NASA Animal Enclosure Module Mouse Odor Containment Study for STS-107 September 15, 1999; SJSU Odor Panel Data

Final sub-project report for NASA COOPERATIVE AGREEMENT NCC2-1136.

February 29, 2000

Daniel C. Holley, Ph.D., Gary D. Mele, M.S., Mary Poffenroth, and Cliff Young

Department of Biological Sciences
San Jose State University
1 Washington Square
San Jose, CA 95192-0100

INTRODUCTION

Experiment #153 by Scott Brady is manifested for shuttle flight STS-107. This evaluation of space flight induced stress and its effects on neuronal plasticity will use 18 six month old C57B1/6 male mice. A 21 day evaluation study was proposed to determine the length of time groups of 6, 9, or 12 mice could be housed in the Animal Enclosure Module (AEM) without odor breakthrough. This study was performed at NASA-Ames Research Center beginning on September 15 1999. NASA personnel, under the direction of Project Scientist, Marilyn Vasques, were responsible for animal care, maintenance, facilities, hardware, etc. San Jose State personnel, under the direction of Professor Dan Holley, performed the odor panel evaluations and data reduction. We used similar procedures and methods for earlier tests evaluating female mice (see Holley et al., 1995a, 1995b, and 1996).

MATERIALS AND METHODS

Mice, Food, and Cages

On test day 0, September 15, 1999, NASA personnel placed a total of 60 mice into seven AEMs. All used standard rat flight filters. Three flight AEMs, S/N (serial number) 007, S/N 008, and S/N 009 were loaded with 6 mice and 405 grams of food bars each and placed at, station # 1 in room 136A, station # 5 in room 136B, and Station # 12 in room 136D, respectively. Two flight AEMs, S/N 001 and S/N 102 were loaded with 9 mice and 630 grams of food bars each and placed at station # 10 in room 136D and station # 8 in room 136B respectively. Two flight AEMs, S/N 003 and S/N 004 were loaded with 12 mice and 765 grams of food bars each and placed at station #7 in room 136B and station #11 in room 136D, respectively. One flight AEM, S/N 002 and three other AEMs, S/N SJSU, S/N CT, and S/N ENG were loaded with 0 mice and 765 grams of food bars and placed at Station #2 in room 136A, station #4 in room 136A, station #6 in room 136B, and station #9 in room 136D, respectively as control for food bar odors. One flight AEM, S/N 101 was loaded with 0 mice and 630 grams of food bars on each cage side, and placed at Station #3 in room 136A.

Animal Rooms

The AEMs were housed in building 240A in rooms 136A, 136B, and 136D.

Odor Panel

1. Qualification

Odor panel qualifications and evaluations were performed in accordance with procedures defined in NASA document # AW-02306, <u>Assessment of Animal Odor Containment: Test Requirements</u>. All members of the odor panel qualified for the panel by identifying three water blanks in a set of seven primary odor standards (Table 1) and three blanks. On every odor test day each panel member was required to correctly identify the blank vial in a set of three glass 20 ml liquid scintillation vials (one blank, and two primary standard odor solutions). Odor scores for panel members failing the 3 sample test were not included in the statistical analysis.

2. Test Procedures

A physicians assistant, Jeff Cooper, performed a nasopharyngeal examination of all panel members each test day. He noted whether the nasal passage, mouth and pharynx were of normal or abnormal appearance and recorded comments. He also answered the question; "Any other indications that the subject may not be capable of participating in an odor test panel?".

On test days 0 through 9, an 18–22 person odor panel evaluated the outlet air of the seven occupied AEMs, five unoccupied odor control AEMs, and three standard odor solutions in 20 ml glass liquid scintillation vials (one blank, and two primary standards). Standard solutions were diluted with Millipore brand ultra pure water (resistivity > 10 megohm-cm). Evaluations by panel members took place from 0700-0800h. *Heavy fabric concealed the AEM contents from view during odor panel evaluations.* Panel members rated odors by assigning them a score from 0 to 4. Scores were recorded by circling the appropriate number on a Medical Questionnaire/ Odor Rating Sheet. The score sheet contained the following list of odor score definitions: 0 - Undetectable, 1 - Barely Detectable, 2 - Easily Detectable, 3 - Objectionable (Disagreeable), 4 - Revolting (extremely offensive) (NASA, NHB 8060.1C).

3. Odor Score Statistical Evaluation

Odor scores were first divided into two score classes, 0-1 and 2-4. This separated scores into one group for odors that were, at most, barely detectable, and a second group for odors that were, at least, easily detectable. Classed odor score frequencies were determined by counting the number of scores in each score class for each test day. For each test day, a 2 by 2 test of independence using the G test (Sokal and Rohlf, 1981) compared the classed odor score frequencies of the occupied Test Enclosures to those of the unoccupied Test Enclosure. Results from the independence tests were considered significant for $P < .05$. A significant result meant that the number of low (0 or 1) and high (2, 3, or 4) odor scores differed between an occupied cage and the unoccupied cage . [Note: the G test, a goodness of fit test, is similar to but more accurate than chi-square analysis.]

RESULTS

Odor Panel

Table 2 through Table 4 show demographic and participation information for this odor test panel. A total of 23 individuals participated in 10 odor tests. *Seventeen odor panel members were present for at least 9 of the 10 tests; 14 subjects were present for all 10 tests* (see Table 3).

Data

Table 5 shows daily odor score frequency data (i.e., number of subjects recording a given score) for the odor standards and for each AEM. It also lists numbers of mice per AEM, and grams of food bars per AEM.

Table 7 shows the odor test score frequencies grouped into the ranges 0-1 versus 2-4. Table 8 lists the results of the 2 by 2 independence tests.

Independence test results comparing occupied AEMs to an unoccupied AEM in the same room (Table 8) showed that the assignment of high and low scores was <u>not</u> independent of the presence of mice for several AEMs on several days.

3

AEM #007 (6 mice) differed from the control on test days 5-9 using cage #101 (0 mice) as the control. When cage #007 (6 mice) was compared to control cage #002 (0 mice), it differed on days 6-9. However, when the same cage #007 (6 mice) was compared to cage #SJSU (0 mice), it was different from the control only on test day 9. The other cage with 6 mice AEM #009 was different from its control only on day 3.

AEM #102 (9 mice) was higher than the control only on test day 3. AEM #001 (9 mice) differed from its control on test days 6-8 (note mice were removed from this cage after the odor panel sampled on day 7.

AEM #003 (12 mice) was higher than the control only on test day 6. AEM #004 (12 mice) differed from the control on test days 6-9.

DISCUSSION

There has been an ongoing debate among individuals involved in evaluating efficiency of AEM exhaust filters to contain odors. This debate centers around the criteria (or rules) to be used to classify filter failure. In past testing, failure has been specified when a qualified AEM odor panel mean score was greater than some arbitrary number (e.g., 1.5). To get away from an arbitrary numerical cut-off level, a statistical independence test based on odor score frequencies was chosen (see NASA document #AW-02306, Assessment of Animal Odor Containment: Test Requirements). This non-parametric evaluation indicates when the scores of two cages are statistically different. Since a difference is indicated if the scores differ (either higher or lower than the control, it is important to check mean scores when a significant difference is indicated. We accepted a "statistical difference" designation when the test cage odor score was higher than it's appropriate control cage. In other words, when the test cage odor score is higher than the control, then the cage is said to have failed to contain odor. However, because odor scores can fluctuate from day to day, in the current test, a cage had to be statistically different (per the G test) for two days in a row to be classified a "failure".

