Animal Welfare Information Center

Newsletter

Winter 1995/1996
Vol. 6, No. 2-4
ISSN: 1050-561X

Congress In Session

by Cynthia Smith

- **H.R. 2179 To amend the Marine Mammal Protection Act of 1972 to support the International Dolphin Conservation Program in the eastern tropical Pacific Ocean, and for other purposes.**

Introduced August 3, 1995, by Randy Cunningham (R-CA) and referred to the Committee on Resources. This Act may be cited as the "International Dolphin Conservation Act Amendments of 1995."

The purposes of this act are the following: to ensure a viable and ecologically sound tuna fishery in the eastern tropical Pacific Ocean, including avoidance of bycatch of nontargeted marine species, maintenance of healthy stocks of tuna, and protection of marine mammal populations; to otherwise strengthen and improve international efforts to reduce incidental dolphin mortality to insignificant levels approaching a zero mortality and serious injury rate as required by

(cont'd p.17)

ALSO IN THIS ISSUE...

Laboratory Animals in Space Life Sciences Research

by

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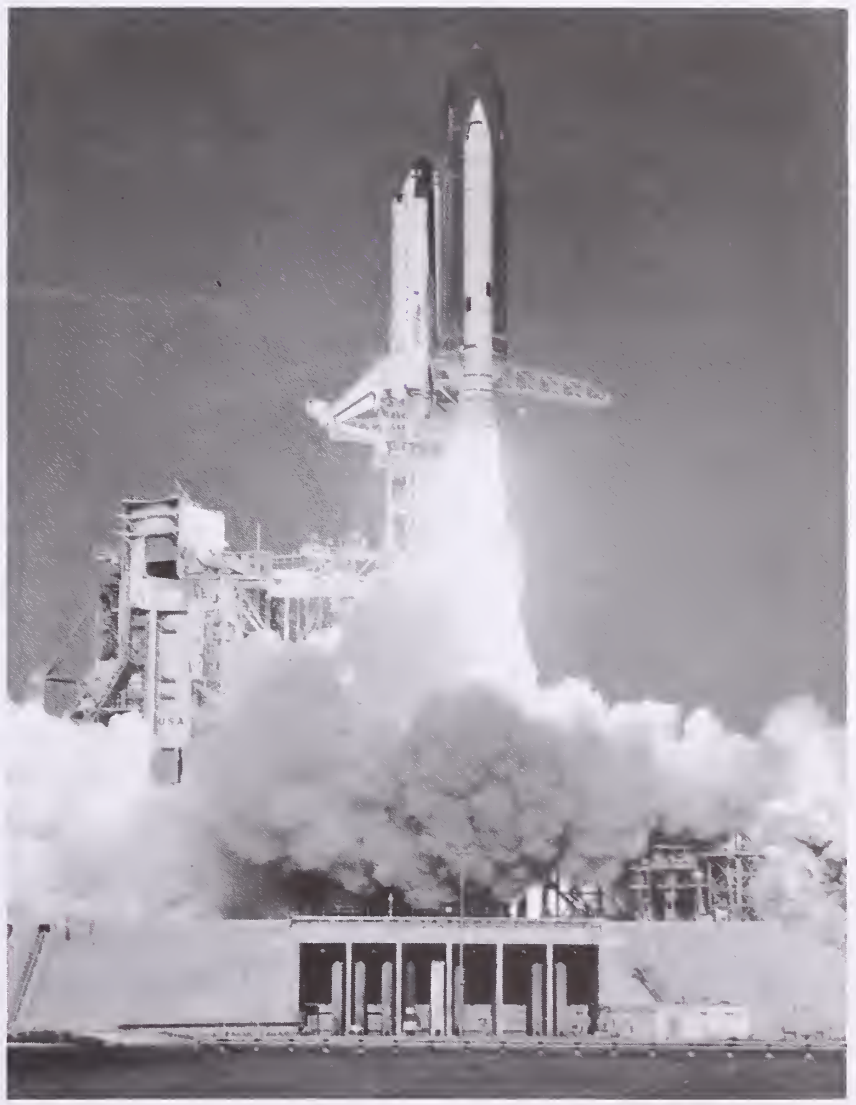
Abstract

Animals have been invaluable in space life sciences research and have contributed greatly to the current database of knowledge in this field. This article presents an overview of the historical involvement of animals, describes the hardware and logistics of flying animal payloads on the space shuttle orbiters, and discusses future plans for animal experiments in space.

Introduction

Since the beginning of modern space exploration, animals have accompanied and sometimes preceded humans as space travelers. Extensive animal experimentation was used in both the United States and Soviet/Russian space programs to collect the medical knowledge and develop and test the engineering design concepts that would be required to support human space exploration. Initially, animals were used as surrogates to test the suitability of the space environ-



(Photo courtesy of NASA)

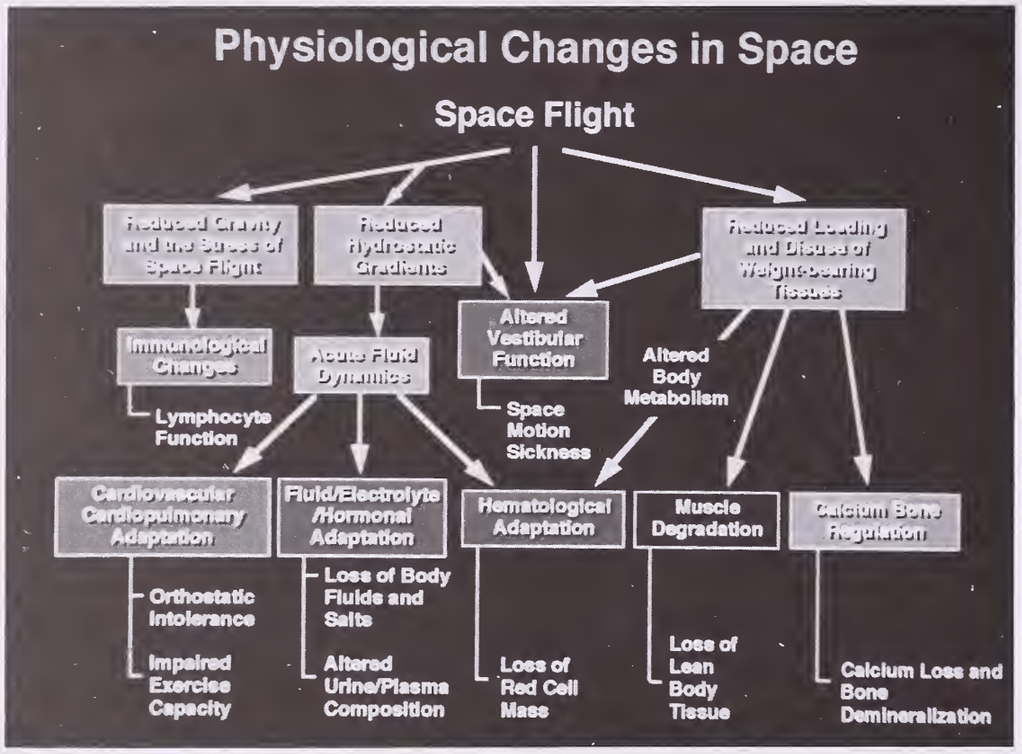


Figure 1. Physiological Changes Due to Exposure to Microgravity

ment for human habitation. Once it was determined that complex biological organisms could live in space, humans ventured into space, and took animals along as experimental subjects. This situation continues today aboard the space shuttle orbiters, as well as on Russian spacecraft (4,12).

Space exploration has advanced significantly over the last five decades and animals continue to be used in microgravity[1] investigations. Bjurstedt has recently reviewed some of the adaptive cardiovascular, musculoskeletal, and neurovestibular changes that have been attributed to microgravity exposure (fig. 1) (6). A primary focus of ongoing animal investigations is to determine how gravitational inputs modulate the complex regulatory mechanisms that may be involved in Earth-based diseases such as anemia, osteoporosis, muscular atrophy, and immune system dysfunction (11,15,16). Many of these experiments use rodent payloads that are transported into space aboard the space shuttle. In this report we will briefly survey some of the pivotal animal studies that made human space flight possible and then focus on the flight hardware that is currently used for microgravity animal investigations aboard the space shuttle.

Laboratory Animals Demonstrate That Living Organisms Can Survive in Space

The preliminary physiological and biological testing for aerospace research occurred at the Physiological Research Laboratory at Wright Field in Dayton, Ohio. From 1935 to 1948, Dr. Harry G. Armstrong used animals and humans in ground-based altitude and acceleration experiments. Based on these pioneering studies, the first suborbital rocket-powered animal flight occurred in June of 1948 when an anesthetized rhesus macaque *(Macaca mulatta)* named Albert was launched aboard a V2 rocket at White Sands, New Mexico. There were three additional V2 rocket flights in 1949 and 1950 involving rhesus and cynomolgus *(Macaca nemestrina)*, but none of the animal payloads were recovered alive because of mechanical failures (2,8).

In 1951 and 1952, three Aerobee rocket flights took place, with mice and nonhuman primates as test subjects. The animals on the third flight flew to an altitude of 64.5 km at a speed of 3,200 kph and were exposed to microgravity for 2 minutes. They were successfully recovered and were appropriately deemed "the first living creatures to survive the test program (2,7,8)."

The next significant involvement of laboratory animals in aerospace research occurred during the "space race" of the late 1950's. Sputnik II, a Soviet (bio)satellite launched in November of 1957, carried a dog *(Canis familiaris)* named Laika, and Sputnik III, IV, and V carried mice, rats and dogs. In the United States in 1958, three separate mouse payloads were flown in the nose cone of Thor-Able rockets. Physiological telemetry data were obtained from the animals during their 20-minute exposure to microgravity. The Bioflight series of 1958-59 contained a squirrel monkey *(Saimiri sciureus)* named Old Reliable (Bioflight 1), and a rhesus monkey (Abel) and a squirrel monkey (Baker) on Bioflight 2. The Bioflight 1 experiment collected telemetry data on physiological parameters, and the Bioflight 2 payload was successfully recovered. Later in 1959 and 1960, two rhesus monkeys named Sam and Miss Sam were separately launched to an altitude of 84 km and performance data were collected as the animals were exposed to microgravity. The equipment that would be used on the manned Mercury flights was successfully tested on these missions. In 1961, before Alan Shepard's historic ballistic space flight (May 5, 1961), a chimpanzee *(Pan troglodytes)* named Ham was launched into space in a Mercury capsule that achieved an altitude of 250 km and a range of 662 km. He was monitored with telemetry equipment and performed discrete and continuous avoidance tasks during the flight. Another chimp (Enos) also spent 3 hours in a microgravity environment before John Glenn's orbital flight (February 20, 1962). Once these critical flights were successfully completed and recovered, there was confidence that humans could live and work in space (2,7,17).

During the Apollo era (1960-72), most of the missions did not include animal payloads, as it had already been shown that animals could survive in space. The last lunar mission (Apollo 17) did, however, include the BIOCORE Pocket Mouse Radiation Experiments to study exposure to cosmic particle radiation hazards. Five pocket mice *(Perognathus longimembris)* were housed in self-sustaining, hermetically sealed, cylindrical aluminum canisters. Richard Simmonds, D.V.M., was instrumental in coordinating this experiment and was

involved with the postflight analysis as well. NASA also launched three Biosatellites during the Apollo years, and Biosatellite #3 carried a rhesus monkey (Bonnie) in orbit for 8 days (2,5).

Skylab, the first U.S. orbiting space station, was launched in May 1973 and orbited the Earth until July 1979, when it re-entered the Earth's atmosphere and crashed in western Australia. The Skylab-3 mission, launched on July 28, 1973, used six pocket mice to study circadian rhythms during spaceflight. These mice were housed in individual circular cages and instrumented for telemetry data collection, but a power failure 30 hours into the mission resulted in loss of the experiment (2,5).

This brief historic overview only summarizes the seminal flight experiments in which animals have been used to significantly advance our understanding of gravitational physiology. A detailed and comprehensive chronological review of numerous experiments that have contributed to our current understanding of aeronautical and aerospace medicine can be obtained in other reports (2,5,7,8). It is also important to note that microgravity investigations involving plant and animal tissues have contributed significantly to our current understanding of gravitational biology (9).

Space Shuttle Provides a More Suitable Environment for Animal Research

In 1981, NASA began using the Space Transportation System (STS) to carry payloads and astronauts into space. The space shuttle orbiter is the flight vehicle for this system, that during launch also includes an external fuel tank and a pair of solid-rocket boosters (SRBs). Other components of the STS include the ground facilities where the shuttle is prepared for flight and tracked and monitored during each mission. There are currently four space shuttle orbiters in operation. On April 12, 1981, Columbia was the first orbiter to be launched from Kennedy Space Center. Challenger, Discovery, and Atlantis were subsequently added to the fleet between 1983 and 1985. Endeavour, the newest orbiter, replaced Challenger, which exploded shortly after launch on January 28, 1986 (1,2,18). The diversity of animal payloads that have flown aboard the space shuttle is summarized in figure 2.

All of the animal experiments that have flown aboard the space shuttle have either been housed in the middeck area, or within a laboratory research module specifically configured for the cargo bay. The orbiter middeck is the housing option most frequently used for rodent experiments (fig. 2). The middeck contains 42 lockers for experiments and payloads. When rodent experiments are scheduled for launch aboard the shuttle, one to three lockers are configured with animal enclosure modules (AEMs) (figs. 3-4). The AEM was originally developed by General Dynamics Company for the Student Shuttle Flight Program and is managed by the NASA Ames Research Center (ARC) in Moffett Field, California. The AEMs are currently being tested and modified to support future microgravity investigations with mice. The AEM is a small, portable, self-contained, animal holding facility that is designed to fit within a single middeck locker. It can be integrated into the middeck 12-18 hours before launch and recovered within 3-6 hours after the orbiter lands, thereby providing great versatility for the investigator. Each AEM contains sufficient food (rodent food bars) for the duration of the mission as well as an onboard water supply that can be periodically replenished on orbit. Approximately 18 hours before launch, the animals are transferred to an AEM, transported to the launch pad and loaded into a middeck locker. Five to eight rats are normally housed in each AEM, but the absolute number depends on the strain and weight of the animal, as well as the duration of the mission. Longer duration missions require larger food reserves and smaller animal payloads to meet the middeck locker safety weight constraints (5,7).

