACMAL), Dr. Brenda Cross, Secretary-Treasurer, 102 Animal Resources Centre, 120 Maintenance Road, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5C4.

CALAM/ACMAL is a national organization of veterinarians with an interest

in laboratory animal medicine. The association's missions are to advise interested parties on all matters pertaining to laboratory animal medicine, to further the education of its members, and to promote ethics and professionalism in the field. The association is committed to the provision of appropriate veterinary care for all animals used in research, teaching, or testing. The association publishes a newsletter, *Interface*, four times a year.

Canadian Association for Laboratory Animal Science/L'association canadienne pour la technologie des animeaux laboratoire (CALAS/ACTAL), Dr. Donald McKay, Executive Secretary, CW401 Biological Science Building, Bioscience Animal Service, University of Alberta, Edmonton, Alberta, Canada T6G 2E9 (phone: 403-492-5193; fax: 403-492-7257; e-mail: dmckay @gpu.srv.ualberta.ca).

CALAS/ACTAL is composed of a multidisciplinary group of people and institutions concerned with the care and use of laboratory animals in research, teaching, and testing. The aims of the association are to advance the knowledge, skills, and status of those who care for and use laboratory animals; to improve the standards of animal care and research; and to provide a forum for the exchange and dissemination of knowledge regarding animal care and research. CALAS/ ACTAL maintains a Registry for Laboratory Animal Technicians, publishes a newsletter six times a year, and hosts an annual national convention.

Canadian Council on Animal Care (CCAC), Constitution Square, Tower II, 315-350 Albert, Ottawa, Ontario, Canada K1R 1B1 (phone: 613-238-4031; fax: 613-238-2837; e-mail: ccac@carleton.ca).

CCAC, founded in 1968 under the aegis of the Association of Universities and Colleges of Canada, became an independently incorporated, autonomous organization in 1982. Through its development of guidelines, assessment visits, and educational/consultation programs, the CCAC is the main advisory and review agency for the use of animals in Canadian science. Compliance with CCAC guidelines, published in two volumes, is a requirement for the receipt of grants or contracts. CCAC is currently funded by the Natural Sciences and Engineering Council of Canada, the Medical Research Council of Canada, and some federal departments.

Center for Alternatives to Animal Testing (CAAT), Johns Hopkins University, 111 Market Place, Suite 840, Baltimore, MD 21202-6709 (phone: 410-223-1693; fax: 410-223-1603; e-mail: caat@jhuhyg.sph.jhu.edu; URL: http:// infonet.welch.jhu.edu/~caat/).

CAAT was founded in 1981 to develop alternatives to the use of whole

animals for product development and safety testing. Although CAAT's mission focuses primarily on the development of alternatives for testing, the center also works with organizations seeking to implement the 3 R's in research and education. These organizations are throughout the world, primarily in North America, Europe, Australia, and Japan.

CAAT is an academic research center based in the School of Hygiene and Public Health at Johns Hopkins University in Baltimore, whose programs encompass laboratory research, education/information, and validation of alternative methods.

CAAT's primary outreach to scientific and lay audiences its newsletter, which is published three times a year. A newsletter for middle-school students, *CAATALYST*, is published three times a year.

Center for Animals and Public Policy, Tufts University, School of Veterinary Medicine, 200 Westboro Road, N. Grafton, MA 01536 (phone: 508-839-7991; fax: 508-839-2953; e-mail: dpease@opal.tufts.edu).

The center is a unit of Tufts School of Veterinary Medicine that deals with all aspects of human-animal interactions. The center publishes two newsletters (*The Animal Policy Report*, quarterly; *The Alternatives Report*, bimonthly) and other reports and related items, including *The Animal Research Controversy*, a 200-page report that includes an appendix on the animal-protection movement. The center also has established an MS program in animals and public policy, a 1-year program directed at persons with a graduate degree or equivalent life experience.

Foundation for Biomedical Research (FBR), 818 Connecticut Avenue, NW, Suite 303, Washington, DC 20006 (phone: 202-457-0654; fax 202-457-0659; e-mail: nabr-fbr@access.digex.net; URL: http://www.fiesta.com/fbr).

FBR is a nonprofit, educational organization dedicated to promoting public understanding and support of the ethical use of animals in medical research. The Foundation has a wide range of educational materials available for students as well as the general public, including brochures, booklets, videotapes, speaker's kits, posters, and is a source of information on education and training materials related to laboratory animal science. FRB hosts press events and assists members of the media in locating researchers to address issues regarding animal research.