Therefore, using the criteria of statistical failure (from the independence, or "G" test) for 2 days in a row, the pass/fail classifications are:

<u>I. Cages with 6 mice.</u>

#008 (6 mice, room B) vs. control #CT	pass
#009 (6 mice, room D) vs. control #ENG	pass (high only on day 3)
#007 (6 mice, room A) vs. control #101	failed on day 6
#007 (6 mice, room A) vs. control #002	failed on day 7
#007 (6 mice, room A) vs. control SJSU	pass (high only on day 9)

Summary 6 animal density: Inconclusive. [Even though cages with 6 mice passed in rooms 136B and 136D, because cage #007 in room 136A can be shown to either pass or fail depending on which of the 3 "control" cages in the same room it is compared, the overall outcome is inconclusive (see discussion of multiple control comparisons below]

<u>II. Cages with 9 mice.</u>

#102 (9 mice, room B) vs. control #CT	pass (high only on day 3)
#001 (9 mice, room D) vs. control #ENG	Inconclusive, since high on d 6 and 7, but rats removed on d 6

Summary 9 animal density: Inconclusive, since one cage passed and one cage was inconclusive.

<u>III. Cages with 12 mice.</u>

#003 (12 mice, room B) vs. control #CT	pass (high only on day 6)
#004 (12 mice, room D) vs. control #ENG	failed on day 7

Summary 12 animal density: Failed, since one cage passed and one cage failed.

Interpretation of these results is confounded by two observations. 1) The 3 empty control cages in room 136 A (#SJSU, #101, and #002) produced different results for cage #007 (6 mice), and 2) in each animal density group (6, 9, 12) at least one cage failed or was inconclusive due to some confounding occurrence.

Per confounding observation #2 (above), failure may be related to some unique aspect of the cage/filter configuration or it may be related to the animals themselves including some unknown aspect of animal behavior. Given the information available to the SJSU team at this time, no conclusion can be drawn. It is recommended that each filter be dissected to search for any cage/filter factors that may have contributed to the current findings.

Per item #1 (above) dealing with the differences in the unoccupied cages in room A: Cage #007 (6 mice) can be shown to fail or pass depending on which control it is compared. We attempted to evaluate empty cages among the various rooms by running the independence test evaluation on control (empty cage) pairs. The lower section of Table 8 shows these comparisons. Differences were found in only 8 of 100 paired comparisons, and no pattern was obvious. It was therefore, concluded that the empty cages (controls) in the various rooms were similar.

We attempted to determine which of the 3 control cages in room A was "most like" the controls in the other two rooms. To do this we summed the G scores from independence test control cage (0 mice) pairs (see Appendix B):

#101 vs. #CT (16.32) and #101 vs. #ENG (16.38) =	32.7
#002 vs. #CT (14.38) and #002 vs. #ENG (8.20) =	22.6
#SJSU vs. #CT (1.47) and #SJSU vs. #ENG (15.39)	16.86

Our reasoning is that the lower the G score sums, the less different the pairs.

From this result it can be concluded that the control cage #SJSU was most similar to controls in the other two rooms. Therefore, if the control cage #SJSU is used to evaluate cage #007 (six mice), then cage #007 would be shown to not fail. This would then lead to the conclusion that the 6 animal density group would not fail over this 9 day test.

REFERENCES

Holley, D.C., S. Naidu, and G.D. Mele. 1995a. NASA Animal Enclosure Module Mouse Qualification, Phase 3, January-'95. Final sub-project report for NASA Cooperative Agreement #NCC2-779.

Holley, D.C., S. Naidu, and G.D. Mele. 1995b. NASA Animal Enclosure Module Mouse Qualification, Phase 4, April-'95. Final sub-project report for NASA Cooperative Agreement #NCC2-779.

Holley, D.C., S. Naidu, and G.D. Mele. 1996. NASA Animal Enclosure Module Mouse Qualification, Phase 5, October-'95. Final sub-project report for NASA Cooperative Agreement #NCC2-779.

National Aeronautics and Space Administration. Handbook NHB 8060.1C: Office of Safety and Mission Quality. Flammability, Odor, Off gassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion. April, 1991.

Sokal, R. R and F. J. Rohlf. 1987. Introduction to Biostatistics (second edition). W. H. Freeman and Company, New York. pp 691-747.

Table 1. Primary Odor Standards.

Odor	Standard compound*	Dilution in Water**
Ether	Diethyl ether	90 µl/333 ml
Camphor	1, 8-Cineole	5 µl/500 ml
Musk	15-Hydroxypentadecanoic acid lactone	1 mg/1000 ml
Floral	1-Methyl-1-ethyl-2-phenyl propanol-1	75 µl/500 ml
Mint	Menthone (dl)	2 µl/333 ml
Pungent	Acetic Acid	2 ml/333 ml
Putrid	Methyl disulfide	1 µl/10 L

* - From NASA NHB 8060.1C.
** - Highly purified water (resistivity > 10 megohm-cm)

Dilution procedure for 100 ml sub stock

Odor	Chemical Name (from packaging)	1st dilution**	2nd Dilution**
Ether	Ether, anhydrous	27.0 µl/100 ml	
Camphor	Cineole (Eucalyptol)	0.1 ml/10 ml	0.1 ml/100 ml
Musk	15-Hydroxypentadecanoic acid lactone	10 mg/10 ml	0.1 ml/100 ml
Floral	ß-Phenylethylmethylethylcarbinol	15 µl/100 ml	
Mint	Menthone	60 µl/10 ml	0.1 ml/100 ml
Pungent	Acetic acid, glacial	0.6 ml/100 ml	
Putrid	Dimethyl disulfide (2,3-Dithiabutane)	10 µl/10 ml	10 µl/100 ml

Chemical suppliers

Odor	Order Name (from catalog)	Amount	Purity	Order Number	Supplier
Ether	Ether, anhydrous	250 ml	>99.0%	9244-01	Baker
Camphor	Cineole	100 ml		C-8144	Sigma
Musk	15-Pentadecanolide	1 g		P-5909	Sigma
Floral	ß-Phenylethylethylmethyl carbinol	100 g		217384	ICN
Mint	Menthone	100 ml	>97%	63680	Fluka
Pungent	Acetic acid, glacial	500 ml	>99.7%	9508-01	Baker
Putrid	Dimethyl disulfide	100 ml	>99%	D-8501	Sigma

Fluka Chemical
980 South Second St.
Ronkonkoma, NY 11779

ICN Biomedicals, Inc.
3300 Hyland Ave
P. O. Box 5023
Costa Mesa, CA 92626

J. T. Baker
222 Red School Lane
Phillipsburg, NJ 08865

Sigma Chemical Co.
P. O. Box 14508
St. Louis, MO 63178

Table 2. Number of odor evaluations performed by each odor panel member. Panel member sex and age.

Tester #	Total Tests	Passed Standards Test	Failed Standards Test	Sex	Age
A1	10	10	0	M	35
A2	7	7	0	F	29
A3	4	4	0	M	36
A4	10	10	0	F	21
A5	10	9	1	F	52
A6	10	3	7	F	42
A7	10	10	0	M	46
A8	10	10	0	F	50
A9	9	9	0	M	44
A10	10	10	0	F	37
A11	10	6	4	F	37
A12	2	2	0	F	45
A13	10	8	2	F	56
A14	9	9	0	M	32
A15	10	6	4	M	38
A16	10	10	0	M	21
A17	10	10	0	M	22
A18	6	6	0	F	29
A19	10	9	1	F	39
A20	10	9	1	M	57
A21	8	8	0	F	32
A22	9	5	4	M	19
A23	1	1	0	F	72

Table 3. Number of panel members performing a specific number of odor evaluations.