The AEM can be thought of as a miniature laboratory animal facility in the sense that it contains all of the components that are required for maintenance of the animals during a mission. Daily health checks can be accommodated during flights by opening the locker cover and pulling the AEM from its stowage position within the locker. A transparent plastic cover on the surface of the animal chamber enables the astronauts to observe the animals at any time during the mission. Food and water consumption can be monitored, and the water reservoir bags can be refilled during the

STS#	EXPERIMENT	ORBITER	DATES	ANIMAL PAYLOAD
8	SSIP-8	Challenger	August 30-September 5, 1983	6 Lewis rats in AEM
10/41-B	SSIP-10	Challenger	February 3-February 11, 1984	6 Lewis rats in AEM
17/51-B	SL3	Challenger	April 29-May 6, 1985	2 Squirrel monkeys & 24 SD rats in RAHF
29	SSIP-3/SE82-8	Discovery	March 13-March 18, 1989	4 Long Evans rats in AEM
41	PSE-01	Discovery	October 6-October 10, 1990	16 SD rats in AEM
40	SLS-1	Columbia	June 5-June 14, 1991	29 SD rats in RAHF & AEM
48	PARE-01	Discovery	September 12-September 18, 1991	8 SD rats in AEM
47	SL-J	Endeavour	September 12-September 20, 1992	4 S. African Clawed frogs in FEU & 2 Koifish (Carp) in Japanese hardware
52	PSE-02	Columbia	October 22-November 1, 1992	12 SD rats in AEM
54	PARE-02	Endeavour	January 13-January 19, 1993	6 SD rats in AEM
56	PARE-03	Discovery	April 8-April 17, 1993	16 SD rats in AEM
57	PSE03	Endeavour	June 21-July 1, 1993	12 F344 rats in AEM
58	SLS-2	Columbia	October 18-November 1, 1993	48 SD rats in RAHF
60	IMMUNE-01	Discovery	February 3-February 11, 1994	12 CD rats in AEM
62	PSE04	Columbia	March 4-March 18, 1994	12 F344 rats in AEM
66	NIHR-01	Atlantis	November 3-November 14, 1994	10 pregnant SD rats in AEM
63	IMMUNE-02	Discovery	February 3-February 11, 1995	12 SD rats in AEM
(70)	NIHR-02	Discovery	July 13-July 22, 1995	10 pregnant SD rats in AEM
(72)	NIHR-03	Endeavour	January 11- January 20, 1995	6 lactating SD rats and neonates in AEM

Figure 2. Vertebrate Animal Payload Summary for Space Shuttle Orbiters

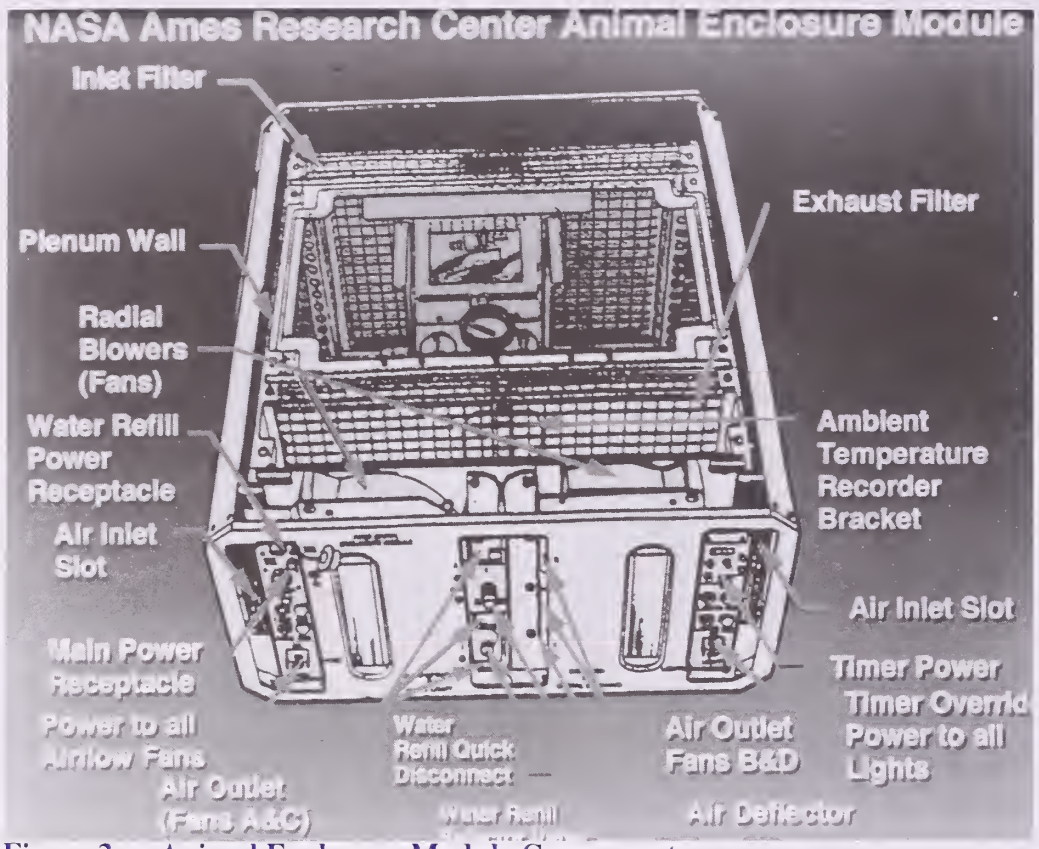


Figure 3. Animal Enclosure Module Components

flight as required. Although the animals can be easily visualized, the AEMs are tightly sealed, and the animals are not accessible for manipulation or treatment (3,7).The animal cage portion of the AEM consists of a removable rectangular stainless steel mesh screen (24 X 36 X 22 cm). A portion of this cage volume is occupied by a waterbox that can hold up to 1.5 liters of water to supply the AEM lixits. Bonting et al., have recently compared the AEM to the environment recommended in the 1985 NIH Guide to the Care and Use of Laboratory Animals (7). The AEM meets most of the NIH guidelines, except for a somewhat increased housing density and an increased ambient temperature. In launchpad orientation, available floor space is about 710 cm^2, with about 14,750 cm^3 of habitable space on orbit. Temperatures within the AEM routinely average about 30°C and run 3-5°C warmer than ambient middeck temperatures in the orbiter. The AEM's do not have active thermal control, therefore the temperature within the habitat depends totally on the middeck cabin temperature. A battery-powered internal temperature recorder is used to log the temperatures within the AEM so that a detailed temperature record can be reconstructed postflight. There are four internal lamps, two of which are used during the day period of the 12-hour light:12-hour dark cycle, and two backup lights. The lamps provide an illumination of approximately 14 lux at the center of the animal cage. The lighting timer has a battery-powered clock that is independent of the orbiter power supply to ensure consistent light cycles. Air circulation is accomplished by four fans that pull cabin air to the back of the cage and through a high efficiency particulate air (HEPA)/charcoal filter and into the animal quarters. After the air passes through the cage, it traverses a second filter where all particulate matter and odors are removed before the air is returned to the orbiter cabin. A continuous airflow of about 15-20 cubic feet per minute is achieved with this system. A 28-volt DC orbiter power supply is used to power the various electrical components within the AEM after integration into the middeck locker. During transit to and from the orbiter, the AEM is connected to an external battery pack (7,13).

The Spacelab module was developed and built by the European Space Agency (ESA) and is mounted in the orbiter cargo bay when it is flown. This unique international laboratory facility converts into an on-orbit research center that can provide additional animal space for rodents and nonhuman primates. The Research Animal Holding Facility (RAHF), when placed into a standard Spacelab double rack, provides housing space for up to 24 rats (350 g) or four 1-kg squirrel monkeys (figs. 5-7). The RAHF provides environmental control, food, water, illumination, and waste management control for the animals. In contrast to the animals housed within the AEM, the animal cages can be removed from the RAHF and transported to the General Purpose Work Station (GPWS). The

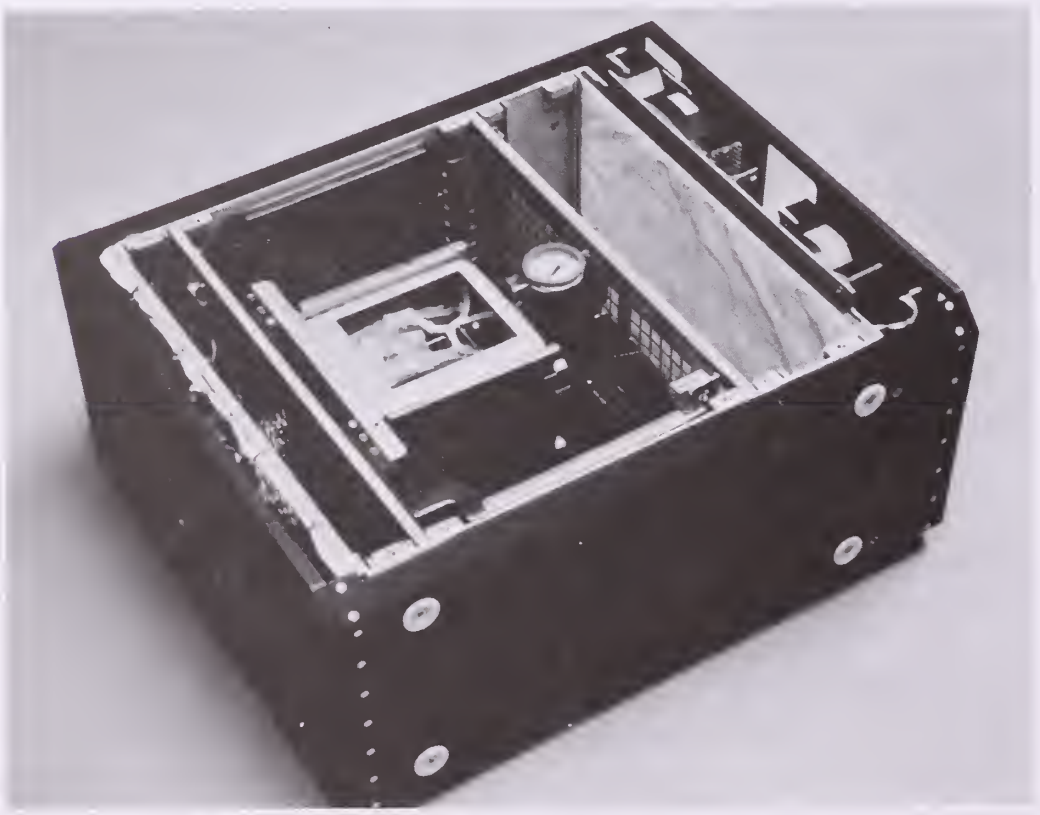


Figure 4. Animal Enclosure Module

GPWS is a laminar flow workbeneh that has glove ports for two astronauts to simultaneously work in the unit. Inside the GPWS the animal cages ean be opened and the animals ean be removed for tissue or fluid sample eolleetion, the administration of specifie treatments, or euthanasia and tissue eollection (3,5,7).

The animals are transported and loaded into the RAHF 36 hours prior to launeh. To aceomplish transfer of the animals from the middeek entry portal to the Spaeelab, a Module Vertical Aeeess Kit (MVAK) is used. The MVAK uses a system of ropes and pulleys to lower the teehnieians from the middeek entranee portal through the orbiter airloek and tunnel adapter and into the Spaeelab module while the orbiter is in the vertieal position on the launehpad. The eage assemblies eontaining the experimental animals are then transferred into the Spaeelab module and loaded into the RAHF. Individual RAHF rodent eage assemblies are designed to house two rats. Eaeh eage provides a habitat spaee of 10.8 X 10.8 X 26 em, uses rodent food bars as a nutrient souree, and eontains two water lixits. The RAHF water supply, food cassettes and detaehable rodent waste management tray assemblies ean all be ehanged out and replenished on orbit (2,3).

The primate housing units are also designed to interfaee with the RAHF eontrol module. A door on the front of the cages permits limited aceess to the animals. Each eage is equipped with an emergeney restraint meehanism that enables the astronauts to restrain the animals in-flight. Beeause of the limited number of primates that ean be aecommodated within the RAHF and the resulting effeet this factor has on experimental designs, the primate eage modules have to date been used only for the Spacelab-3 mission (STS-51B, April 1985), and there are no eurrent plans to use primates again on any projeeted shuttle mission through the turn of the eentury (2).

The AEM and RAHF arc the only flight-certified hardware that ean be eurrently used for warm-blooded vertebrate animal expcrimentation aboard the orbiter. Due to thc size and unique requirements of the hardware, all animal experiments are flown either in the middeek area of the orbiter (AEM) or in the Spaeelab module (RAHF). Upgrades to the AEM under eonsideration inelude on-orbit food replenishment eapability and eonnee-tion of temperature monitors within thc AEM eage to the orbiter data system, to permit realtime downlink[2] of in-eage temperatures. The Flight Payloads Offiee of the Life Sciences Division at NASA Ames Research Center (ARC) is eurrently designing the Advaneed Animal Habitat (AAH), whieh is scheduled to replace the AEM in 1998. The AAH environment will have active heat rejeetion and will maintain temperatures in the 22°C-28°C range. Other eapabilities in the AAH include on-orbit food and water replenishment, on-orbit animal access, built-in video monitoring capability, and realtime data downlink eapability.

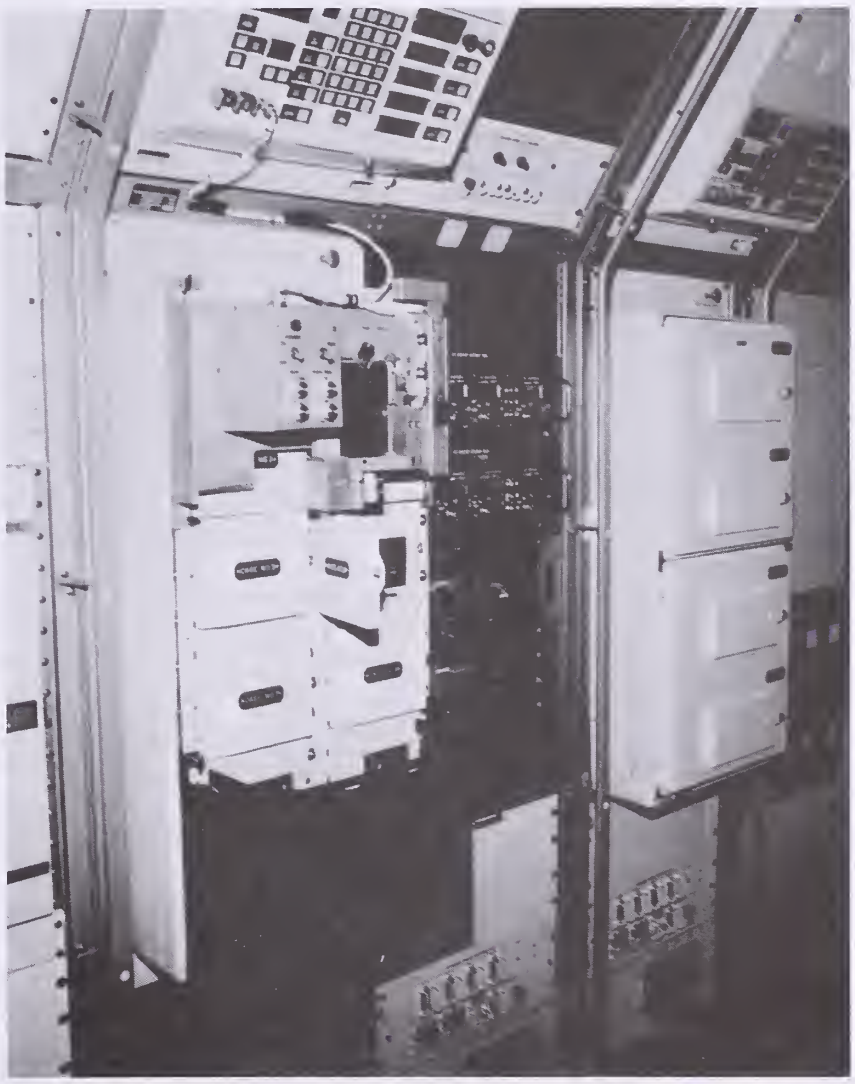


Figure 5. Research Animal Holding Facility in Spacelab Module

Thc SLSPO (Space Lifc Sciences Payload Office) foodbar diet was developed over the last 15 years at ARC in support of rodent spaceflight experimentation. It is composcd of a dry rodent diet (NASA Experimental Rodent Diet #93062) prcpared by Harlan Teklad (Madison, WI), supplemented with minerals and vitamins, and then formed and extruded into bars with a final water content of about 26 percent. Thc foodbars are then vacuum-sealed in plastic and radiation-sterilized. Thc foodbars havc been sucecssfully used with rats and are currently bcing cvaluatcd for usc with mice.