The Humane Society of the United States (HSUS), 2100 L Street, NW, Washington, DC 20037 (phone: 202-452-1100; fax: 301-258-3082; e-mail: HSUSLAB@ix.netcom.com).

HSUS is the nation's largest animal-protection organization. The society is active on a wide variety of humane issues, including those affecting wildlife,

companion animals, and animals in laboratories and on farms. HSUS publishes a quarterly magazine (*The HSUS News*), a newsletter (*The Animal Activist Alert*), and a variety of reports, brochures, and other advocacy materials. The society works actively on issues involving the use of animals in research, safety testing, and education. This work is spearheaded by the HSUS Animal Research Issues Section, with the aid of a Scientific Advisory Council. The aims of this research are to promote the 3 R's of replacement, reduction, and refinement; strong regulations and their enforcement; openness and accountability among research institutions; and an end to egregious mistreatment of animals. HSUS pursues these aims through educational, legislative, legal, and investigative means. Staff are available to give presentations and write articles on these topics.

Institute of Laboratory Animal Resources (ILAR), National Research Council, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418 (phone: 202-334-2590; fax: 202-334-1687; e-mail: ILAR@nas.edu; *ILAR Journal* e-mail: ILARJ@nas.edu; URL: http://www2.nas.edu/ilarhome).

ILAR develops guidelines and disseminates information on the scientific, technologic, and ethical use of animals and related biologic resources in research, testing, and education. ILAR promotes high-quality, humane care of animals and the appropriate use of animals and alternatives. ILAR functions within the mission of the National Academy of Sciences as an adviser to the federal government, the biomedical research community, and the public. *ILAR Journal* is published quarterly and is distributed to scientists, biomedical administrators, medical libraries, and students.

International Council for Laboratory Animal Science (ICLAS), Dr. Steven Pakes, Secretary General, Division of Comparative Medicine, University of Texas Southwestern Medical Center, 5323 Harry Hines Boulevard, Dallas, TX (phone: 214-648-3340; fax: 214-648-2659; e-mail: spakes@mednet.swmed.edu).

ICLAS is an international nongovernment scientific organization that was founded in 1961 under the auspices of UNESCO and several scientific unions. The aims of ICLAS are to promote and coordinate the development of laboratory animal science throughout the world, to promote international collaboration in laboratory animal science, to promote the definition and monitoring of quality laboratory animals, to collect and disseminate information on laboratory animal science, and to promote the humane use of animals in research, testing, and teaching through recognition of ethical principles and scientific responsibilities.

ICLAS has programs addressing microbiologic and genetic monitoring and standardization, assisting developing countries in pursuing their objectives in improving the care and use of laboratory animals, and improving education and training in laboratory animal science. ICLAS accomplishes its goals through

regional scientific meetings, an international scientific meeting held every 4 years, the dissemination of information, and expert consultation with those requesting assistance.

ICLAS membership is composed of national members, scientific union members, scientific members, and associate members. The Governing Board is responsible for implementing the general policy of ICLAS and is elected by the General Assembly every 4 years.

Laboratory Animal Management Association (LAMA), Mr. Paul Schwikert, Past-President. P.O. Box 1744, Silver Spring, MD 20915 (phone: 313-577-1418; fax: 313-577-5890).

LAMA is a nonprofit educational organization. Membership includes individuals and institutions involved in laboratory animal management, medicine, and science. The mission of the association, founded in 1984, is to "enhance the quality of management and care of laboratory animals throughout the world." The objectives of LAMA include promoting the dissemination of ideas, experiences, and knowledge in the management of laboratory animals, encouraging continued education, acting as a spokesperson for the field of laboratory animal management, and assisting in the training of managers. The organization conducts a midyear forum on management issues and topics of interest to the general membership and an annual meeting in conjunction with the American Association of Laboratory Animals Science national meeting. *LAMA Review* is a quarterly journal on management issues published by the organization, and *LAMA Lines* is a bimonthly newsletter on topics of general interest to the membership.

Massachusetts Society for the Prevention of Cruelty to Animals/American Humane Education Society (MSPCA/AHES), 350 South Huntington Avenue, Boston, MA 02130 (phone: 617-522-7400; fax: 617-522-4885).

The Center for Laboratory Animal Welfare at MSPCA/AHES was formed in 1992 to bring thoughtful analysis to the complex issues surrounding the use of animals in research, testing, and education. Its work involves researching issues related to the welfare of laboratory animals, creating educational materials, and developing programs on issues of interest to the public.