Number of tests performed	1	4	6	7	8	9	10
Number of panel members	1	1	2	1	1	3	14

Table 4. Total number of odor panel members present and the number of panel members who correctly identified the two odor standards and blank.

Test Day Number	0	1	2	3	4	5	6	7	8	9
Panel Members Present	20	22	21	21	19	20	20	19	19	18
Panel Members Passing Test	19	19	19	17	15	18	16	16	18	18

Table 5. Daily odor score frequencies for odor standards and AEMs. Number of mice, and grams of food bars per cage side are shown in parenthesis.

	Odor Score						
Day 0 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	19	0	0	0	0	0.0	0.0
standard2	0	0	15	3	1	2.3	0.1
standard3	0	1	11	6	1	2.4	0.2
#101 (136A, 0 mice, 630 grams)	9	6	4	0	0	0.7	0.2
SJSU (136A, 0 mice, 765 grams)	5	12	1	1	0	0.9	0.2
#002 (136A, 0 mice, 765 grams)	9	9	1	0	0	0.6	0.1
#CT (136B, 0 mice, 765 grams)	8	7	3	0	1	0.9	0.2
#ENG (136D, 0 mice, 765 grams)	10	8	0	1	0	0.6	0.2
#007 (136A, 6 mice, 405 grams)	11	8	0	0	0	0.4	0.1
#008 (136B, 6 mice, 405 grams)	8	9	2	0	0	0.7	0.2
#009 (136D, 6 mice, 405 grams)	5	11	3	0	0	0.9	0.2
#102 (136B, 9 mice, 630 grams)	14	5	0	0	0	0.3	0.1
#001 (136D, 9 mice, 630 grams)	10	7	2	0	0	0.6	0.2
#003 (136B 12 mice, 765 grams)	8	9	2	0	0	0.7	0.2
#004 (136D 12 mice, 765 grams)	10	7	1	1	0	0.6	0.2

	Odor Score						
Day 1 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	0	12	6	1	2.4	0.1
standard2	0	1	16	1	1	2.1	0.1
standard3	19	0	0	0	0	0.0	0.0
#101 (136A, 0 mice, 630 grams)	11	7	0	1	0	0.5	0.2
SJSU (136A, 0 mice, 765 grams)	3	12	3	1	0	1.1	0.2
#002 (136A, 0 mice, 765 grams)	8	10	1	0	0	0.6	0.1
#CT (136B, 0 mice, 765 grams)	3	12	3	0	1	1.2	0.2
#ENG (136D, 0 mice, 765 grams)	7	11	1	0	0	0.7	0.1
#007 (136A, 6 mice, 405 grams)	4	11	3	1	0	1.1	0.2
#008 (136B, 6 mice, 405 grams)	9	8	2	0	0	0.6	0.2
#009 (136D, 6 mice, 405 grams)	3	13	2	0	1	1.1	0.2
#102 (136B, 9 mice, 630 grams)	8	9	1	1	0	0.7	0.2
#001 (136D, 9 mice, 630 grams)	4	10	4	1	0	1.1	0.2
#003 (136B 12 mice, 765 grams)	6	10	1	1	1	1.0	0.2
#004 (136D 12 mice, 765 grams)	11	7	1	0	0	0.5	0.1

Table 5 continued. Daily odor score frequencies for odor standards and AEMs.
Number of mice, and grams of food bars per cage side are shown in parenthesis.

	Odor Score						
Day 2 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	1	9	9	0	2.4	0.1
standard2	0	1	16	2	0	2.1	0.1
standard3	19	0	0	0	0	0.0	0.0
#101 (136A, 0 mice, 630 grams)	11	6	1	1	0	0.6	0.2
SJSU (136A, 0 mice, 765 grams)	3	13	2	0	1	1.1	0.2
#002 (136A, 0 mice, 765 grams)	13	5	1	0	0	0.4	0.1
#CT (136B, 0 mice, 765 grams)	7	9	2	1	0	0.8	0.2
#ENG (136D, 0 mice, 765 grams)	5	13	0	1	0	0.8	0.2
#007 (136A, 6 mice, 405 grams)	6	9	3	1	0	0.9	0.2
#008 (136B, 6 mice, 405 grams)	9	8	2	0	0	0.6	0.2
#009 (136D, 6 mice, 405 grams)	4	10	4	1	0	1.1	0.2
#102 (136B, 9 mice, 630 grams)	10	6	2	1	0	0.7	0.2
#001 (136D, 9 mice, 630 grams)	6	9	4	0	0	0.9	0.2
#003 (136B 12 mice, 765 grams)	7	9	2	0	1	0.9	0.2
#004 (136D 12 mice, 765 grams)	13	5	1	0	0	0.4	0.1

	Odor Score						
Day 3 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	0	10	7	0	2.4	0.1
standard2	0	1	13	2	1	2.2	0.2
standard3	17	0	0	0	0	0.0	0.0
#101 (136A, 0 mice, 630 grams)	12	4	1	0	0	0.4	0.1
SJSU (136A, 0 mice, 765 grams)	5	8	3	1	0	1.0	0.2
#002 (136A, 0 mice, 765 grams)	12	5	0	0	0	0.3	0.1
#CT (136B, 0 mice, 765 grams)	8	5	3	1	0	0.8	0.2
#ENG (136D, 0 mice, 765 grams)	5	11	1	0	0	0.8	0.1
#007 (136A, 6 mice, 405 grams)	4	8	4	1	0	1.1	0.2
#008 (136B, 6 mice, 405 grams)	11	5	1	0	0	0.4	0.1
#009 (136D, 6 mice, 405 grams)	2	9	5	0	1	1.4	0.2
#102 (136B, 9 mice, 630 grams)	11	6	0	0	0	0.4	0.1
#001 (136D, 9 mice, 630 grams)	3	11	3	0	0	1.0	0.1
#003 (136B 12 mice, 765 grams)	6	6	4	1	0	1.0	0.2
#004 (136D 12 mice, 765 grams)	11	5	1	0	0	0.4	0.1

Table 5 continued. Daily odor score frequencies for odor standards and AEMs. Number of mice, and grams of food bars per cage side are shown in parenthesis.