Ground Control Flight Simulation And Animal Monitoring

The loeation of the animals aboard the orbiter dctermines the type and dcgree of monitoring and interaction that can oeeur between thc mission spccialists and thc animals. Animals that are housed in the middeck lockers are not aeeessible to the shuttle erew beeause the AEMs are seeurely sealed after the animals are loaded into the cages. Daily observations by the mission specialists are limited to opening the locker door, sliding out the AEM, and observing the animals through the transparent cover. These observations are reeorded in log books and also downlinked to the payload seientists for cvaluation. Animal health and aetivity, food and water supplies are monitorcd during the flight, and the water reservoir is refilled as neeessary.

Since October 1992, middeck temperaturc, humidity, and gas pressure data have been downlinked to the Life Seienccs Support Facilities (LSSF) at Kennedy Space Center (KSC). The data are colleeted and used to control the Orbital Environmental Simulator (OES) wherc the ground eontrol AEMs are housed. Beeause of the time delays assoeiated with the downlink of orbiter data, the ground eontrol animals are proeessed and handled in a manner identical to the flight animals

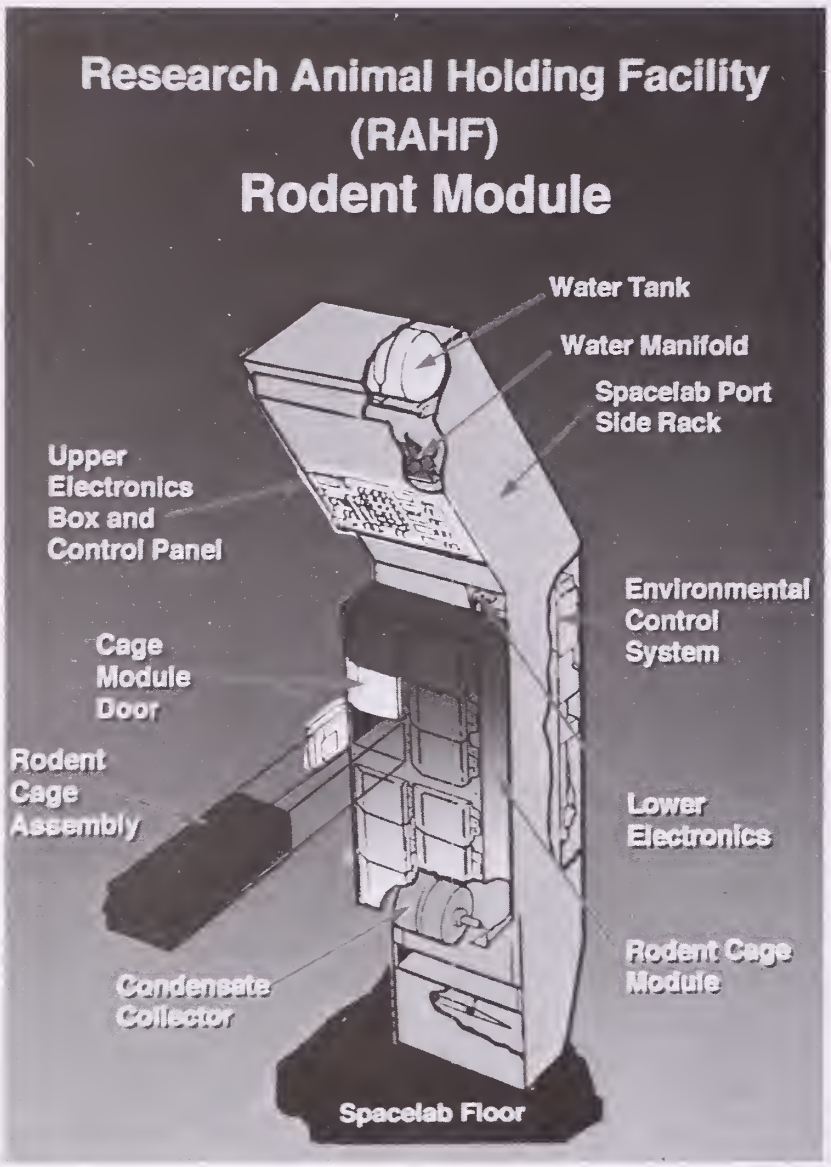


Figure 6. Rodent Housing Unit for Spacelab

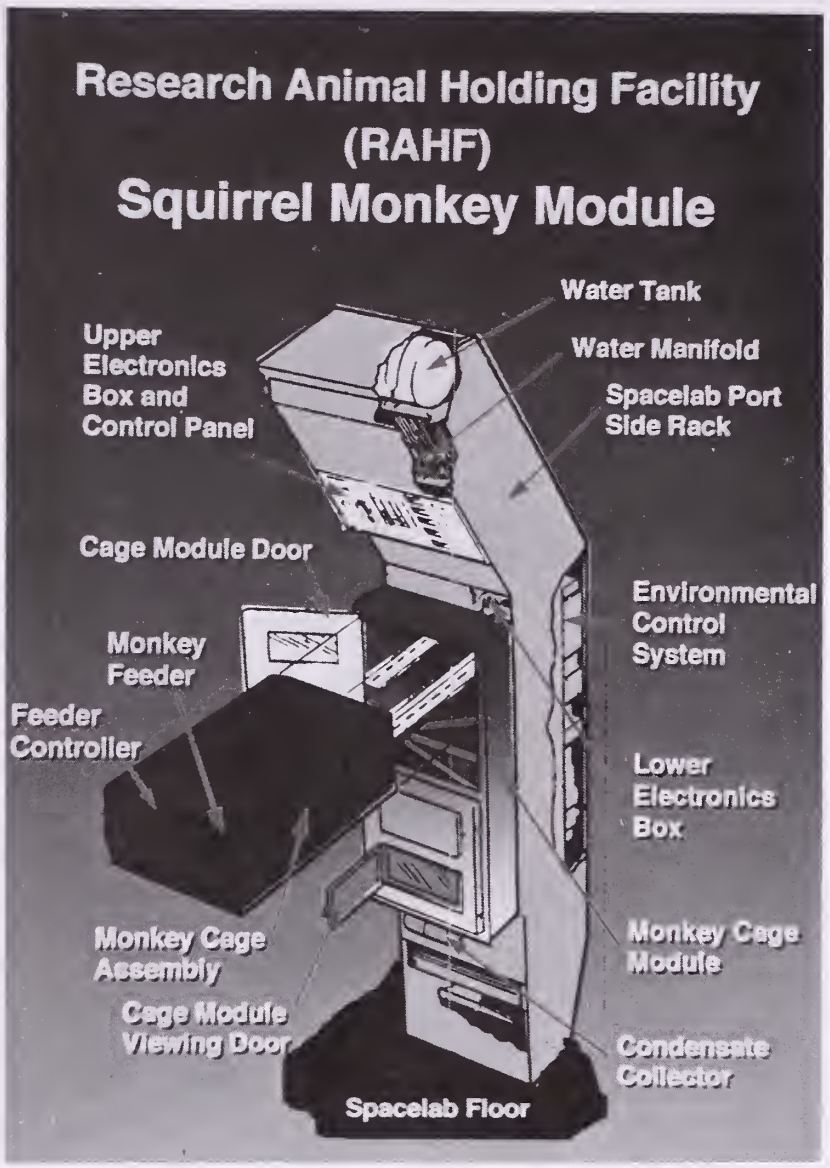


Figure 7. Squirrel Monkey Housing Unit for Spacelab

on a 24- or 48-hour time-delay basis. Using the downlink data, the OES is automatically controlled by a system of computers to emulate the middeck environment (temperature, CO_2 fraction, relative humidity) aboard the orbiter. The OES is not capable of mimicking the pressure and gas composition changes that occur if there is extravehicular activity (EVA) during the mission.

The ability to manipulate animals housed in cages in the RAHF is a significant advantage for the experimenter. However, until the Space Life Sciences-2 (SLS-2) mission (STS-58, October 1993), this important experimental intervention had not been exploited. Since the RAHF hardware provides more sensitive environmental control and monitoring capabilities, ground control studies can be performed with greater fidelity than is currently possible with the AEM.

Although current procedures with the ground control animals can simulate most orbiter low earth orbit environmental parameters except microgravity and radiation exposure, there are currently no facilities at KSC to mimic the noise (up to 120dB) and the g-forces of launch (3g) and landing (2g). There have been no reported or observed detrimental health effects in the animals as a result of exposure to these stressors, but this dissimilarity between the ground controls and the flight animals must be considered for experimental planning.

The primary landing site for the orbiters is the landing strip at KSC, with NASA's Dryden Flight Research Center at Edwards Air Force Base (near Mojave, California) serving as the alternate site (1). If landing occurs at KSC, animals are removed from the orbiter within 3-6 hours, transported to the LSSF, examined, and handled according to experimental protocols. If bad weather at KSC or technical problems force a Dryden landing, a backup scientific team receives and examines the animals. At that time, several options are available: (1) fly the primary science team from Florida to California to perform postflight procedures, (2) have a full science team in California perform postflight procedures on the flight animals, while the KSC science team performs postflight procedures on control animals in Florida, (3) fly the flight animals from California to Florida for postflight analysis in Florida, (4) fly the control animals from Florida to California for postflight analysis in California, or (5) fly the flight animals from California and the ground control animals from Florida to the principal investigator's laboratory.

International Space Station Alpha

The current plans for International Space Station Alpha include several options for short- and long-term microgravity housing of experimental animals. Currently, there are plans to include a 2-meter diameter variable-g centrifuge facility (maximum 1g) aboard Space Station Alpha to allow for in-flight control animals. The

centrifuge rodent housing hardware is currently planned as an upgrade to the AAH, which will provide caging for up to twelve 200-gram rats in a gang-housed environment. On-orbit access to animals, active temperature control, video monitoring, and food and water replenishment will be incorporated in such hardware. Housing hardware for other species, and laboratory facilities for on-orbit collection and analysis of specimens, will be incorporated in the Space Station Life Sciences Suite. The Space Station, once operational, will significantly improve the capabilities to perform animal-based experiments in a microgravity environment.

Conclusions

The ability to conduct life sciences experimentation in space has been pivotal to our understanding of how biological processes are affected by microgravity. The early animal space explorers paved the way for humans to venture into space. A variety of animal models have been used to evaluate an assortment of flight issues that have included propellant systems, radiation exposure, life support systems, and recovery procedures. In the absence of animal models, this work would have progressed much more slowly and with far greater human risk.

Currently, animals often accompany astronauts on space shuttle flights, and they are being used to further our understanding of biological changes that occur during microgravity exposure (10,14,20). It is now known that weightlessness produces certain physiological changes that may produce useful experimental models for studies of Earth-based diseases such as osteoporosis, immune dysfunction, vestibular disorders, wound healing impairment, anemia, and aging (19). The judicious use and application of experimental animal models to the study of complex biomedical and pathophysiological problems will continue to provide new insights into biological mechanisms that influence our lives on Earth and in space[3].

Endnotes

1)Microgravity - A term commonly applied to a condition of free-fall within a gravitational field in which the weight of an object is significantly reduced compared to its weight at rest on Earth. When orbiting Earth, a spacecraft is in a condition of continuous free-fall and thus, is in microgravity ($< 1X10^{-6}g$).

2)Realtime downlink - The process of transmitting data (as it is generated) from the orbiter (250-km altitude) via a TDRS (Tracking and Data Relay System) satellite to NASA ground stations. TDRS satellites are positioned in geosynchronous orbit (37,000-km altitude) and provide downlink coverage for approximately 75 minutes of each 90-minute shuttle orbit of the Earth.

3)To be placed on the mailing list for NASA Research Announcements (NRA's) and Announcements of Opportunity (AO), contact:

National Aeronautics and Space Administration
Office of Life and Microgravity Sciences and Applications (OLSMA)
Mail Code UP
Washington, DC 20546-0001.

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Acknowledgement - Portions of this work were completed under the auspices of the Penn State Center for Cell Research, a NASA Center for the Commercial Development of Space (CCDS), Grant # NAGW 1196. ■

Save the Manatee Club

The manatee is a large, aquatic mammal that can be found in the shallow, slow-moving rivers, estuaries, saltwater bays, canals, and coastal areas of Florida. They are gentle and slow-moving animals and spend most of their time grazing for submerged plants and basking in warm waters. A manatee adoption is a rare and original gift because it is a way to get to know one of these unique animals--up close and personal.

Twenty-three manatees who live in their natural environment and winter at Blue Spring State Park in Orange City, Florida, have been chosen for Save the Manatee Club's (SMC) Adopt-A-Manatee program. For $20, "parents" receive an adoption certificate, an underwater photo of "their" manatee, the manatee's life history, and a subscription to the SMC Newsletter.

Photo by D.R. and T.L. Schrichte

Boomer, Brutus, Lucille and Paddy Doyle, Flash, Success, and Howie -- these are names of just some of the adoptees in SMC's Adopt-A-Manatee program. Each manatee has distinctive characteristics -- Boomer is curious, Brutus is huge (1,800 pounds!), Lucille is now a grandmother, and Paddy Doyle is feisty. Flash is shy, Success just had her third calf, and Howie, well, Howie loves to upset the research canoe!