Founded in 1868, MSPCA/AHES is one of the largest animal-protection organizations in the world. It operates three animal hospitals, seven animal shelters, and a statewide law-enforcement program in Massachusetts. It is widely recognized for national leadership in humane education, publications, legislative issues, and veterinary medicine.

National Association for Biomedical Research (NABR), 818 Connecticut Avenue, NW, Suite 303, Washington, DC 20006 (phone: 202-857-0540; fax 202-659-1902; e-mail: nabr-fbr@access.digex.net; URL: http://www.fiesta.com/nabr).

NABR is a nonprofit organization of 350 institutional members from both academia and industry whose mission is to advocate public policy that recognizes the vital role of laboratory animals in research, education, and safety testing. NABR is a source of information concerning existing and proposed animal welfare legislation and regulations at the national, state, and local level.

Office for Protection from Research Risks (OPRR), National Institutes of Health, 6100 Executive Blvd., Suite 3B01, Rockville, MD 20892 (phone: 301-496-7163; fax: 301-402-2803).

The Division of Animal Welfare of OPRR fulfills responsibilities set forth in the Public Health Service (PHS) Act. These include developing and monitoring, as well as exercising compliance oversight relative to, the PHS Policy on Humane Care and Use of Laboratory Animals (Policy), which applies to animals involved in research conducted or supported by any component of PHS; establishing criteria for and negotiation of assurances of compliance with institutions engaged in PHS-conducted or PHS-supported research using animals; directing the development and implementation of educational and instructional programs with respect to the use of animals in research; and evaluating the effectiveness of PHS policies and programs for the humane care and use of laboratory animals.

Primate Information Center, Regional Primate Research Center SJ-50, University of Washington, Seattle, WA 98195 (phone: 206-543-4376; fax: 206-865-0305).

The Primate Information Center's goal is to provide bibliographic access to all scientific literature on nonhuman primates for the research and educational communities. Coverage spans all publication categories (articles, books, abstracts, technical reports, dissertations, book chapters, etc.) and many subjects (behavior, colony management, ecology, reproduction, field studies, disease models, veterinary science, pharmacology, physiology, evolution, taxonomy, genetics, zoogeography, etc.). A comprehensive computerized database is maintained and used to publish a variety of bibliographic products to fulfill this mission. The collection of materials on primate research is fairly comprehensive. However, the center is an indexing service and not a library, so materials generally do not circulate. It will make individually negotiated exceptions for items that researchers are not able to acquire otherwise.

Primate Supply Information Clearinghouse (PSIC), Cathy A. Johnson-Delany, Director, Regional Primate Research Center, SJ-50 University of Washington, Seattle, WA 98195 (phone: 206-543-5178; fax: 206-685-0305; e-mail: cathydj@bart.rprc.washington.edu).

The goal of PSIC is to provide communication between research institutions, zoologic parks, and domestic breeding colonies for the efficient sharing of non-human primates and their tissues, equipment, and services. PSIC also publishes *New Listings* and the *Annual Resource Guide*.

Purina Mills, Inc., 505 North 4th and D Street, Richmond, IN 47374.

Purina Mills, Inc. offers a correspondence course, called Laboratory Animal Care Course, for everyone working with small animals. The course includes the following six lessons: introduction to laboratory animals; management of laboratory animals; housing, equipment, and handling; disease and control; glossary; and housing supplements and miscellaneous.

Scientists Center for Animal Welfare (SCAW), 7833 Walker Drive, Suite 340, Greenbelt, MD 20770 (phone: 301-345-3500; fax: 301-345-3503).

SCAW is an independent organization supported by individuals and institutions involved in research with animals and concerned about maintaining the highest standards of humane care. SCAW publishes resource materials, organizes conferences, and supports a wide variety of educational activities.

Universities Federation for Animal Welfare (UFAW), 8 Hamilton Close, South Mimms, Potters Bar, Herts EN6 3QD, United Kingdom (phone: 44-707-58202; fax: 44-707-49279).

UFAW was founded in 1926 as the University of London Animal Welfare Society (ULAWS). Its work expanded, and in order to allow a wider membership, UFAW was formed in 1938 with ULAWS as its first branch. UFAW publishes the *UFAW Handbook on the Care and Management of Laboratory Animals* and other publications.

United States Department of Agriculture, Animal and Plant Health Inspection Service, Regulatory Enforcement of Animal Care (REAC), 4700 River Road, Unit 84, Riverdale, MD 20737-1234 (phone: 301-734-4981; fax: 301-734-4328; e-mail: sstith@aphis.usda.gov).