Day 4 odor evaluation	Odor Score					Mean	Std Err
	0	1	2	3	4		
standard1	0	10	5	0	0	1.3	0.1
standard2	15	0	0	0	0	0.0	0.0
standard3	0	8	6	1	0	1.5	0.2
#101 (136A, 0 mice, 630 grams)	8	5	2	0	0	0.6	0.2
SJSU (136A, 0 mice, 765 grams)	5	7	3	0	0	0.9	0.2
#002 (136A, 0 mice, 765 grams)	10	4	1	0	0	0.4	0.2
#CT (136B, 0 mice, 765 grams)	4	8	2	0	1	1.1	0.3
#ENG (136D, 0 mice, 765 grams)	7	5	3	0	0	0.7	0.2
#007 (136A, 6 mice, 405 grams)	7	4	2	2	0	0.9	0.3
#008 (136B, 6 mice, 405 grams)	6	4	3	2	0	1.1	0.3
#009 (136D, 6 mice, 405 grams)	5	8	1	1	0	0.9	0.2
#102 (136B, 9 mice, 630 grams)	9	5	1	0	0	0.5	0.2
#001 (136D, 9 mice, 630 grams)	8	4	3	0	0	0.7	0.2
#003 (136B 12 mice, 765 grams)	5	8	2	0	0	0.8	0.2
#004 (136D 12 mice, 765 grams)	10	4	1	0	0	0.4	0.2

Day 5 odor evaluation	Odor Score					Mean	Std Err
	0	1	2	3	4		
standard1	0	10	8	0	0	1.4	0.1
standard2	18	0	0	0	0	0.0	0.0
standard3	0	13	5	0	0	1.3	0.1
#101 (136A, 0 mice, 630 grams)	10	8	0	0	0	0.4	0.1
SJSU (136A, 0 mice, 765 grams)	4	10	3	1	0	1.1	0.2
#002 (136A, 0 mice, 765 grams)	11	5	2	0	0	0.5	0.2
#CT (136B, 0 mice, 765 grams)	6	8	3	0	1	1.0	0.2
#ENG (136D, 0 mice, 765 grams)	8	7	2	1	0	0.8	0.2
#007 (136A, 6 mice, 405 grams)	1	11	4	2	0	1.4	0.2
#008 (136B, 6 mice, 405 grams)	7	7	3	1	0	0.9	0.2
#009 (136D, 6 mice, 405 grams)	4	11	3	0	0	0.9	0.2
#102 (136B, 9 mice, 630 grams)	2	12	3	1	0	1.2	0.2
#001 (136D, 9 mice, 630 grams)	3	13	2	0	0	0.9	0.1
#003 (136B 12 mice, 765 grams)	2	7	8	1	0	1.4	0.2
#004 (136D 12 mice, 765 grams)	8	3	5	2	0	1.1	0.3

Table 5 continued. Daily odor score frequencies for odor standards and AEMs. Number of mice, and grams of food bars per cage side are shown in parenthesis.

	Odor Score						
Day 6 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	5	11	0	0	1.7	0.1
standard2	16	0	0	0	0	0.0	0.0
standard3	0	7	8	1	0	1.6	0.2
#101 (136A, 0 mice, 630 grams)	6	8	2	0	0	0.8	0.2
SJSU (136A, 0 mice, 765 grams)	2	10	4	0	0	1.1	0.2
#002 (136A, 0 mice, 765 grams)	5	9	2	0	0	0.8	0.2
#CT (136B, 0 mice, 765 grams)	2	10	3	0	1	1.3	0.2
#ENG (136D, 0 mice, 765 grams)	7	9	0	0	0	0.6	0.1
#007 (136A, 6 mice, 405 grams)	1	6	6	3	0	1.7	0.2
#008 (136B, 6 mice, 405 grams)	1	7	4	4	0	1.7	0.2
#009 (136D, 6 mice, 405 grams)	6	8	2	0	0	0.8	0.2
#102 (136B, 9 mice, 630 grams)	8	5	2	1	0	0.8	0.2
#001 (136D, 9 mice, 630 grams)	3	9	4	0	0	1.1	0.2
#003 (136B 12 mice, 765 grams)	2	3	10	1	0	1.6	0.2
#004 (136D 12 mice, 765 grams)	3	2	5	6	0	1.9	0.3

	Odor Score						
Day 7 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	7	7	2	0	1.7	0.2
standard2	16	0	0	0	0	0.0	0.0
standard3	0	11	4	1	0	1.4	0.2
#101 (136A, 0 mice, 630 grams)	6	7	3	0	0	0.8	0.2
SJSU (136A, 0 mice, 765 grams)	1	8	6	0	1	1.5	0.2
#002 (136A, 0 mice, 765 grams)	5	7	3	1	0	1.0	0.2
#CT (136B, 0 mice, 765 grams)	4	6	5	0	1	1.3	0.3
#ENG (136D, 0 mice, 765 grams)	5	9	2	0	0	0.8	0.2
#007 (136A, 6 mice, 405 grams)	0	4	6	5	1	2.2	0.2
#008 (136B, 6 mice, 405 grams)	5	7	2	2	0	1.1	0.2
#009 (136D, 6 mice, 405 grams)	3	8	5	0	0	0.9	0.2
#102 (136B, 9 mice, 630 grams)	4	9	3	0	0	0.9	0.2
#001 (136D, 9 mice, 630 grams)	1	7	6	2	0	1.6	0.2
#003 (136B 12 mice, 765 grams)	3	5	7	1	0	1.4	0.2
#004 (136D 12 mice, 765 grams)	2	3	3	7	1	2.1	0.3

Table 5 continued. Daily odor score frequencies for odor standards and AEMs.
Number of mice, and grams of food bars per cage side are shown in parenthesis.

			Odor Score				
Day 8 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	3	13	1	1	2.0	0.2
standard2	0	1	11	5	1	2.3	0.2
standard3	18	0	0	0	0	0.0	0.0
#101 (136A, 0 mice, 630 grams)	11	7	0	0	0	0.4	0.1
SJSU (136A, 0 mice, 765 grams)	4	9	4	0	1	1.2	0.2
#002 (136A, 0 mice, 765 grams)	13	3	2	0	0	0.4	0.2
#CT (136B, 0 mice, 765 grams)	5	10	2	0	1	1.0	0.2
#ENG (136D, 0 mice, 765 grams)	4	10	4	0	0	1.0	0.2
#007 (136A, 6 mice, 405 grams)	1	9	6	1	1	1.6	0.2
#008 (136B, 6 mice, 405 grams)	4	8	5	1	0	1.2	0.2
#009 (136D, 6 mice, 405 grams)	3	10	4	1	0	1.2	0.2
#102 (136B, 9 mice, 630 grams)	3	13	2	0	0	0.9	0.1
#001 (136D, 9 mice, 630 grams)	0	8	8	2	0	1.7	0.2
#003 (136B 12 mice, 765 grams)	1	9	6	1	1	1.6	0.2
#004 (136D 12 mice, 765 grams)	1	2	6	7	2	2.4	0.2

			Odor Score				
Day 9 odor evaluation	0	1	2	3	4	Mean	Std Err
standard1	0	4	13	1	0	1.8	0.1
standard2	0	1	10	6	1	2.4	0.2
standard3	18	0	0	0	0	0.0	0.0
#101 (136A, 0 mice, 630 grams)	10	5	3	0	0	0.6	0.2
SJSU (136A, 0 mice, 765 grams)	3	10	4	0	1	1.2	0.2
#002 (136A, 0 mice, 765 grams)	7	8	3	0	0	0.8	0.2
#CT (136B, 0 mice, 765 grams)	6	7	4	0	1	1.1	0.2
#ENG (136D, 0 mice, 765 grams)	5	6	6	0	1	1.2	0.2
#007 (136A, 6 mice, 405 grams)	1	4	10	2	1	1.9	0.2
#008 (136B, 6 mice, 405 grams)	6	8	2	0	2	1.1	0.3
#009 (136D, 6 mice, 405 grams)	3	9	5	1	0	1.2	0.2
#102 (136B, 9 mice, 630 grams)	2	10	3	3	0	1.4	0.2
#001 (136D, 9 mice, 630 grams)	1	7	8	2	0	1.6	0.2
#003 (136B 12 mice, 765 grams)	2	7	5	2	2	1.7	0.3
#004 (136D 12 mice, 765 grams)	0	1	7	8	2	2.6	0.2

Table 6. Summary of mean odor scores by AEM. Standard error is listed in Table 5. Scores of 1.5 and above are indicated in bold.