Each newsletter contains an update on the adoptees, written by Ranger Wayne Hartley, of Blue Spring State Park, who says that his favorite part of the job is "manatees, anything to do with them. I like greeting them all in the fall when they come in, seeing them swim by," says Ranger Hartley. "When they go out for the season, I wonder who's going to come back, what are they going to look like?" Wayne always has stories to tell about the manatees -- who's expecting a new calf, who is "hanging" out with whom, which manatee has made the most visits, and who has new scars (from being hit by boat propellers). A manatee adoption is a way to learn about manatees and the environment.

Funds from the Adopt-A-Manatee program go toward helping to save manatees from extinction. This is done through public awareness activities such as State and national public service announcements and "Caution - Manatee Area" signs distributed free to Florida residents living on the water; free education materials for school classes all across the United States; funds given to manatee research and manatee rescue and rehabilitation efforts; and lobbying on the local, State, and Federal levels to ensure better protection for manatees and their habitat.

Currently, there are about 1,800 manatees left in the United States, and they are listed as endangered by the U.S. Fish and Wildlife Service. Many manatee deaths are human-related, with watercraft collisions responsible for the largest number of these. Other causes of human-related manatee deaths include ingestion of fish hooks, litter, and monofilament line, entanglement in crab trap lines, and vandalism. Loss of habitat from coastal development is associated with all of these.

Save the Manatee Club is a national, nonprofit organization established in 1981 by former Florida Governor Bob Graham (now a U.S. Senator) and singer-environmentalist Jimmy Buffett (cochairman of SMC). For more information on manatees, the Adopt-A-Manatee program, to receive a free copy of manatee protection tips for boaters, or to receive a copy of the SMC gift catalog, call Save the Manatee Club at 1-800-432-JOIN, or write to SMC at 500 N. Maitland Ave., Maitland, FL 32751. ■

The Role of the Librarian in the Work of the Institutional Animal Care and Use Committee (IACUC)

by
Elaine Keefer, M.S.L.S., and Fred Westbrook, Ph.D.
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The Improved Standards for Laboratory Animals Act of 1985 resulted in the establishment of the IACUC to review all research protocols involving the use of animals, inspect the institution's animal facilities and animal care program every 6 months, ensure that all personnel working with animals are properly trained in the care and use of animals, respond to any reports of improper treatment of animals, and act as the conscience of the institution in the care of its laboratory animals.

The Information Needs of the IACUC

The members of the IACUC and those using animals in education, testing, and research need to be made aware of the Animal Welfare Act amendments of 1985 and the regulations for the care and use of animals provided in the Code of Federal Regulations (Title 9, Chapter 1, Subchapter A--Animal Welfare). They need to know how to access printed and online bibliographies on topics such as care and use of specific species in the laboratory, animal models in biomedical research, alleviation of pain in animals, and use of alternatives in research using animals. The librarian can provide the following information services to meet these needs:

Maintenance of a file of resources

National Agricultural Library (NAL) and National Library of Medicine (NLM) publications on animal welfare and use of animals in the laboratory (see box).

Newsletters from animal welfare organizations such as the Scientists Center for Animal Welfare (SCAW) and the Center for Alternatives to Animal Testing (CAAT).

Provision of database-searching service to allow principal investigators opportunities to provide assurances that their research does not duplicate work already done and that their procedures are carried out with a minimum of discomfort to the animals. This service is also necessary for investigators to determine if there are alternative species lower on the evolutionary scale that could be used in the research or if in vitro methods could be used.

Promotion of information on animal welfare publications, audiovisuals, internet resources, and database searching tips in the publications of the institution the librarian serves, such as the library newsletter or the Department of Animal Resources newsletter.

Development of Library Services for the IACUC at Emory University

In 1987, the chair of the Institutional Animal Care and Use Committee at Emory University requested that a librarian on the Health Sciences Center Library (HSCL) staff be appointed as liaison for the IACUC. Elaine Keefer was assigned that role and it has been a very challenging and rewarding experience. The first task was to check the bibliographies in the *Guide for the Care and Use of Laboratory Animals,* published by the National Institutes of Health (NIH), against Emory University Libraries holdings. Items not owned were checked by the chair of the IACUC to submit for purchase with the understanding that some items might not be purchased but obtained, if needed, through interlibrary loan.

In 1988, the IACUC sent Keefer to the Animal Welfare Information Center (AWIC) located in the NAL, and to the Office of Veterinary Affairs at the NLM, to acquaint her with the resources available on animal welfare and the use of laboratory animals in biomedical research. Using the resulting lists of resources and contact persons, she prepared a brochure to send to Emory personnel working with animals announcing that in response to the Animal Welfare Act amendments of 1985, the HSCL had assessed the Emory University collection and was prepared to support their information needs. Emphasis was placed on available databases that would help them provide the assurances requested by the U.S. Department of Agriculture (USDA) that they were not unnecessarily duplicating research and that they had searched the literature for possible alternatives to painful or distressful procedures applied to the animals.

In 1991, Jean Larson, Coordinator, Animal Welfare Information Center, was contacted to plan for an AWIC workshop at Emory. IACUC members, researchers, and librarians at Emory were invited and assembled in the HSCL classroom for a half-day session. The thrust of the presentation was the "3R's" of Russell and Burch--reduce, refine, and replace--and the importance of assurances by principal investigators that they have searched the literature to determine if they can apply one or more of the "3R's" to their research. Multidatabase searching was stressed as the way to provide these assurances. The workshop was a great success in raising awareness among the three groups of people that attended. Shortly thereafter, Keefer was invited to be an ex-officio member of the IACUC. In 1992, she was invited to become a voting member of the IACUC and pursue these activities along with additional duties such as reviewing applications for the IACUC's monthly protocol review meeting and participating in the animal facilities inspection every 6 months.

Laboratory Animal Care and Use Training and the Emory Information

Infrastructure

Another responsibility of the IACUC is to document that personnel have received training in the care and use of the animals with which they are working. A committee consisting of the IACUC chair, the university veterinarian, the head of the HSCL Media Services, and Keefer decided on a test for certification. This certification at Emory is given on completion of an audiovisual/computerized test produced by the Laboratory Animal Training Association (LATA). The LATA program best suited our need to provide training to over 900 people working with animals at Emory and use our

new developing information infrastructure. Our ultimate goal is to provide access to the video training tapes via a campus cable station accessible to personnel at all Emory vivarium locations. Unfortunately, off-campus sites do not yet have the cable access needed and are being served by scheduling the tapes for group viewings at their departments or in the library. By the time we received our tapes, the deadline for certification was very close and several hundred people requested access within a short period of time, which became a real challenge to the staff in Media Services.

The ultimate goal for access to the computerized test is for people to be able to access the library server via MS-DOS and Ethernet on their PC's. However, remote locations are not on Ethernet and some sites on campus cannot get into the server because of the security system protecting patient records at Emory Hospital and Clinic. Happily, another route was found to access the computerized test by using a modem to dial in with Norton pcANYWHERE software. We also have stations in HSCL Media Services for those without remote computer access.

Needless to say the job of trying to clarify these access problems to the over 900 Emory people has been a challenging one, and we report on this in hopes that it will alert others to possible pitfalls.

The LATA software for the tests provides a report system that lists names of participants, their department, the titles of tests they took, and their grades. In all there are nine training videotapes to view, depending on the person's animal care activities, with tests for five of these tapes (see appendix). The chair of the IACUC can view these results, sorting out those with grades below 60 to be notified to repeat the test, and then print out the report to send to LATA. LATA then provides certificates for each of the five tests that were successfully completed, charging the IACUC $3 per test taken and $3 per certificate prepared and mailed.

Concerns of a Librarian on the IACUC

According to Keefer, her role as an IACUC member has taken her beyond her library concerns and into a world of ethical decision-making that the IACUC deals with at monthly meetings with vigor and care. In addition to Keefer, who is a lay representative as well as liaison for the HSCL, there are 20 members of the Emory IACUC: 6 veterinarians, 2 veterinary interns, a clergy, the director of the Atlanta Humane Society, the director of the Office of Sponsored Programs, and 9 faculty/research members. Our members come from the Yerkes Primate Center and the Veterans Administration Medical Center, as well as Emory campus departments. This allows an excellent array of expertise with which to review the varied applications the IACUC receives. Keefer explains that it has been gratifying, as one of the lay representatives, to see the committee's great concern that the applicants' presentations of their reasons for doing their project and their descriptions of the procedures that will be used on the animals are given in lay terms as requested by USDA and NIH. Of key importance is their careful monitoring of the assurances, required in 9 CFR , Sec. 2.31d, that alternative models are not available and that the research does not unnecessarily duplicate previous work. The methods and sources used to determine this are provided, and any database(s) searched are listed with date of last search attached. The main duty of the lay representative is to question any shortcomings in the foregoing concerns and any other discrepancies that might appear in a protocol. However, as a librarian, Keefer's main duty is to provide information to the committee and to the applicants about databases and resources that might shed further light on an area of research or testing.

RESOURCE FILE

1. NAL publications

a. Bibliographies
- QB series (Quick Bibliography Series)
- SRB series (Special Reference Briefs)
- AWIC Series (Animal Welfare Information Center)
- Information Resource Series

b. Newsletters
- ALIN (Agricultural Libraries Information Notes)
  ALIN Editor, Room 204
  United States Department of Agriculture
  National Agricultural Library
  Beltsville , MD 20705-2351

(Contains listing of new and updated bibliographies that can be ordered from NAL .)

- Animal Welfare Information Center Newsletter

(Contains animal welfare and IACUC information.)

2. NLM publications

a. NLM Current Bibliographies in Medicine
b. SBS Specialized Bibliography Series
(These can be found in the monthly issues of Index Medicus.)

3. Animal Welfare organizations' newsletters

a. SCAW (Scientists Center for Animal Welfare)
SCAW Newsletter
b. CAAT (Center for Alternatives to Animal Testing)
The Johns Hopkins Center for Alternatives to Animal Testing

4. Key databases that cover animal care and research involving the use of animals

- Agricola
- Biosis Previews
- Cab Abstracts
- Embase
- Federal Research in Progress
- Life Sciences
- Medline
- Psychinfo
- Toxline
- Toxnet
- Zoological Record

5. Animal welfare organizations

Animal Welfare Information Center (AWIC),
U.S. Department of Agriculture
National Agricultural Library
5 th Floor
10301 Baltimore Boulevard
Beltsville, MD 20705-2351

SCAW Scientists Center for Animal Welfare
Golden Triangle Building One
7833 Walker Drive Suite #340
Greenbelt, MD 20770

CAAT The Johns Hopkins Center for Alternatives to Animal Testing
The Johns Hopkins School of Hygiene and Public Health
111 Market Place, Suite 840
Baltimore, MD 21202-6709

ENVIRONMENTAL ENRICHMENT GUIDE FOR LABORATORY ANIMALS NOW AVAILABLE FROM NAL AND UFAW

BELTSVILLE, MD USA; POTTERS BAR, HERTFORDSHIRE UK--The National Agricultural Library's (NAL) Animal Welfare Information Center (AWIC) and the Universities Federation for Animal Welfare (UFAW) are pleased to announce the publication of *Environmental Enrichment Information Resources for Laboratory Animals 1965-1995.* This publication was produced under Individual Memorandum of Understanding No. 58-0520-3M-F105.

This 294-page resource guide was produced in an effort to encourage the implementation of environmental enrichment programs in laboratory animal husbandry. This publication covers birds, cats, dogs, farm animals, ferrets, rabbits, and rodents. Each section of the bibliography is introduced by a paper which provides background information on the biology of the animals and their currently accepted needs in captivity. *Environmental Enrichment* also contains a list of journals that appear in the bibliography, subscription information for those publications that routinely publish articles on enrichment, a world-wide list of laboratory animal organizations, contact information for 27 commercial suppliers of enrichment objects, lists of toys and other objects that are commonly used with the species covered, and a keyword index.

Copies of this publication are available from:

North America, South America, Caribbean, Central America, Mexico

Animal Welfare Information Center
National Agricultural Library, USDA
10301 Baltimore Blvd.
Beltsville, MD 20705-2351
USA
Tel: (301) 504-6212
Fax: (301) 504-7125
e-mail: awic@nal.usda.gov
Price: Free

United Kingdom, Europe, Africa, Asia, Australia

Universities Federation for Animal Welfare (UFAW)
8 Hamilton Close
South Mimms
Potters Bar, Hertfordshire EN6 3QD
UNITED KINGDOM
Tel: 01707 658202
Fax: 01707 649279
e-mail: ujhhtpo@ucl.ac.uk
Price: UK and Europe £7.00 inclusive of postage.
Elsewhere £4.50 + postage.
Make cheques payable to UFAW

Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART)
PO Box 19
Glen Osmond, SA 5064
AUSTRALIA
Tel: 61 8 303 7393
Fax: 61 8 303 7113
Price: Please inquire

AWIC is one of 10 specialized information centers established by NAL to keep abreast of current information on issues of particular importance to U.S. agriculture. Other subjects covered include agricultural trade and marketing, aquaculture, biotechnology, food and nutrition, plant genome, rural development and health, technology transfer, and water quality.

NAL is part of the U.S. Department of Agriculture's Agricultural Research Service. It is the largest agricultural library in the world and one of four national libraries of the United States, along with the Library of Congress, the National Library of Medicine, and the National Library of Education.

UFAW is a science-based animal welfare charity (registered charity number 207996) which has helped improve the lives of numerous farm, laboratory, zoo, wild, and pet animals since 1926. UFAW gives research grants and student scholarships; provides advice and publishes books, videos, and leaflets on animal care; publishes the journal *Animal Welfare;* gives awards for high animal welfare standards; and organizes meetings and conferences. All aspects of UFAW's work contribute towards improving the conditions under which animals are kept. UFAW is an independent charity and does not receive income from universities, government, or commerce. For additional information, contact Victoria Taylor, BSc, Development Officer, at the address listed above. ■

6. **LATA Integrated Training Program**
Laboratory Animal Training Program (LATA)
54 Remington Dr Suite 301
Highland Village, TX 75067

Tape #1 - The New Research Environment
Tape #2 - The New Research Environment
Tape #3 - The Humane Care and Use of Laboratory Animals (TEST AVAILABLE)
Tape #4 - The Humane Care and Use of the Mouse, Rat and Hamster (TEST AVAILABLE)
Tape #5 - The Human Care and Use of the Rabbit and Guinea Pig (TEST AVAILABLE)
Tape #6 - The Humane Care and Use of the Dog and Cat (TEST AVAILABLE)
Tape #7 - The Humane Care and Use of Nonhuman Primates (TEST AVAILABLE)
Tape #8 - Aseptic Surgery of Rodents
Tape #9 - Anesthesia and Analgesia of Rodents

For additional information, contact Elaine Keefer M.S.L.S., HSCL Reference Librarian, (Tel: (404) 727-0286 or e-mail: libek@emory.edu) or Dr. Fred Westbrook, Director Media Services HSCL, (Tel: (404) 727-5812 or e-mail: libfnw@unix.cc.emory.edu), Emory University, Atlanta, GA 30322. ■

Computer Simulation Studies and Biomedical Research

by
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Department of Emergency Medicine and the Department of Physiology, University of Mississippi Medical Center, Jackson, Mississippi

There are very few researchers in the biological sciences that would disagree with the morality of the basic tenets of the Animal Welfare Act. The problem arises when the scientists try to rectify the basic goals and philosophy of scientific investigation with what appear to be constraints on the acquisition of knowledge. When the use of live animal experimental models became too costly and time consuming by virtue of their intensive regulation, many scientists turned to cellular or organ preparations to carry on their work. While in vitro techniques provide insights into the functioning of specific biological elements, the information gained is out of context with the dynamic interactions within the total animal. Whole body physiological functioning is complex and requires a systems analysis approach for a more complete understanding. Modern technology has provided a potential resolution to this conflict of ideas.