The missions of the Animal Care Program are to provide leadership in establishing acceptable standards of humane animal care and treatment and to monitor

and achieve compliance through inspections and educational and cooperative efforts. Copies of the Animal Welfare Regulations and the Animal Welfare Act are available from REAC.

Wisconsin Regional Primate Research Center (WRPRC) Library, University of Wisconsin, 1220 Capitol Court, Madison, WI 53715-1299 (phone: 608-263-3512; fax: 608-263-4031; e-mail: library@primate.wisc.edu; URL: http://www.primate.wisc.edu/WRPRC).

The library supports research programs of WRPRC and aids in the dissemination of information about nonhuman primates to the scientific community. Books, periodicals, newsletters, and other documents in all languages related to primatology are included. Special collections include rare books and audiovisual materials.

APPENDIX C
Some Federal Laws Relevant to Animal Care and Use

ANIMAL WELFARE

The Animal Welfare Act of 1966 (P.L. 89-544)—as amended by the Animal Welfare Act of 1970 (P.L. 91-579); 1976 Amendments to the Animal Welfare Act (P.L. 94-279); the Food Security Act of 1985 (P.L 99-198), Subtitle F (Animal Welfare File Name: PL99198); and the Food and Agriculture Conservation and Trade Act of 1990 (P.L. 101-624), Section 2503, Protection of Pets (File Name: PL101624)—contains provisions to prevent the sale or use of animals that have been stolen, to prohibit animal-fighting ventures, and to ensure that animals used in research, for exhibition, or as pets receive humane care and treatment. The law provides for regulating the transport, purchase, sale, housing, care, handling, and treatment of such animals.

Regulatory authority under the Animal Welfare Act is vested in the secretary of the U.S. Department of Agriculture (USDA) and implemented by USDA's Animal and Plant Health Inspection Service (APHIS). Rules and regulations pertaining to implementation are published in the Code of Federal Regulations, Title 9 (Animals and Animal Products), Chapter 1, Subchapter A (Animal Welfare). Available from: Regulatory Enforcement and Animal Care, APHIS, USDA, Unit 85, 4700 River Road, Riverdale, MD 20737-1234. File Name 9CFR93.

ENDANGERED SPECIES

The Endangered Species Act of 1973 (P.L. 93-205; 87 Statute 884) became effective on December 28, 1973, supplanting the Endangered Species Conserva-

tion Act of 1969 (P.L. 91-135; 83 Statute 275). The new law seeks "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conservation of wild flora and fauna worldwide."

Regulatory authority under the Endangered Species Act is vested in the secretary of the U.S. Department of the Interior (USDI) and implemented by USDI's Fish and Wildlife Service. Implementing rules and regulations are published in the Code of Federal Regulations, Title 50 (Wildlife and Fisheries), Chapter 1 (U.S. Fish and Wildlife Service, Department of the Interior), Subchapter B, Part 17 (Endangered and Threatened Wildlife and Plants). Copies of the regulations, including a list of species currently considered endangered or threatened, can be obtained by writing to the Office of Endangered Species, U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC 20240.

APPENDIX

D

Public Health Service Policy and Government Principles Regarding the Care and Use of Animals

PUBLIC HEALTH SERVICE POLICY ON HUMANE CARE AND USE OF LABORATORY ANIMALS

The *Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals* was updated in 1996. In the policy statement, the PHS endorses the *U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training* (reprinted below), which were developed by the Interagency Research Animal Committee. The PHS policy implements and supplements these principles. Information concerning the policy can be obtained from the Office for Protection from Research Risks, National Institutes of Health, 6100 Executive Boulevard, MSC 7507, Rockville, MD 20892-7507.

PRINCIPLES FOR THE CARE AND USE OF ANIMALS USED IN TESTING, RESEARCH, AND TRAINING

The principles below were prepared by the Interagency Research Animal Committee. This committee, which was established in 1983, serves as a focal point for federal agencies' discussions of issues involving all animal species needed for biomedical research and testing. The committee's principal concerns are the conservation, use, care, and welfare of research animals. Its responsibilities include information exchange, program coordination, and contributions to policy development.