	Test Day Number									
	0	1	2	3	4	5	6	7	8	9
#101 (136A, 0 mice, 630 grams)	0.7	0.5	0.6	0.4	0.6	0.4	0.8	0.8	0.4	0.6
SJSU (136A, 0 mice, 765 grams)	0.9	1.1	1.1	1.0	0.9	1.1	1.1	**1.5**	1.2	1.2
#002 (136A, 0 mice, 765 grams)	0.6	0.6	0.4	0.3	0.4	0.5	0.8	1.0	0.4	0.8
#CT (136B, 0 mice, 765 grams)	0.9	1.2	0.8	0.8	1.1	1.0	1.3	1.3	1.0	1.1
#ENG (136D, 0 mice, 765 grams)	0.6	0.7	0.8	0.8	0.7	0.8	0.6	0.8	1.0	1.2
#007 (136A, 6 mice, 405 grams)	0.4	1.1	0.9	1.1	0.9	1.4	**1.7**	**2.2**	**1.6**	**1.9**
#008 (136B, 6 mice, 405 grams)	0.7	0.6	0.6	0.4	1.1	0.9	**1.7**	1.1	1.2	1.1
#009 (136D, 6 mice, 405 grams)	0.9	1.1	1.1	1.4	0.9	0.9	0.8	1.1	1.2	1.2
#102 (136B, 9 mice, 630 grams)	0.3	0.7	0.7	0.4	0.5	1.2	0.8	0.9	0.9	1.4
#001 (136D, 9 mice, 630 grams)	0.6	1.1	0.9	1.0	0.7	0.9	1.1	**1.6**	**1.7**	**1.6**
#003 (136B 12 mice, 765 grams)	0.7	1.0	0.9	1.0	0.8	1.4	**1.6**	1.4	**1.6**	**1.7**
#004 (136D 12 mice, 765 grams)	0.6	0.5	0.4	0.4	0.4	1.1	**1.9**	**2.1**	**2.4**	**2.6**

Table 7. Frequency of scores in the ranges 0-1 and 2-4.

				Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
Station	AEM	Density	Food	0-1	2-4	0-1	2-4	0-1	2-4	0-1	2-4	0-1	2-4	0-1	2-4	0-1	2-4
# 3	#101	0	630	15	4	18	1	17	2	16	1	13	2	18	0	14	2
# 4	SJSU	0	765	17	2	15	4	16	3	13	4	12	3	14	4	12	4
# 2	#002	0	765	18	1	18	1	18	1	17	0	14	1	16	2	14	2
# 6	CT	0	765	15	4	15	4	16	3	13	4	12	3	14	4	12	4
# 9	ENG	0	765	18	1	18	1	18	1	16	1	12	3	15	3	16	0
# 1	#007	6	405	19	0	15	4	15	4	12	5	11	4	12	6	7	9
# 5	#008	6	405	17	2	17	2	17	2	16	1	10	5	14	4	8	8
# 12	#009	6	405	16	3	16	3	14	5	11	6	13	2	15	3	14	2
# 8	#102	9	630	19	0	17	2	16	3	17	0	14	1	14	4	13	3
# 10	#001	9	630	17	2	14	5	15	4	14	3	12	3	16	2	12	4
# 7	#003	12	765	17	2	16	3	16	3	12	5	13	2	9	9	5	11
#11	#004	12	765	17	2	18	1	18	1	16	1	14	1	11	7	5	11

				Day 7		Day 8		Day 9	
Station	AEM	Density	Food	0-1	2-4	0-1	2-4	0-1	2-4
# 3	#101	0	630	14	3	17	0	14	3
# 4	SJSU	0	765	10	7	12	5	12	5
# 2	#002	0	765	13	4	15	2	14	3
# 6	CT	0	765	11	6	14	3	13	4
# 9	ENG	0	765	15	2	13	4	11	6
# 1	#007	6	405	5	12	9	8	5	12
# 5	#008	6	405	13	4	12	5	14	3
# 12	#009	6	405	12	5	12	5	10	6
# 8	#102	9	630	14	3	15	2	11	6
# 10	#001	9	630	9	8	8	9	8	9
# 7	#003	12	765	9	8	9	8	8	9
# 11	#004	12	765	6	11	3	14	1	16

Table 8. Adjusted G score from 2 by 2 independence test calculations for unoccupied *vs.* occupied AEMs. Odor evaluation scores for a test cage differ from the control if $G_{adj} > 3.84$ (Chi Square for [df=1, P=.05]). * indicates a significant difference. Bold indicates that the cage with animals was higher than it's respective control. For the empty cage comparisons, underlining indicates that the scores for the two empty cages were different on a given day. From Sokal and Rohlf 1987.

		Test Day Number									
		0	1	2	3	4	5	6	7	8	9
#101 0 mice	#007 6 mice	5.34*	2.00	0.74	3.21	0.78	**8.77***	**6.83***	**10.31***	**12.57***	**11.48***
SJSU 0 mice	#007 6 mice	2.31	0.00	0.16	0.14	0.17	0.53	3.15	3.15	1.04	**7.07***
#002 0 mice	#007 6 mice	0.94	2.00	2.00	**7.07***	2.07	2.50	**6.83***	**8.00***	**4.98***	**11.48***
#CT 0 mice	#008 6 mice	0.74	0.74	0.21	2.03	0.64	0.00	2.06	0.55	1.28	0.14
#ENG 0 mice	#009 6 mice	1.03	1.03	3.14	**4.55***	0.22	0.00	2.32	1.57	0.14	0.12
#CT 0 mice	#102 9 mice	5.34*	0.74	0.00	**5.40***	1.06	0.00	0.17	1.33	0.21	0.12
#ENG 0 mice	#001 9 mice	0.32	3.14	2.00	1.05	0.00	0.21	**5.43***	**5.21***	**4.13***	0.97
#CT 0 mice	#003 12 mice	0.74	0.16	0.00	0.14	0.22	2.93	**6.08***	0.49	3.20	1.81
#ENG 0 mice	#004 12 mice	0.32	0.00	0.00	0.00	1.06	2.14	**20.22***	**10.77***	**13.92***	**13.40***
#101 0 mice	SJSU 0 mice	0.74	2.00	0.21	2.03	0.22	<u>5.37*</u>	0.77	2.25	<u>7.02*</u>	0.61
#101 0 mice	#002 0 mice	2.00	0.00	0.32	0.94	0.32	2.31	0.00	0.17	2.31	0.00
#101 0 mice	#CT 0 mice	0.00	2.00	0.21	2.03	0.22	<u>5.37*</u>	0.77	1.33	3.79	0.61
#101 0 mice	#ENG 0 mice	2.00	0.00	0.32	0.00	0.22	3.79	2.32	0.22	<u>5.37*</u>	2.14
SJSU 0 mice	#002 0 mice	0.32	2.00	1.03	<u>5.40*</u>	1.06	0.75	0.77	1.19	1.53	0.61
SJSU 0 mice	#CT 0 mice	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.61	0.00
SJSU 0 mice	#ENG 0 mice	0.32	2.00	1.03	2.03	0.00	0.17	<u>5.43*</u>	3.80	0.14	0.48
#002 0 mice	#CT 0 mice	2.00	2.00	1.03	<u>5.40*</u>	1.06	0.75	0.77	0.55	0.21	0.61
#002 0 mice	#ENG 0 mice	0.00	0.00	0.00	0.94	1.06	0.21	2.32	0.77	0.75	2.14
#CT 0 mice	#ENG 0 mice	2.00	2.00	1.03	2.03	0.00	0.17	<u>5.43*</u>	2.59	0.17	0.48