Since the beginning of scientific exploration, mathematical models have been used to put our ideas into simple and exact expressions that have the ability to predict events in an ever-changing world. The physical sciences have had a great deal of success with the use of these quantitative models in the scientific method as a concrete technique of hypothesis formulation.

Methods are now being developed for using mathematical models of biological systems in computer simulation studies to explore hypotheses concerning basic physiology, pharmacology, and systems toxicology and to extrapolate the findings of in vitro tissue and cell culture preparations to theoretical meaning within the context of the total animal. Computerized mathematical models that simulate physiological processes can be used to theoretically test hypotheses concerning the effects of physiological and pharmacological factors on the whole animal. The model and methods then serve as a resource for those interested in exploring the possible effects of pharmacological or toxic substances and thus avoids the need for many pilot experimental studies in live animals.

Mathematical modeling and systems analyses have been used successfully in physiology as a means to better qualify and quantify ideas about interactions that take place among complex systems under study. These models often serve as a formal statement of hypotheses concerning proposed mechanisms of physiological functioning and when used in computer simulation studies can reveal insight into interactions among physiological variables that may not be intuitively obvious otherwise. Models used in this way can help to develop and theoretically test hypotheses concerning complex systems and can assist in development of more intelligent research protocols before they are actually performed on live animals.

One of the major stated goals of most animal welfare organizations is to refine and reduce the number of animals used in biomedical experimentation. Though computer simulation studies are not expected to totally replace responsible animal research, they can serve as a means for refining experimental protocols and thereby reducing the number of animals wasted in poorly planned studies. Intelligent research can be accomplished with the use of an algorithm such as that depicted in figure 1. In the proposed scheme there is a constant interaction between the information obtained from in vitro studies, the theoretical considerations of those findings, and the implications within the whole animal. The results of in vitro experiments are first translated into dose-response or cause-effect relations for the organ or cellular elements under study. These relations are then extrapolated to the whole animal level with the use of mathematical models. The models are then solved with the aid of computers in simulation studies to predict the dynamic results of the in vitro findings on the total system. Planned whole animal studies can then be first performed theoretically to test the integrity of the proposed protocols and to look for potential gaps in knowledge or problems in testing before live animals are utilized. The loop is complete when the results of the live protocols are fed back into the computer simulations and the models and theories are refined. Science is then advanced and the direction of future research (in vivo and in vitro) is clarified. This method also allows the scientist who does not participate in in vivo research to translate the results of his or her studies into whole animal meaning.

Thus, methods for computer simulation studies would be important in the testing and evaluation of pharmacological and toxicological agents in a number of ways that will reduce the number of animals used in basic biomedical research.

1. Mathematical modeling and computer simulation methods provide a way to theoretically assess and quantitate the whole animal meaning of the pharmacological or toxic action of a substance found in experiments using cell, tissue, or organ preparations.

2. Systems models allow us to theoretically evaluate the possible toxic effects of a substance on systems not directly influenced by the substance but

which may be indirectly affected because of complex and often subtle interactions inherent in physiological systems. Many times the most important toxic side-effects of a drug or agent are not concerned with the system specifically being treated. Only a complex and comprehensive approach with large-scale modeling can predict these possible effects.

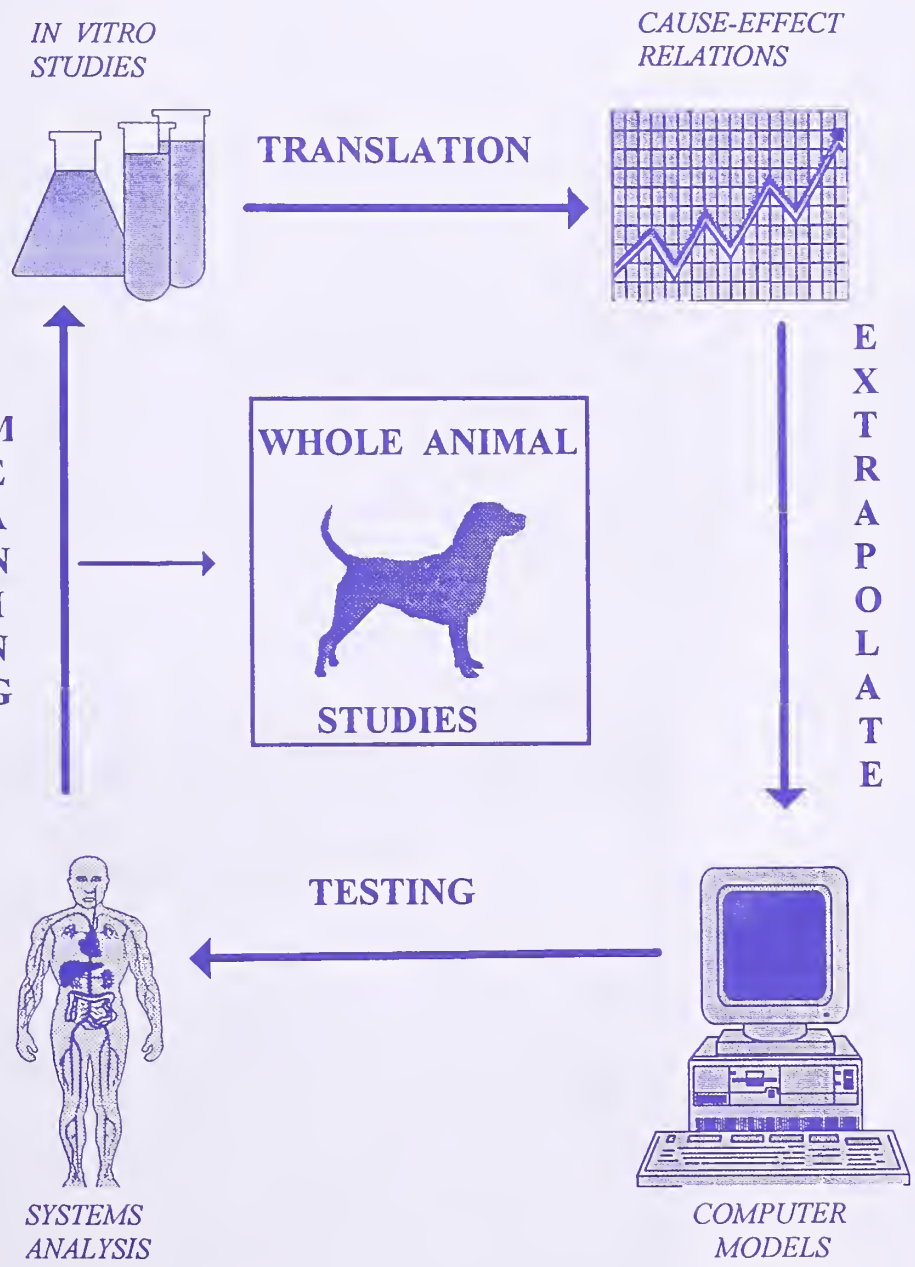
3. In some instances only a computer model that can be run indefinitely can give clues to the long-term toxicity or effects of a substance based on information gathered in short- term experiments. Such long-term studies of toxic substances are often difficult to perform in live animals or result in unacceptable suffering for the animal.

4. Computer modeling indirectly provides insight into the effects of a substance on variables of an animal's system which are not readily measurable without extensive instrumentation.

5. Computer simulation studies using comprehensive models provide an excellent means for intelligent protocol development.

While mathematical models and computer simulations are not the perfect answer for those seeking to eliminate animals from biomedical research, they do provide some hope that our research efforts will be more thoughtful and productive. There are still a number of theoretical and philosophical issues with regard to their use in directing biological research. The many gaps in our understanding of the detailed functioning of these systems preclude the use of computer simulations in many areas. In these instances animal studies may be our only means for obtaining a complete picture. However, as our knowledge of biological systems progresses, the models will become more detailed and complex and hence can give us a greater insight into the direction of biomedical research. It is only with this continuing interaction between the experimental and the theoretical as delineated by the models can we intelligently carry out our goals in biomedical research. Not only is this the moral obligation to those who use animals in research but it is also just sound science.

Figure 1. Scheme for the Extrapolation of *In Vitro* Findings to Systemic-Whole Animal Meaning



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Selection for Improved Efficiency of Lean Gain in Mice: Population and Procedures

by

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Introduction

Cost of feed for the slaughter animal accounts for about 45 percent of the total costs of producing lean tissue from the swine herd. It represents the greatest single economic input in swine production (9). Efficiency of feed utilization and percentage lean in the carcass are traits over which there is substantial genetic control (2,7). Improvement of feed conversion to lean by 5 percent would be expected to decrease the cost of producing a slaughter pig by nearly $2. Direct emphasis on the trait in selection programs has been limited because of difficulty in making individual measurements of feed intake and lean percentage. In addition, selection on a trait defined as a ratio (feed/lean gain) may not yield optimum response in the components (3). In past studies in which feed:gain ratio was a selection criterion, improvement in efficiency of feed utilization resulted from decreased intake with little, if any, improvement in lean gain. Decreased feed consumption limits overall productivity of the animals and may also limit long-term response to selection.

Laboratory animals have often been used as a model species for genetic studies of swine because of their relatively low cost and rapid generation turnover (5). Previous studies of selection for lean efficiency in laboratory animals have relied on family selection because of lack of an efficient method of estimating body composition of the live animal (6). Advances in technology for estimating body composition have yielded an accurate method that can be applied to the live animal (10). Measurement of total body electrical conductivity (TOBEC) allows prediction of fat-free mass that is highly correlated to chemical composition. Individually caging mice allows measurement of feed intake. The objective of this study is to compare alternatives to selection on the ratio of lean gain/feed intake on improvement of efficiency of lean tissue deposition in mice.

Materials and Methods

Population

Experimental animals are outbred mice of the CF1 strain. Outbred lines of mice are generally comparable to breeds of livestock. The base population was produced by reciprocally mating CF1 males and females obtained from two commercial sources. One generation of random mating was practiced before selection was initiated. Two replicates of five selection lines are included in the experiment. Each line consists of 12 litters per generation resulting from pair matings. Animals are mated at approximately 60 days of age. Four generations are expected to be produced per year.

Experimental animals are reared in litters standardized to four male and four female pups. Number born, number weaned, litter birth weight, and litter weaning weight are recorded. Litters are weaned at 21 days of age and pups weighed. At 25 days of age, mice are again weighed and placed in individual cages, and recording of feed intake is initiated. Body weights and feed intake are recorded at 31, 37, and 42 days of age. Intake is defined as weight of feed placed in the cage minus that present in the cage at the end of the recording period. Animals are fed daily an amount expected to slightly exceed that consumed. At 45 days of age, mice are weighed and anesthetized by intraperitoneal injection of 0.015 ml of 2.5 percent Avertin (4) per gram of body weight. An EM-SCAN SA-2 instrument (EM-SCAN, Inc., Springfield, IL; see sidebar) is used to obtain a measure of conductivity (E) in triplicate (fig. 1). The mean of the three measures is calculated and fat- free mass (FFM) estimated by using the equation: $FFM = -3.732 + 0.578$ body weight $+ 2.967\ E^{0.5}$. Previous calibration of the instrument has yielded an R2 of 0.97 between the TOBEC-estimated fat-free mass and chemical composition. The relationship of

Figure 1. An anesthetized mouse is inserted into the TOBEC instrument for measurement of electrical conductivity subsequently used to predict fat-free mass.

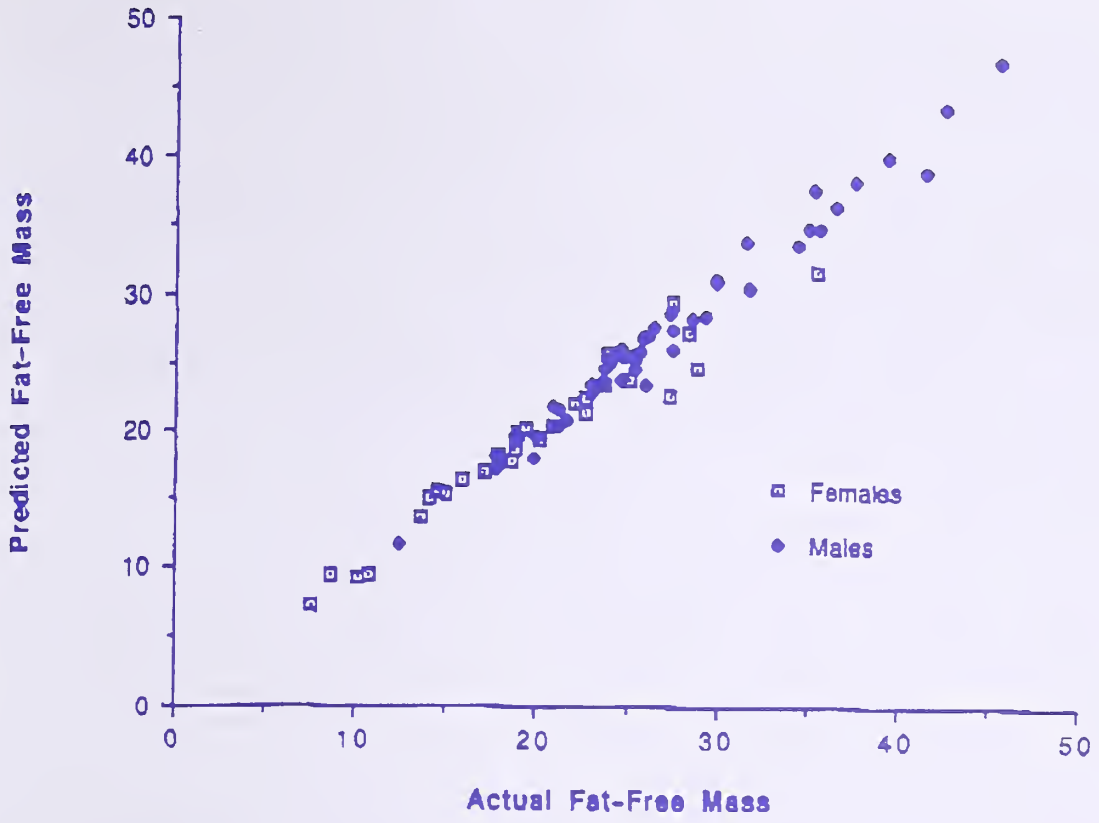

Figure 2. Fat-free mass predicted with the use of TOBEC plotted against actual fat-free mass.

predicted FFM and chemical composition of 79 male and female mice is shown in figure 2.