U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training

The development of knowledge necessary for the improvement of the health and well-being of humans as well as other animals requires *in vivo* experimentation with a wide variety of animal species. Whenever U.S. Government agencies develop requirements for testing, research, or training procedures involving the use of vertebrate animals, the following principles shall be considered; and whenever these agencies actually perform or sponsor such procedures, the responsible Institutional Official shall ensure that these principles are adhered to:

I. The transportation, care, and use of animals should be in accordance with the Animal Welfare Act (7 U.S.C. 2131 et seq.) and other applicable Federal laws, guidelines, and policies.[1]

II. Procedures involving animals should be designed and performed with due consideration of their relevance to human or animal health, the advancement of knowledge, or the good of society.

III. The animals selected for a procedure should be of an appropriate species and quality and the minimum number required to obtain valid results. Methods such as mathematical models, computer simulation, and *in vitro* biological systems should be considered.

IV. Proper use of animals, including the avoidance or minimization of discomfort, distress, and pain when consistent with sound scientific practices, is imperative. Unless the contrary is established, investigators should consider that procedures that cause pain or distress in human beings may cause pain or distress in other animals.

V. Procedures with animals that may cause more than momentary or slight pain or distress should be performed with appropriate sedation, analgesia, or anesthesia. Surgical or other painful procedures should not be performed on unanesthetized animals paralyzed by chemical agents.

VI. Animals that would otherwise suffer severe or chronic pain or distress that cannot be relieved should be painlessly killed at the end of the procedure or, if appropriate, during the procedure.

VII. The living conditions of animals should be appropriate for their species and contribute to their health and comfort. Normally, the housing, feeding, and care of all animals used for biomedical purposes must be directed by a veterinarian or other scientist trained and experienced in the proper care, handling, and use of the species being maintained or studied. In any case, veterinary care shall be provided as indicated.

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[1]For guidance throughout these Principles, the reader is referred to the *Guide for the Care and Use of Laboratory Animals* prepared by the Institute of Laboratory Animals Resources, National Academy of Sciences.

VIII. Investigators and other personnel shall be appropriately qualified and experienced for conducting procedures on living animals. Adequate arrangements shall be made for their in-service training, including the proper and humane care and use of laboratory animals.

IX. Where exceptions are required in relation to the provisions of these Principles, the decisions should not rest with the investigators directly concerned but should be made, with due regard to Principle II, by an appropriate review group such as an institutional animal care and use committee. Such exceptions should not be made solely for the purposes of teaching or demonstration.

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Related Publications

The following publications are available from the National Academy Press, 2101 Constitution Avenue, NW, Lockbox 285, Washington, DC 20055 (phone toll-free 1-800-624-6242 or call 202-334-3313 in the Washington metropolitan area). You may also order electronically via Internet at http://www.nap.edu. Additional related publications, including the quarterly *ILAR Journal* and *Principles and Guidelines for the Use of Animals in Precollege Education*, are available directly from the Institute of Laboratory Animal Resources (phone: 202-334-2590; fax: 202-334-1687; email: ILAR@nas.edu; URL: http://www2.nas.edu/ilarhome/).

Occupational Health and Safety in the Care and Use of Research Animals. Forthcoming

Psychological Well-Being of Nonhuman Primates. Forthcoming

Rodents: Laboratory Animal Management Series. Forthcoming

Nutrient Requirements of Laboratory Animals, Fourth Revised Edition. 1995

Dogs: Laboratory Animal Management Series. 1994

Nutrient Requirements of Poultry, Ninth Revised Edition. 1994

Nutrient Requirements of Fish. 1993

Recognition and Alleviation of Pain and Distress in Laboratory Animals. 1992

Education and Training in the Care and Use of Laboratory Animals: A Guide for Developing Institutional Programs. 1991

Infectious Diseases of Mice and Rats. 1991

Companion Guide to Infectious Diseases of Mice and Rats. 1991
Immunodeficient Rodents: A Guide to Their Immunobiology, Husbandry, and Use. 1989
Nutrient Requirements of Swine, Ninth Revised Edition. 1988
Use of Laboratory Animals in Biomedical and Behavioral Research. 1988
Vitamin Tolerances of Animals. 1987
Nutrient Requirements of Cats, Revised Edition. 1986
Nutrient Requirements of Dogs. 1985
Nutrient Requirements of Sheep, Sixth Revised Edition. 1985
Nutrient Requirements of Goats. 1981
Mineral Tolerances of Domestic Animals. 1980
Nutrient Requirements of Nonhuman Primates. 1978
Nutrient Requirements of Rabbits. 1977

GUIDE FOR THE CARE AND USE OF LABORATORY ANIMALS
1996(第七版) 實驗動物飼養管理及使用規範

譯：張維正、黃士軒
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