Figure 1. Mean ± S.E.M odor score for one occupied and three unoccupied AEMs in Room 136A
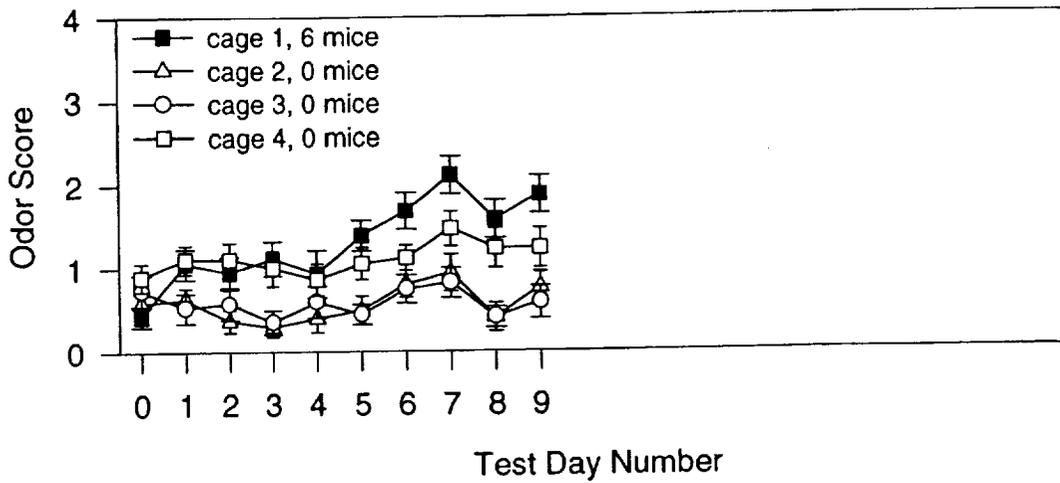
Figure 2. Mean ± S.E.M odor score for three occupied AEMs and one unoccupied AEM in Room 136B.
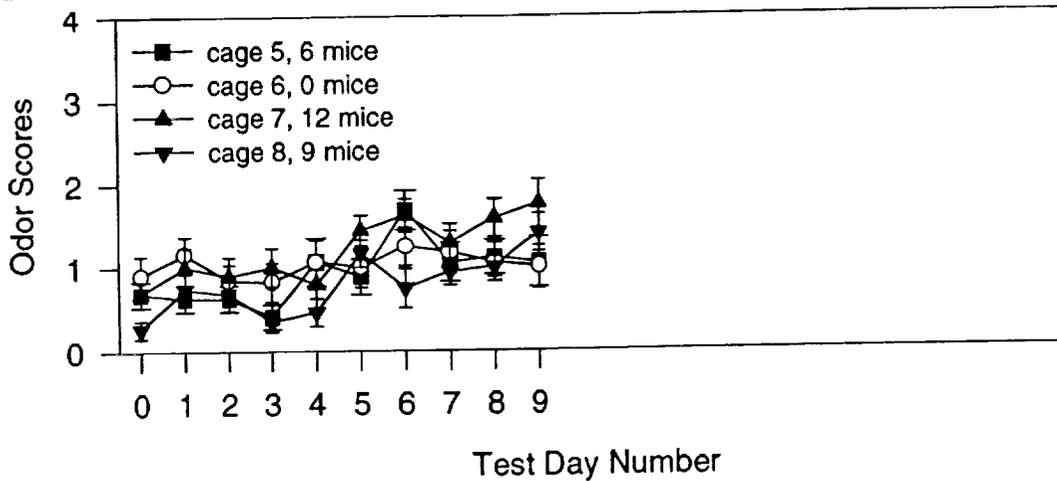
Figure 3. Mean ± S.E.M odor score for three occupied AEMs and one unoccupied AEM in Room 136D.
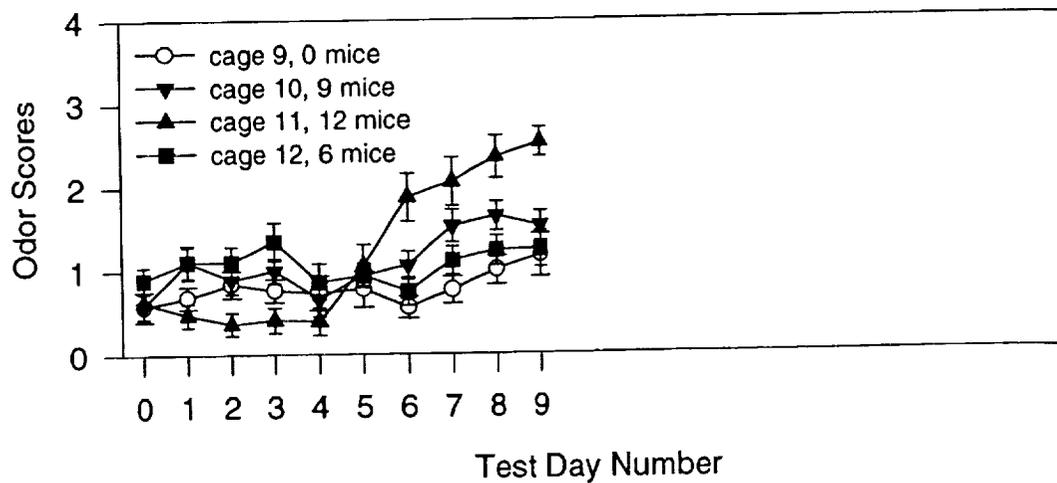
Figure 4. Odor score frequencies for five occupied AEMs, 007, 008, 010, 009, 102 and two unoccupied AEMs, 104 and S/N SJSU. Each bar shows scores frequencies for one enclosure for one test day.
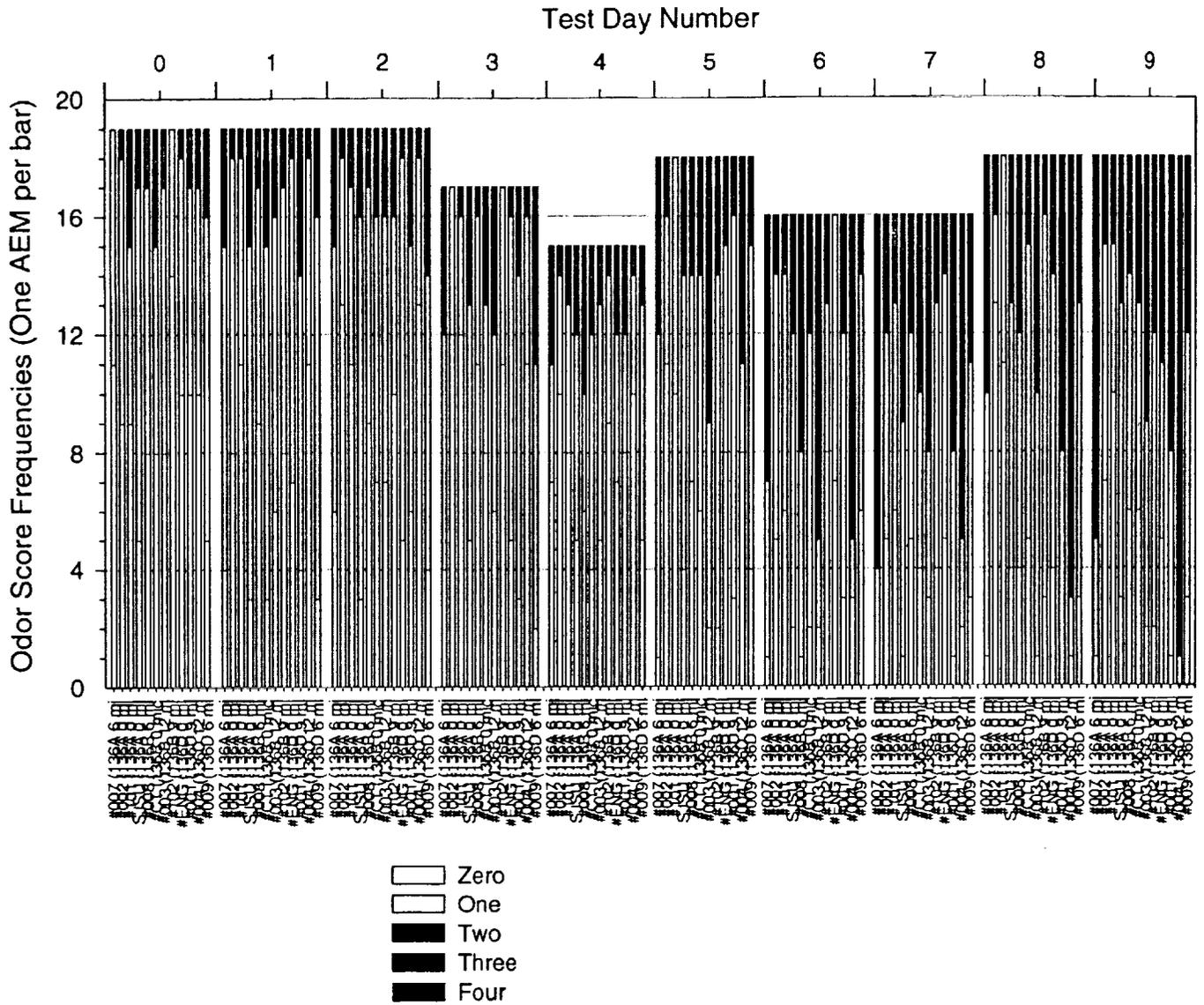
Test day 0 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	0	2	2	0	0	1	1	1	2	1	0	0	1	0	1
A2	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
A3	0	2	2	1	0	2	1	1	2	2	1	3	2	1	2
A4	0	4	4	0	1	2	3	2	4	2	0	0	1	3	2
A5	1	2	2	0	0	0	1	0	0	1	0	1	1	0	1
A6	0	2	2	1	1	2	1	1	1	1	1	1	2	2	1
A7	0	2	2	1	0	0	1	0	1	1	0	1	0	0	1
A8	0	2	3	1	1	1	1	1	1	1	1	1	1	1	1
A9	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
A10	0	2	2	0	0	0	2	1	1	1	0	1	1	1	1
A11	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0
A12	0	2	2	1	0	1	1	1	1	1	0	1	0	1	0
A13	0	3	3	0	1	0	1	0	1	0	1	1	1	1	1
A14	0	3	3	0	1	1	1	0	0	1	1	0	1	1	2
A15	0	2	2	1	1	0	1	1	0	0	0	1	0	0	1
A16	0	2	3	1	2	2	0	1	2	1	0	0	0	0	1
A17	0	3	1	0	1	1	1	2	0	1	0	1	1	1	1
A18	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
A19	0	2	3	0	1	0	1	0	0	0	0	0	0	0	1
A20	0	2	2	0	0	0	1	1	1	0	0	0	0	0	1
A21															
A22															
A23															