All mice have *ad libitum* access to a pelleted diet (23 percent crude protein and 4.5 percent fat; Lab Diet 5001, PMI Feeds, Inc., St. Louis, Missouri) and distilled water. From day 17 of pregnancy until litters are weaned, females are housed in polycarbonate cages measuring 28 x 17 x 12 cm. Litters remain in these cages until 25 days of age. During the test period, mice are individually housed in stainless steel hanging wire cages measuring 24 x 10 x 13 cm. Animal rooms are maintained at 22° C +/- 2° C with a relative humidity of 50 +/- 10 percent. The light cycle is 12 hours light:12 hours dark.

Selection Criteria

Five lines are included in the selection experiment. A line in which a male and female are selected at random from each litter serves as a negative control. This line serves to measure fluctuations and trends in the environment. A line in which the selection criterion is weight of FFM gained divided by feed disappearance (intake) between 25 and 42 days of age (gain/feed) is the positive control line. This selection criterion represents the standard criterion from past experiments. Three experimental criteria represent alternatives to selection on the gain/feed ratio. The first is intake deviation. Animals selected on this criterion are those with the greatest negative deviation from the regression line of intake on gain of FFM. This is equivalent to selection on least intake after adjustment to a constant gain of FFM. This criterion has been used for selection in the commercial poultry industry. The second experimental criterion is gain deviation. Animals selected on this criterion are those with the greatest positive deviation from the regression line of gain of FFM on intake. This is equivalent to selection on greatest gain of FFM after adjustment to a constant intake. The final criterion is denoted intrinsic efficiency (8). It is similar to intake deviation except that adjustment is also made for average FFM maintained.

Two replicates of each of the proposed criteria are included in the experiment. Selection will be practiced for six generations. Direct and correlated responses to selection will be measured as regressions of line-generation means calculated as deviations from controls on generation. Replication of lines allows tests of significance to be performed using empirical standard errors. Realized heritabilities and genetic correlations will be estimated by regression of cumulative response on cumulative selection differentials. Of particular interest is correlated response in feed consumption.

Results

Selection on any of the four positive selection criteria described above would be expected to improve efficiency of feed utilization by either increasing gain, decreasing intake, or a combination of both. To determine the similarities among the criteria, phenotypic correlations were calculated between selection criteria and values rounded to the nearest 0.05 (table 1).

These correlations demonstrate the similarities and differences among the selection criteria. In this population, gain is more closely related to gain/feed than is intake. Residual intake and intrinsic efficiency differ only by the adjustment for average weight maintained in intrinsic efficiency, and the correlation between these criteria is high. Since both use intake after adjustment to a common gain as part of the criterion, the correlation of each with gain is near zero and their correlation with intake is high. Conversely, the correlation of residual gain with intake is zero as it uses gain adjusted to a common intake as the selection criterion. Its correlation with gain is high.

Variable	Intake	Gain/feed	Residual gain	Residual intake	Intrinsic efficiency
Gain	0.10	0.90	0.85	0.00	0.00
Intake		-0.35	0.00	0.90	0.90
Gain/feed			0.80	-0.40	-0.40
Residual gain				0.00	0.00
Residual intake					0.95

Table 1. Correlations between experimental selection criteria and components of efficiency of lean gain.

Generation 1						
	Mean		Standard deviation		Selection differential	
Line	Female	Male	Female	Male	Female	Male
Gain/feed	0.08	0.10	0.04	0.04	0.65	0.13
Residual gain	7.9	10.3	2.4	3.1	0.50	0.44
Residual intake	108.1	116.5	27.8	26.7	0.62	0.62
Intrinsic efficiency	112.4	118.3	21.5	23.1	0.51	0.54
Generation 2						
Gain/feed	0.09	0.12	0.04	0.03	1.03	0.96
Residual gain	9.2	12.7	3.0	2.2	1.30	1.39
Residual intake	98.0	103.0	13.0	14.8	1.25	1.14
Intrinsic efficiency	96.8	102.8	11.5	11.7	1.03	1.12

Table 2. Descriptive statistics and standardized selection differentials by sex and line for generations one and two of selection.

Descriptive statistics and standardized selection differentials of the four selected lines for generations 1 and 2 are presented in table 2. Standardized selection differentials tend to be similar within generation and depend primarily on reproductive rate. Low reproductive rate in generation 1 compared to that in generation 2 resulted in lower selection differentials. The expected selection differentials are expected to be about 1.25 standard deviations (1).

Summary

Efficiency of lean gain is a trait of great economic importance to the livestock industry. Efforts to improve this trait by genetic selection have been hampered by difficulty in measuring its components --feed intake and lean gain--and have required inefficient family selection procedures. Recent improvements in technology for measuring body composition no longer require sacrifice of the animal to determine lean content. Use of TOBEC allows rapid determination of fat-free mass of an animal that can later be used for breeding. Alternative methods of individual selection for improving efficiency of lean gain are evaluated using mice as models for the livestock industry.

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ALTERNATIVES IN BODY COMPOSITION ANALYSIS FROM EM-SCAN

This study uses the principle of TOBEC (total body electrical conductivity) as a simple, fast, noninvasive alternative to more traditional methods of determining body composition (lean body mass, percent body fat, and total body water). This method measures the ionic content of the electrolytes found in the hydrated tissues of a subject. The basic principle is that lean tissue conducts electricity 20 times more effectively than either fat or bone. A low-level electromagnetic field, less than that of a small radio, surrounds the subject in the detection chamber. The amount of energy absorbed by the subject is detected by the instrument, and the body composition measurements are calculated by the computer using a species-specific calibration equation. Instruments using the TOBEC technology are available for a wide range of animal sizes. Researchers using TOBEC technology have documented its usefulness in over 150 published research projects.

For more information about the specific instrument used in this study (EM-SCAN/TOBEC Model SA-3000), contact Larry Perko, Small Animal Product Manager, EM-SCAN, Inc., 3420 Constitution Dr., Springfield, IL 62707; phone (217) 793-3666; fax: (217) 793-3489.

Legislation cont'd from p.1

the Marine Mammal Protection Act of 1972.

Congress finds the following: Although in past years the yellowfin tuna fishery of the eastern tropical Pacific Ocean has resulted in excessive incidental mortality to dolphins, efforts by tuna fishermen operating under United States and international conservation programs have reduced this incidental mortality to levels that are approaching a zero mortality and serious injury rate; Support of the "International Dolphin Conservation Program" is necessary to assure that these low levels of dolphin mortality are maintained and eventually eliminated.

- **S. 968 To require the Secretary of the Interior to prohibit the import, export, sale, purchase, and possession of bear viscera or products that contain or claim to contain bear viscera, and for other purposes.**

Introduced June 27, 1995, by Mitch McConnell (R-KY) and referred to the Committee on Finance. Referred to the Subcommittee on Trade on August 8, 1995. Referred to the Subcommittee on Fisheries, Wildlife and Oceans on August 9, 1995. This act may be cited as the "Bear Protection Act." For purposes of this act the term "bear viscera" is defined as body fluids or internal organs (including the gallbladder) of a species of bear.

The Secretary of the Interior shall prohibit the import into the United States, or export from the United States, of bear viscera or products that contain or claim to contain bear viscera. The sale, barter, offer of sale or barter, purchase, or possession with intent to sell or barter, in interstate or foreign commerce, of bear viscera or products that contain or claim to contain bear viscera is prohibited. Related bills: H.R. 2240, H.R. 353.

- **S. 768 To amend the Endangered Species Act of 1973 to reauthorize the Act, and for other purposes.**

Introduced May 9, 1995, by Slade Gorton (R-WA) and referred to the Committee on Environment and Public Works. This act may be cited as the "Endangered Species Reform Act of 1995."

The purposes of this act are: to improve and protect the integrity of the programs established under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) for the conservation of endangered species and threatened species; to ensure the scientific validity of decisions to designate the species and the critical habitat of the species; to ensure balanced consideration of all impacts of decisions implementing the act; to make the conservation planning process central to, and reduce the number of decisions needed for, the implementation of the Act; to provide for equitable treatment of non-Federal persons and Federal agencies under the act; to ameliorate the impact of the act on, and provide less costly and time-consuming procedures for, non-Federal lands; and to encourage non-Federal persons to contribute voluntarily to species conservation. Related bills: H.R. 2275, H.R. 490, S. 191, H.R. 571, S.239.

- **H.R.1619 To amend section 227 of the Housing and Urban-Rural Recovery Act of 1983 to prohibit owners and managers of federally assisted rental housing from preventing elderly residents of such housing from owning or having household pets in such housing.**

Introduced May 11, 1995, by Susan Molinari (R-NY) and referred to the Committee on Banking and Financial Services. Referred to the Subcommittee on Housing and Community Opportunity on May 19, 1995. This act may be cited as the "National Senior Citizens Pet Ownership Protection Act."

Section 227 of the Housing and Urban-Rural Recovery Act of 1983 (12 U.S.C. 1701r-1) is amended by inserting a new section entitled "pet ownership by elderly and disabled families in federally assisted rental housing." Section 227 outlines the rights of elderly and disabled families to own common household pets in federally assisted rental housing. Managers of federally assisted rental housing may not restrict or discriminate against any elderly family in connection with admission to, or continued occupancy of, such housing by reason of pet ownership, or by the presence of such pets in the dwelling accommodations.

Managers may prescribe reasonable rules for the keeping of pets, that consider factors such as density of tenants, pet size, types of pets, potential financial obligations of tenants, and standards of pet care.

- **S. 773 To amend the Federal Food, Drug, and Cosmetic Act to provide for improvements in the process of approving and using animal drugs, and for other purposes.**

Introduced May 9, 1995, by Nancy Landon Kassebaum (R-KS) and referred to the Committee on Labor and Human Resources. This act may be cited as the "Animal Drug Availability Act of 1995."

Congress finds that: the new animal drug approval process has been proceeding too slowly, with the result that necessary and useful drug therapies are being kept from the marketplace; the lack of drug approvals for new animal drugs places the health and well-being of animals at risk; the expense and delays caused by effectiveness testing for new animal drugs have begun to outweigh the benefits of such testing; the over-reliance on field investigations to establish the effectiveness of new animal drugs is a primary reason the new animal drug approval process has become so burdensome.

Further sections of the bill: define drug effectiveness; limitation on residues; export of new animal drugs; and dispute resolutions.

- **S. 852 To provide for uniform management of livestock grazing on Federal land.**

Introduced July 28, 1995, by Pete Domenici (R-NM) and reported to the Committee on Energy and Natural Resources as amended. Senate Report 104-123 issued. This act may be cited as the "Livestock Grazing Act."

Congress finds that through the cooperative and concerted efforts of the Federal rangeland livestock industry, Federal and State land management agencies, and the general public, the Federal rangelands are in the best condition they have been in during this century, and their condition continues to improve. Populations of big game and wildlife are increasing and stabilizing across vast areas of

the West. Maintaining the economic viability of the western livestock industry is essential to maintaining open space and habitat for big game, wildlife, and fish, but currently there are pressures to sell the base property of the Federal land ranches for subdivision or other development, which would reduce or remove the available open space for fish and wildlife habitat.

The objective of this act is to achieve orderly use, improvement, and development of Federal land; enhancement of productivity of Federal land by conservation of forage resources and reduction of soil erosion; consideration of wildlife populations and habitat, consistent with land-use plans.

- **S. 745 To require the National Park Service to eradicate brucellosis afflicting the bison in Yellowstone National Park, and for other purposes.**

Introduced May 3, 1995, by Conrad Burns (R-MT) and referred to the Committee on Energy and Natural Resources. Referred to the Subcommittee on Parks, Preservation and Recreation on May 4, 1995. Committee on Energy and Natural Resources requested executive comment from the Department of the Interior, and the Office of Management and Budget on July 20, 1995.

The Secretary of the Interior, acting through the Director of the National Park Service, shall: perform a blood test of each bison in the herd inhabiting Yellowstone National Park for brucellosis; State veterinarians of the States of Idaho, Montana, and Wyoming, will vaccinate and restrain under quarantine restrictions each bison that tests negative for brucellosis; engage the services of a team of independent range scientists to determine the optimum population of bison that the land available for the herd in Yellowstone National Park is capable of sustaining; in consultation with the Secretary of the Interior, appropriate officials of Indian tribes, the States of Idaho, Montana, and Wyoming, and other interested parties, identify locations outside the Park that would be suitable for sustaining herds of bison created from any excess number of bison in the Yellowstone herd that are certified as being free of brucellosis, in accordance with standards established under the law of the States of Idaho, Montana, and Wyoming; and after brucellosis has been eradicated, continue to reduce the population of the Yellowstone herd to a number that is approximately 500 below the optimum population by transferring the excess number of bison.

- **H.R.1529 To authorize certain construction at military installations for fiscal year 1996, and for other purposes.**

Introduced May 2, 1995, by Joel Hefley (R-CO) and referred to the Committee on National Security. This act may be cited as the "Military Construction Authorization Act for Fiscal Year 1996."

The Secretary of the Air Force authorizes conveyance of the Primate Research Laboratory at Holloman Air Force Base, and ownership of the colony of Air Force-owned chimpanzees used in connection with research at the laboratory, to the Coulston Foundation or, if the Coulston Foundation is unwilling or unable to accept the conveyance, to any other not-for-profit entity which the Secretary finds is capable of utilizing the laboratory, able to provide adequate care for the Air Force-owned chimpanzees, and is otherwise well qualified to operate the laboratory in a manner which will further scientific and medical research.

- **S. 555 To amend the Public Health Service Act to consolidate and reauthorize health professions and minority and disadvantaged health education programs, and for other purposes.**

Introduced June 6, 1995, by Nancy Landon Kassebaum (R-KS) and referred to the Committee on Labor and Human Resources. Senate report 104-93 issued.

Section 481B(a) of the Public Health Service Act (42 U.S.C. 287a-3(a)) is amended to decrease funding for the construction of regional centers for research on primates from $5,000,000 to $2,500,000.

- **H.R. 1977 Making appropriations for the Department of the Interior and related agencies for the fiscal year ending September 30, 1996, and for other purposes.**

Introduced on June 30, 1995, by Ralph Regula (R-OH) and referred to the House Committee on Appropriations. Measure passed House with amendments on July 18, 1995, and reported to Senate from the Committee on Appropriations with amendments on July 28, 1995. Measure passed Senate on August 9, 1995. House Report 104-259 filed in House on September 21, 1995.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the following sums are appropriated, out of any money in the Treasury not otherwise appropriated, for the Department of the Interior and related agencies for the fiscal year ending September 30, 1996, and for other purposes. The following are provisions directly relating to wildlife conservation:

For expenses necessary to carry out the provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543), as amended by Public Law 100-478, $8,085,000 for grants to States, to be derived from the Cooperative Endangered Species Conservation Fund, and to remain available until expended.

For expenses necessary to implement the Act of October 17, 1978, the National Wildlife Refuge Fund (16 U.S.C. 715s), $10,779,000, to remain available until expended.

For expenses necessary to carry out the provisions of the African Elephant Conservation Act (16 U.S.C. 4201-4203, 4211-4213, 4221-4225, 4241-4245, and 1538), $600,000, to remain available until expended.

For deposit to the Rhinoceros and Tiger Conservation Fund, $200,000, to remain available until expended, to be available to carry out the provisions of the Rhinoceros and Tiger Conservation Act of 1994 (P.L. 103-391).

For deposit to the Wildlife Conservation and Appreciation Fund, $998,000, to remain available until expended, to be available for carrying out the Partnerships for Wildlife Act only to the extent such funds are matched as provided in section 7105 of said act.

- **H.R.1864 Making emergency supplemental appropriations for additional disaster assistance and making rescissions for the fiscal year ending September 30, 1995, and for other purposes.**

Introduced June 15, 1995, by Ed Royce (R-CA) and referred to the Committee on Appropriations, and the Committee on the Budget.

The following rescissions in sums of money appropriated by Congress to the Department of Agriculture and the Department of the Interior, for fiscal year ending September 30, 1995, will be made. Of the funds made available for Agricultural Research Service, USDA, for buildings and facilities under Public Law 103-330 and other Acts, $14,178,000 is rescinded, including $12,678,000 for construction of the National Swine Research Center.

Of the funds made available to the Cooperative State Research Service, USDA, under Public Law 103-330, $7,586,000 is rescinded, including $524,000 for contracts and grants for agricultural research under the Act of August 4, 1965, as amended (7 U.S.C. 450i(c)); $434,000 for necessary expenses of Cooperative State Research Service activities; $327,000 for cool season legume; $188,000 for entomology acoustics detection; $220,000 for low bush blueberry; $4,200,000 for wood utilization; $1,000,000 for geographic information systems; and $600,000 for agricultural development in the American Pacific: Provided, That the amount of "$9,917,000" available under this heading in Public Law 103-330 (108 Stat. 2441) for a program of capacity building grants to colleges eligible to receive funds under the Act of August 30, 1890, is amended to read "$9,207,000."

Of the funds made available to the USDA Animal and Plant Health Inspection Service for buildings and facilities under Public Law 103-330, $2,000,000 is rescinded. Of the funds made available to the Department of the Interior in Public Law 103-332, Public Law 103-138, Public Law 102-381, and Public Law 101-512, $1,076,000 is rescinded. Of the funds available for the National Biological Survey for research, inventories, and surveys by Public Law 103-138, $14,549,000 is rescinded. Of the funds available to the Smithsonian Institution for construction and improvements to the national zoological park, under Public Law 102-381 and Public Law 103-138, $1,000,000 is rescinded.

No funds available to the USDA Forest Service may be used to implement Habitat Conservation Areas in the Tongass National Forest for species which have not been declared threatened or endangered pursuant to the Endangered Species Act, except that with respect to goshawks the Forest Service may impose interim Goshawk Habitat Conservation Areas not to exceed 300 acres per active nest consistent with the guidelines utilized in national forests in the continental United States.

- **S. 790 To provide for the modification or elimination of Federal reporting requirements.**

Introduced May 15, 1995, by John McCain (R-AZ). Measure passed Senate with amendments on July 17, 1995. Referred to the House Committee on Government Reform and Oversight on September 12, 1995. This act may be cited as the "Federal Reports Elimination and Sunset Act of 1995."

Title I , Subtitle A, lists Department of Agriculture reports that are to be eliminated or modified. Section 1012 modifies the report on Animal Welfare Enforcement section 25 of the Animal Welfare Act (7 U.S.C. 2155) to include the report on the Horse Protection Act of 1970 (15 U.S. C. 1830). ■

AMERICANS WITH DISABILITIES ACT AND ITS APPLICABILITY TO ZOOS

by
Richard Crawford, D.V.M.,
Animal Welfare Information Center, USDA

The Americans With Disabilities Act (ADA) recently became effective and is applicable to facilities and areas of public access. The Regulatory Enforcement and Animal Care staff in the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service became involved in the application of the ADA to zoos and its potential conflict with the Animal Welfare Act in regard to the use of service animals (for example, seeing eye dogs) in zoos. Meetings were held with USDA's Office of the General Counsel and with attorneys from the Civil Rights Division, Department of Justice, to work out a way to handle such conflicts and comply with the ADA. A position statement was provided by the Department of Justice in regard to the use of service animals in public areas and is reprinted below for the guidance of facilities that allow public access.

The Application of the ADA to Zoo Policies on Service Animals

" Zoos and other facilities where animals are exhibited are subject to the requirements of the Americans With Disabilities Act (ADA). One of the underlying goals of the ADA is to foster the independence and self-sufficiency of individuals with disabilities. Service animals allow many individuals with disabilities to be self-reliant. Refusing to allow service animals in a place of public accommodation is not permissible under the ADA absent evidence that such animals pose a real threat to safe operation of the facility.

The ADA requires zoos and other facilities to make reasonable modifications in their regular policies, practices, and procedures when necessary to afford an individual with disability the same goods, services, facilities, privileges, advantages, or accommodations offered to others. Generally, zoos and other facilities must permit the use of a service animal by an individual with a disability. Any limitations on the use of service animals in zoos and other facilities where animals are exhibited must be shown by the zoo to be necessary for safe operation.

Each facility needs to make its own analysis of its circumstances, and the determinations are very likely to differ from facility to facility depending on the types of animals and the configurations of the facilities. Facilities that wish to restrict service animals in any way should make a careful assessment of each area to determine where safety concerns justify restricting the access of persons with their service animals. Unsubstantiated fears about potential risks will not suffice to justify the exclusion of service animals from areas open to the general public."

It is not likely that a total ban of service animals from the entire facility can ever be justified. There are many zoo facilities that permit service animals in all parts of their facilities apparently without problems. ■

Announcements...

• Alternatives Funding Directory

Three R Alternatives: An International Directory of Funding Sources by A. Tarzi and F.B. Orlans was developed to help scientists identify potential funding sources for work involving refinement, reduction, or replacement of animal experiments. Fifty-nine entries in 15 countries are listed, along with information on program objectives and how to apply. Funding sources include animal protection organizations, other charities, private industry, universities, and government agencies. The cost for this 18-page booklet is $10; inquiries about discounts for bulk orders are welcome. For more information or to place an order, contact Alternatives Directory, The American Society for the Prevention of Cruelty to Animals, 424 East 92nd St., New York, NY 10128-6804.

• Wildlife Mammals as Research Models: In the Laboratory and Field

The Scientists Center for Animal Welfare (SCAW) has published the proceedings of a SCAW-sponsored conference held on July 12, 1994, in San Francisco,CA on "Wildlife Mammals as Research Models: In the Laboratory and Field." Topics covered include management of wild mammals in the laboratory; monitoring fertility and new contraception techniques in free-roaming and captive populations; ethical considerations of marking, trapping, and manipulating animals; ethics of maintaining cetaceans in captivity; and the use of positive reinforcement in enhancing animal care, research, and well-being. The volume is available for $20 per copy (6 or more copies are $15 each) from: SCAW, Golden Triangle Building One, 7833 Walker Dr., Suite 340, Greenbelt, MD 20770, Tel: (301) 345-3500, Fax: (301) 345-3503.

• New Alternatives Newsletter

The Netherlands Centre for Alternatives to Animal Use (NCA) was established in 1994 to stimulate the development, validation, and implementation of alternatives to animal experiments. The *NCA Newsletter* reviews international progress on development and evaluation of alternative methods, relevant meetings, and other noteworthy events. Newsletter subscriptions are free and available from: Netherlands Centre for Alternatives to Animal Use, Yalelaan 17, De Uithof, 3584 CL Utrecht, The Netherlands.

• Food for Thought

This video, produced by the Ontario Farm Animal Council (OFAC), addresses issues in animal agriculture including farm animal care and welfare, food safety, and agriculture and the environment. This three-segment program covers these issues by going to the experts. Farmers, inspectors, and animal scientists all comment on their areas of expertise. Footage of Canadian farms and food-testing facilities all help to illustrate how food in Canada is produced. This program also addresses common questions on farm animals and their impact on the environment, both nationally and globally. This video, which is available for Canadian $10, is a supplement to other OFAC publications: *Food for Thought: Facts about Food and Farming in Canada* and *ISSUES: Teachers Guidelines for Sensitive Issues in Agriculture and Food Production (Intermediate/Secondary level)*. For more information or to place an order, contact OFAC, 7195 Millcreek Drive, Mississauga, Ontario L5N 4H1 CANADA, Fax: (905) 858-1589.

• Heifer Project International

Volunteers in International Veterinary Assistance (VIVA) is a program of Heifer Project International (HPI), which has livestock projects in 35 countries. VIVA works in partnership with veterinarians, technicians, and village-level volunteers who are struggling to keep local animals alive, healthy, and productive. To continue this vital work, these veterinarians are asking for donations of used equipment. You can help--either through your practice, your veterinary teaching hospital, or on your own. Work with your hospital/laboratory or clinic director to recycle and clean (sterilize where appropriate) supplies that you might otherwise discard. Pack similar items together in the same box. Enclose a packing list inside each box, listing items, quantity, and size(s). Tape an envelope on the outside of each box with another packing list. Address to: HPI/VIVA, 500 Main Street, New Windsor, MD 21776, Tel: (301) 635-8740.

Equipment and supplies needed include: unused syringes, hypodermic needles (priority: 18 ga. x 1' and 1/2"; 20 ga. x 1" and 1/2"), and blood collection needles, bolus antibiotics for large animals, balling guns, scissors, scalpel handles and blades, rectal thermometers (C only), suture material, forceps, needle holders, large animal suture needles, simplex IV sets, palpation sleeves, sterile and nonsterile gloves (sizes 6-8), Rescos, hog snares, tape, hoof knives, bull leads, blood collection tubes, burdizzos, recent textbooks, emasculators, and other lab supplies (please call for guidelines).

If you have any questions, ideas, or other supplies that you feel might be useful, call Dr. Robert Pelant at (800) 422-0474 or write to the above address.

For more information on other HPI programs, contact Heifer Project International, World Headquarters, P.O. Box 808, 1015 South Louisiana, Little Rock, AR (Arkansas) 72203, USA, Tel: (800) 422-0474 or (501) 376-6836, Fax: (501) 376-8906, Telex: 4949415 HEIFER.

• Electronic Newsgroups, Gophers, and Websites

Lab Animal magazine has a new website located at http://www.mxol.com/labanimal/. The site features a searchable index of articles, monthly columns, and other items found in the print version.

PLTRYNWS is a newsgroup for those interested in the poultry industry. Topics discussed include poultry health, management, and production. To subscribe, e-mail to: listserv@sdsuvm.sdstate.edu with the body of the message containing the command: subscribe PLTRYNWS your firstname lastname.

APSAD-L is internet access to the American Psychological Association's Research Psychology Funding Bulletin. Designed to alert users to research and training funding, each file in the index summarizes recently published requests for applications (RFA), requests for proposals (RFP), and similar documents. To join, send an e-mail message to: LISTSERV@VTVM2.BITNET with the command in the text SUBSCRIBE APSAD-L your name. The bulletin board is regularly updated.

The **Primate Info Net (PIN)**, the gopher of the Wisconsin Regional Primate Research Center, now contains *Primate Library Report: Audio-Visual Acquisitions*. The report and its updates contain listings of slides, videos, audiotapes, and borrowing information. It is only available electronically. The report, primate bibliographies, newsletters, and the PrimateTalk directory are located at: gopher@primate.wisc.edu. If

you would like to receive the audiovisuals newsletter by e-mail, send your name and address to: hamel@primate.wisc.edu

Abstracts from recently published **National Toxicology Program (NTP)** and **National Institute of Environmental Health Sciences (NIEHS)** reports, the status of all NTP studies, *The Seventh Annual Report on Carcinogens* (Summary), and the *NTP Annual Plan* are available from: gopher.niehs.nih.gov or World Wide Web at: http://www.niehs.nih.gov/ntp/ntp.html

National Institutes of Health (NIH) Guide for Grants and Contracts is now available on the Internet. To subscribe to NIHDE-L, BITNET users should send mail to LISTSERV@JHUVM, and Internet users to LISTSERV@JHUVM.HCF.JHU.EDU. The text of the mail should be:

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The first and last names should be in upper and lower case, for example,

SUBSCRIBE NIHGDE-L Bill Jones

If you prefer to get only the table of contents each week and access the NIH Guide files via gopher when necessary, subscribe to the NIHTOC-L list instead. The NIH gopher is located at: gopher.nih.gov. For further information, contact: Myra Brockett, Program Analyst, Institutional Affairs Office, National Institutes of Health, Bethesda, MD 20892, Tel: (301) 496-5366, e-mail: q2c@cu.nih.gov

Alternatives in Education (ALT-ED) Database is available from the web site of the Association of Veterinarians for Animal Rights (AVAR). The address is http://envirolink.org/arrs/avar-www.htm

Updated frequently, this database cites books, journal articles, computer programs, clinical programs, and information about other resources actively used in life sciences education. It covers educational levels from primary school through special residencies in human and veterinary medicine. It also includes results of a survey of the Canadian and U.S. veterinary medical colleges in regards to alternative study tracks that minimize the use of animals. ALT-ED is distributed free to interested individuals and institutions. To obtain a copy on floppy disks, send two high-density, formatted diskettes (3.5" or 5.25") or four low-density diskettes for the Windows version; send two-high- or low-density diskettes for the MS-DOS version (this version is no longer being updated). AVAR requests a donation of $5 to defray mailing costs and to replace diskettes damaged in the mail. Send orders to Association of Veterinarians for Animal Rights, P.O. Box 6269, Vacaville, CA 95696-6269. ■

Upcoming Meetings

Society of Toxicology, March 10-14, 1996. Anaheim, CA. Contact: (202) 371-1393.

ARENA (Applied Research Ethics National Association) and PRIM&R Annual Meetings, March 13-15, 1996. Boston, MA. Contact: (617) 423-4112.

National Science Teachers Association Annual National Meeting, March 28-31, 1996. St. Louis, MO. Contact: (703) 312-9221.