Test day 1 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	2	0	1	0	0	0	1	2	1	0	1	2	1	1
A2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
A3	2	3	0	2	0	1	1	2	2	3	2	1	2	1	2
A4	4	4	0	3	1	3	3	2	4	4	3	1	3	1	4
A5	2	2	0	0	0	0	1	0	1	0	0	1	1	0	1
A6	2	2	1	1	1	1	2	2	2	1	1	1	1	1	2
A7	2	2	0	1	0	1	1	0	1	0	1	0	1	0	1
A8	3	2	0	1	1	1	1	1	1	1	0	1	1	1	1
A9	2	2	0	1	1	1	2	0	0	0	1	0	1	0	2
A10	2	2	0	1	1	1	0	0	1	1	0	0	1	1	1
A11	2	2	0	2	2	1	1	1	1	1	1	1	1	1	1
A12	2	2	0	1	1	0	1	1	1	1	1	1	0	0	0
A13	3	2	0	1	1	0	1	0	1	1	0	1	1	1	1
A14	3	2	0	2	1	0	1	0	1	2	1	2	1	0	1
A15	2	2	0	1	1	0	2	1	1	1	1	1	2	0	1
A16	3	2	0	0	0	0	1	1	1	0	0	1	1	0	1
A17	3	2	0	1	1	1	2	0	1	1	1	0	0	0	1
A18	3	2	0	0	0	0	1	0	0	1	1	0	0	0	1
A19	3	2	1	1	1	0	1	1	1	1	0	1	1	0	1
A20	2	2	0	1	1	0	1	1	1	0	1	0	1	0	0
A21	2	1	0	1	0	0	1	1	2	1	0	1	2	2	1

A22	2	2	1	1	0	1	1	1	2	0	0	1	1	1	1
A23															

Appendix A
NASA Animal Enclosure Module Mouse Qualification, Sept-'99
Draft Sub Project Report 11/22/99 (Cooperative Agreement NCC2-1136, San Jose State University)

Test day 2 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	2	0	1	1	1	1	0	1	1	1	1	0	1	0
A2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
A3	3	2	0	0	0	1	1	1	2	2	0	1	0	0	1
A4	2	3	0	3	2	3	4	1	3	4	3	3	2	0	3
A5	3	2	0	0	0	0	1	0	0	0	0	0	1	0	0
A6	3	2	2	2	1	2	2	2	2	2	1	2	2	1	2
A7	2	2	0	0	0	1	1	1	1	0	0	0	1	1	1
A8	3	2	0	1	1	0	1	1	1	1	1	1	1	1	1
A9	2	2	0	2	0	0	1	0	0	1	0	1	1	1	1
A10	2	2	0	1	0	0	1	0	1	0	1	1	1	0	1
A11	2	2	0	1	1	0	1	1	1	0	1	1	1	0	1
A12															
A13	3	2	0	1	0	0	1	0	1	0	0	1	1	0	1
A14	3	3	0	2	1	2	2	1	0	1	1	1	2	0	2
A15	3	2	0	1	0	1	1	1	0	1	2	1	2	1	2
A16	3	2	0	1	0	0	1	0	1	1	1	1	0	0	1
A17	1	2	0	2	0	1	1	2	1	2	2	1	2	0	2
A18	3	2	0	0	0	0	0	0	1	0	0	0	0	0	1
A19	3	2	0	1	1	1	1	1	0	1	0	1	1	0	1
A20	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0
A21	2	2	0	1	0	0	2	2	2	1	0	1	1	2	2
A22	2	2	1	0	0	0	1	0	1	1	0	0	1	1	1
A23															