AZA Eastern Regional Conference, April, 10-13, 1996. Greenville, SC. Contact: (803) 467-4300 - Bob Wilson.

FASEB (Federation of American Societies for Experimental Biology), April 14-18, 1996. Washington, DC. Contact: (301) 530-7010.

AALAS (American Association for Laboratory Animal Sciences) District IV Annual Meeting, April 17-19, 1996. Knoxville, TN. Contact:(901) 754-8620.

The Association for Research in Vision & Ophthalmology, April 21-26, 1996. Fort Lauderdale, FL. Contact: (301) 571-1844.

33rd Annual Upstate NY Branch of AALAS Meeting - "Working Safely with Laboratory Animals," May 9-10, 1996. Saratoga Springs, NY. Contact: (607) 335-2643, Fax: (607) 335-3095 - Kim Edgar.

AZA Western Regional Conference, May 15-18, 1996. Denver, CO. Contact: (303) 331-5805 - Angela Baier.

American Society of Microbiology, May 19-23, 1996. New Orleans, LA. Contact: (202) 737-3600.

World Congress on In Vitro Biology, June 22-26, 1996, San Francisco, CA. Contact: (410) 992-0946.

The Internationalization of Veterinary Education 14th Symposium: Strengths, Challenges, and Opportunities, June 29 - July 1, 1996. Athens, GA. Contact: (706) 542-5728.

CALAS (Canadian Association of Laboratory Animal Science) Annual Meeting, July 8-10, 1996. Charlottetown, Prince Edwards, Canada. Contact: (403) 492-5193, Fax (403) 492-7257, e-mail: dmckay@gpu.srv.ualberta.ca

American Veterinary Medical Association Annual Meeting, July 20-24, 1996. Louisville, KY. Contact: (708) 925-8070.

American Society of Animal Science 88th Annual Meeting, July 22-26, 1996. Rapid City, SD. Contact: (217) 356-3182, Fax: (217) 398-4119, e-mail: mollyk@adsa.org

American Institute for Biological Science, August 4-8, 1996. Seattle, WA. Contact: (202) 628-1500

American Psychological Association, August 9-13, 1996. Toronto, Canada. Contact: (202) 336-5500.

Society of Research Administrators Annual Meeting, October 6-9, 1996. Toronto, Canada. Contact: (202) 857-1141.

National Association of Biology Teachers (NABT) Annual Meeting, October 16-19, 1996. Charlotte, NC. Contact: (703) 471-1134

2nd World Congress on Alternatives and Animal Use in the Life Sciences, October 20-24, 1996. Utrecht , The Netherlands. Contact: +31.30.53.5044/2728, Fax: +31.30.53.3667 or e-mail: l.donkers@pobox.ruu.nl

American College of Toxicology Annual Meeting, November, 10-13, 1996. Valley Forge, PA. Contact: (301) 571-1840, Fax: (301) 571-1852.

National AALAS Annual Meeting, November 3-7, 1996. Minneapolis, MN. Contact: (901) 754-8620.

American Heart Association Annual Meeting, November 11-14, 1996. New Orleans, LA. Contact: (214) 706-1230.

Society for Neuroscience Annual Meeting, November 16-21, 1996. Washington, DC. Contact: (202) 462-6688.

Association of American Medical Colleges Annual Meeting, San Francisco, CA.November 6-12, 1996. Contact: (202) 828-0400.

FASEB International Congress for Cell Biology, December 7-11, 1996. San Francisco, CA. Contact: (301) 530-7010. ■

Grants...

• Call for CAAT Research Proposals

The Johns Hopkins Center for Alternatives to Animal Testing (CAAT) is soliciting proposals for the 1997-1998 grant period. These proposals should provide fundamental knowledge needed to develop replacement alternative tests for safety/hazard evaluation, risk assessment, and efficacy of commercial products.

We encourage the investigation of in vitro approaches to evaluating cellular and target organ toxicity. Some examples are: developing new cell culture systems, applying current testing methods to human cells/cell lines, and designing new, mechanistic, state-of-the-art methods that may use cultured cells, computer technology, or any other system applicable to toxicity/efficacy evaluation. At the present time, CAAT does not fund projects relating to carcinogenicity or mutagenicity, or those not focused on developing testing strategies.

Applications must be placed on a CAAT Preproposal Abstract Form (97-98). To obtain this form, write to Ann Kerr, CAAT, 111 Marketplace, Suite 840, Baltimore, MD 21202-6709, Tel: (410) 223-1693, Fax: (410) 223-1603. Deadline for submission of preproposal abstracts is March 8, 1996.

• Wards Offering $10,000 in Grants for Refinement Work

Working for Animals used in Research, Drugs and Surgery (WARDS) will be providing up to four awards totalling $10,000 for individuals conducting alternatives work focusing on refinement.

To be considered, applicants must submit a detailed, triple-spaced (unpublished) manuscript which explains how pain and distress (these factors are not synonymous) were reduced, the criteria for their chosen refinement pursuit and the anticipated impact of their achieved results.

The study must have involved experimental procedures (not husbandry practices) using rodents or rabbits. Manuscripts will be reviewed by WARDS and a five-person panel of experts. For further information, contact Christopher Byrnes at 202-785-0423 or 1-800-876-5572.

Material must be sent by June 15, 1996 to : WARDS Refinement Project, c/o WARDS, P.O. Box 25249, Arlington, VA 22202-9249.

• Call for 3R Research Proposals

The Swiss FOUNDATION RESEARCH 3R promotes research to reduce, replace, and refine the use of animals in biomedical tests. A total of 900,000 Swiss francs are presently available. Research grants are issued on a competitive basis with preference given to projects promising applicability in the near future. The funding priorities include new testing models for therapy of arthritis, anticonvulsive therapy, antimicrobial prophylaxis and therapy, and therapy of septic shock. No official application form is requested. Deadline for submission of proposals is March 1, 1996. For more information contact R. Greber at: Tel: 031-323 83 83, Fax: 031-323 85 70, e-mail: greber@ivi.ch. For more information about FOUNDATION RESEARCH 3R or to subscribe to 3R-Info-Bulletin, contact STIFTUNG FORSCHUNG 3R, Secretariate, P.O. Box 149, 3110 Münsingen, Switzerland, Tel: 031-721 50 51, Fax: 031-721 50 80.

• National Science Foundation Animal Behavior Grants

The Animal Behavior Program supports research on mechanisms, development, functions, and evolution of behavior, studied observationally and experimentally in laboratory and natural settings. Areas include animal learning, behavioral ecology, and the environmental, genetic, motivational, and cognitive processes underlying the behavior of animals. Interdisciplinary collaborations and other projects that integrate diverse approaches to the study of behaviors are particularly encouraged. Eligible recipients must be U.S. citizens or permanent residents. The awards, up to $10,000, are to be used to support research activities only. For more information, contact Ronald Barfield, Animal Behavior Program, National Science Foundation, Arlington, VA 22230, Tel: (703) 306-1419, e-mail: rbarfiel@nsf.gov

• Theodore Roosevelt Memorial Fund (American Museum of Natural History)

This fund provides support for research on North American fauna, except birds. Consumable supplies, living expenses in the field or at a research station, and travel expenses are most commonly supported. Permanent equipment, salary for the principal investigator, overhead, and conference or meeting costs are not supported. Awards average $700 but may be made up to $2,000. For more information or an application form, contact Theodore Roosevelt Memorial Fund, American Museum of Natural History, 79 Canal Street and Central Park West, New York, NY 10024.

• Frank M. Chapman Memorial Fund (American Museum of Natural History)

This fund provides support for ornithological research anywhere in the world. Consumable supplies, living expenses in the field or at a research station, and travel expenses are most commonly supported. Permanent equipment, salary for the principal investigator, overhead, and conference or meeting costs are not supported. Awards average $700 but may be made up to $2,000. For more information or an application form, contact Frank M. Chapman Memorial Fund, American Museum of Natural History, 79 Canal Street and Central Park West, New York, NY 10024.

• Lerner-Gray Fund for Marine Research (American Museum of Natural History)

This fund provides support for research on marine zoology with an emphasis on systematics, evolution, ecology, and field-oriented behavior. It does not support botany. Consumable supplies, living expenses in the field or at a research station, and travel expenses are most commonly supported. Permanent equipment, salary for the principal investigator, overhead, and conference or meeting costs are not supported. Awards average $700 but may be made up to $2,000. For more information or an application form, contact Lerner-Gray Fund for Marine Research, American Museum of Natural History, 79 Canal Street and Central Park West, New York, NY 10024.

- **Southwestern Research Station (American Museum of Natural History)**

This fund supports graduate students or postdoctoral researchers pursuing research at the Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona. Awards range between $400 - $800. For more information or an application form, contact Office of Grants and Fellowships, American Museum of Natural History, 79 Canal Street and Central Park West, New York, NY 10024. For questions concerning the research station, contact Dr. Wade Sherbrooke, Director, Southwestern Research Station, Portal, AZ 85632, Tel: (602) 558-2396.

- **Biological Research Station of the Edmund Niles Huyck Preserve**

This fund supports biological research that uses the resources of the preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2,000-acre preserve is located on the Helderberg Plateau, near Albany, New York. Habitats include northeast hardwood-hemlock forest, conifer plantations, old fields, permanent and intermittent streams, 10- and 100-acre lakes, and several waterfalls. Facilities include laboratories, library, and houses/cabins for researchers. Awards may total to $2,500. For an application form or more information, contact Dr. Richard Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, NY 12147.

- **Geraldine R. Dodge Foundation**

The Foundation supports a variety of activities that enhance the welfare of animals. For more information, contact Scott McVay, 95 Madison Ave., P.O. Box 1239, Morristown, NJ 07960.

- **Winn Feline Grants**

The Winn Feline Foundation is a nonprofit organization, affiliated with The Cat Fanciers' Association, Inc., which supports research into medical problems affecting cats. The foundation has sponsored studies in areas such as catteries, hypertrophic cardiomyopathy, heparin therapy, asthma, commercial vaccine component examination, and critical illness survival prediction. The maximum grant amount is $15,000. For more information, contact The Winn Feline Foundation, 1805 Atlantic Ave., P.O. Box 1005, Manasquan , NJ 08736-0805, Tel: (908) 528-9797.

- **Dr. Hadwen Trust for Humane Research**

The mission of the Dr. Hadwen Trust is to advance the development and acceptance of nonanimal techniques to replace animal experiments in medical research. It funds research used for development of alternative techniques in education, research, and testing. For additional information, contact Dr. Hadwen Trust for Humane Research, 22 Bancroft, Hitchin, Herts SG5 1JW England, Tel: 01462 436819.

- **Esther A. and Joseph Klingenstein Fund, Inc.**

This program funds educational activities promoting appropriate animal use in biomedical research. For more information, contact the fund at 787 Seventh Ave., 6th Floor, New York, NY 10019-6016, Tel: (212) 492-6181, Fax: (212) 492-7007.

- **Clinical Neuroscience of Drug Abuse and Addiction, PA-95-089**

The National Institute on Drug Abuse (NIDA) is supporting a major neuroscience initiative that targets newly developing technologies designed for study of human subjects, autopsy material, or, in appropriate circumstances, animal models. The NIDA invites applications to use current, or to develop new, noninvasive techniques to assess neuroanatomical, neurophysiological, neurochemical, or functional differences in human brain that (1) result from consequences of drug use; (2) indicate individuals' vulnerabilities to initiate and escalate drug use into abuse or addiction; or (3) result from pharmacological or nonpharmacological treatment. The PA, which describes the research objectives, application procedures, and award criteria for this solicitation may be obtained electronically through the NIH Grant Line (data line (301) 402-2221) and the NIH gopher (gopher.nih.gov) and by mail and e-mail from Roger Brown, Ph.D., Division of Basic Research, National Institute on Drug Abuse, 5600 Fishers Lane, Room 10A-19, Rockville, MD 20857, Tel: (301) 443-6975, e-mail: rbrown1@aoda.ssw.dhhs.gov

- **Research on Atherosclerosis Lesions Using Human Tissues Collected in PDAY/RFEHA, PA-95-085**

The Division of Heart and Vascular Diseases, National Heart, Lung, and Blood Institute (NHLBI) announces a program to support research on atherosclerosis lesions using human tissues collected in the Pathobiological Determinants of Atherosclerosis in Youth/Risk Factors in Early Human Atherogenesis (PDAY/RFEHA) program. These specimens are suitable for use to investigate cellular and molecular factors that may be implicated in the initiation and progression of atherosclerotic lesions. The PA, which describes the research objectives, application procedures, and award criteria for this solicitation may be obtained electronically through the NIH Grant Line (data line (301) 402-2221) and the NIH gopher (gopher.nih.gov) and by mail and e-mail from Momtaz Wassef, Ph.D., Division of Heart and Vascular Diseases, NHLBI, Two Rockledge Center, Suite 10193, 6701 Rockledge Drive, Bethesda, MD 20892-7956, Tel: (301) 435-0550, Fax: (301) 480-2858, e-mail: MOMTAZ_WASSEF@NIH.GOV ■

AWIC's E-mail Address Changes

Our new e-mail address is awic@nal.usda.gov

AWIC Workshop

"Meeting the Information Requirements of the Animal Welfare Act."

The Animal Welfare Information Center (AWIC) of the U.S. Department of Agriculture, National Agricultural Library (NAL) has developed a 2-day workshop for individuals who are responsible for providing information to meet the requirements of the Animal Welfare Act. The workshops will be held at NAL in Beltsville, Maryland.

The act requires that investigators provide Institutional Animal Care and Use Committees (IACUC) with documentation demonstrating that a thorough literature search was conducted regarding alternatives. An alternative is any procedure that results in the reduction in the numbers of animals used, refinement of techniques, or replacement of animals.

The objectives of the workshop are to provide:

- an overview of the Animal Welfare Act and the information requirements of the act.
- a review of the alternatives concept.
- a comprehensive introduction to NAL, AWIC, and other organizations.
- instruction on the use of existing information databases/networks.
- online database searching experience.

This workshop is targeted for principal investigators, members of IACUC's, information providers, administrators of animal use programs, and veterinarians. All participants will receive a resource manual.

Workshops will be held on April 4-5, August 1-2, and November 14-15, 1996. Each workshop will be limited to 20 people. There is presently no fee for the workshop.

For more information, contact AWIC at Tel: (301) 504-6212, Fax: (301) 504-7125, or e-mail: awic@nal.usda.gov, or write to:

Animal Welfare Information Center, U.S. Department of Agriculture, National Agricultural Library, 10301 Baltimore Boulevard, Beltsville, MD 20705-2351

United States Department of Agriculture
Agricultural Research Service
National Agricultural Library
AWIC Newsletter Staff
10301 Baltimore Blvd.
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ANIMAL WELFARE INFORMATION CENTER NEWSLETTER
ISSN 1050-561X

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