Test day 3 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	2	0	3	0	0	1	1	2	0	1	1	1	0	2
A2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
A3	3	2	0	2	0	1	0	0	2	2	1	1	2	1	1
A4	3	4	0	2	1	0	3	0	3	3	1	1	1	2	4
A5	2	2	0	0	0	0	0	0	0	0	0	1	1	0	1
A6	3	2	1	2	1	1	2	1	2	2	1	2	2	2	2
A7	2	2	0	1	0	0	1	0	0	0	0	0	0	0	0
A8	3	2	0	1	1	1	1	1	1	1	1	1	1	1	1
A9	2	2	0	1	0	0	1	0	0	0	0	0	1	1	2
A10	2	2	0	1	0	1	2	1	1	1	0	1	2	1	2
A11	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1
A12															
A13	3	3	0	0	1	0	1	0	0	1	0	1	1	0	1
A14	3	3	0	2	1	1	2	2	1	2	0	2	1	0	2
A15	2	2	1	2	1	1	0	0	1	2	1	1	2	1	1
A16	3	2	0	1	0	0	0	0	0	1	0	1	1	0	2
A17	2	2	0	2	1	0	1	0	1	2	0	1	2	1	1
A18	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1
A19	3	2	0	1	0	0	1	1	1	1	1	1	1	0	1
A20	2	1	0	1	0	0	1	1	0	1	0	0	1	0	1
A21	2	2	0	1	0	2	2	0	2	2	1	1	1	0	1

| A22 | 2 | 3 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| A23 | | | | | | | | | | | | | | | |

NASA Animal Enclosure Module Mouse Qualification, Sept-'99
Draft Sub Project Report 11/22/99 (Cooperative Agreement NCC2-1136, San Jose State University)

Test day 4 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	1	0	2	3	0	1	0	3	0	0	1	1	0	1	1
A2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
A3															
A4	2	0	1	3	1	1	2	3	4	2	1	1	2	1	3
A5	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0
A6	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2
A7	1	0	1	0	0	0	1	0	1	1	0	0	0	0	1
A8	1	0	2	1	1	1	1	1	1	1	1	1	1	1	1
A9															
A10	1	0	1	2	0	0	1	2	2	1	0	2	2	1	0
A11	2	0	2	1	1	1	1	1	1	1	1	1	1	0	1
A12															
A13	0	0	1	1	0	0	0	1	1	0	0	1	1	0	1
A14															
A15	2	2	1	2	0	1	0	2	2	0	0	1	2	1	1
A16	2	0	2	0	0	0	1	0	1	1	0	0	1	0	1
A17	1	0	2	0	1	1	2	1	1	1	0	2	0	0	0
A18	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1
A19	1	0	1	1	0	0	1	2	1	1	0	1	0	0	1
A20	1	0	0	0	0	0	1	0	1	0	1	1	1	0	1
A21	1	0	1	0	0	2	1	1	1	1	0	0	1	0	1
A22	2	1	2	0	0	0	1	2	1	1	1	2	1	0	2
A23	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0

Test day 5 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	0	2	2	0	0	0	3	1	2	1	1	1	3	0
A2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
A3															
A4	2	0	1	3	1	1	3	1	4	3	3	3	1	1	2
A5	1	0	1	1	0	0	1	0	1	1	1	0	1	2	1
A6	2	1	1	2	1	2	2	2	2	2	1	1	3	2	
A7	1	0	1	1	0	0	1	0	0	1	1	0	0	0	0
A8	2	0	2	1	1	1	1	2	1	2	1	2	1	3	1
A9	1	0	1	1	1	1	2	1	1	2	1	0	1	0	1
A10	1	0	1	2	1	1	2	1	2	2	2	1	1	2	1
A11	2	1	2	0	1	1	1	1	1	1	1	1	1	1	1
A12	1	0	1	1	0	1	1	1	1	1	1	1	1	2	1
A13	1	0	1	1	0	0	1	1	0	1	1	0	1	0	1
A14	2	0	2	1	1	0	1	0	0	2	1	1	2	0	2
A15	2	0	1	2	2	0	1	1	2	2	2	1	2	1	1
A16	2	0	1	2	0	0	0	0	0	1	0	1	1	0	1
A17	1	0	1	3	0	1	2	2	1	2	1	0	1	2	2
A18															
A19	1	0	1	1	0	0	1	2	1	2	1	1	1	2	1
A20	2	0	1	1	0	0	0	0	0	1	1	0	1	0	1
A21	1	0	2	1	0	1	1	0	2	0	1	0	0	0	0

| A22 | 2 | 0 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| A23 | | | | | | | | | | | | | | | |

Test day 6 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	0	2	2	1	0	0	3	1	2	0	1	1	3	1
A2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
A3															
A4	2	0	3	3	2	1	2	3	4	2	3	1	2	3	2
A5	1	0	1	1	0	0	1	1	1	0	0	0	1	3	1
A6	2	2	2	3	2	2	2	3	2	3	2	1	2	4	2
A7	1	0	1	1	0	0	1	1	1	1	0	0	1	1	1
A8	2	0	2	2	2	2	2	2	2	2	2	1	2	3	1
A9	1	0	1	2	1	1	1	2	1	2	0	1	1	2	1
A10	2	0	2	2	1	1	2	2	1	2	1	0	1	2	0
A11	2	1	2	2	2	1	1	1	1	1	1	1	1	1	1
A12	2	0	1	1	0	1	1	1	1	1	0	0	0	2	0
A13	1	0	0	1	1	0	0	0	1	1	0	0	1	0	
A14	1	0	2	1	1	1	1	1	2	2	2	1	1	2	1
A15	2	1	1	3	2	0	0	2	2	2	2	1	1	3	1
A16	2	0	1	2	1	1	2	1	1	2	1	0	2	0	1
A17	2	0	2	1	1	0	1	2	1	2	1	1	1	2	0
A18															
A19	1	0	1	3	0	1	1	3	1	3	1	1	1	3	0
A20	2	0	1	2	1	0	1	1	0	2	0	0	0	0	1
A21	2	0	2	1	1	2	1	1	2	1	0	1	1	1	0
A22	2	0	2	3	1	1	1	3	1	2	1	1	2	3	2
A23															

Test day 7 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	1	0	3	3	1	0	1	3	2	2	1	1	2	3	1
A2															
A3															
A4	3	0	1	3	2	0	4	1	4	2	2	1	3	4	1
A5	1	0	1	2	0	0	1	1	1	0	1	0	1	3	1
A6	2	2	2	3	2	1	2	2	2	3	3	2	3	4	2
A7	2	0	1	1	0	1	1	1	0	0	1	0	1	1	1
A8	2	0	1	2	1	1	2	3	2	2	1	2	2	3	1
A9	1	0	1	2	2	1	2	1	1	1	1	1	2	2	2
A10	2	0	1	2	0	1	1	0	2	1	1	1	2	3	2
A11	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1
A12	2	0	1	2	1	2	2	1	1	2	2	1	1	2	0
A13	1	0	1	1	1	0	1	0	0	1	0	0	1	1	1
A14	2	0	2	2	1	1	2	2	2	2	2	2	1	2	1
A15	2	2	1	2	2	0	1	1	2	2	1	2	2	2	0
A16	2	0	2	3	1	2	2	0	1	2	0	0	3	0	2
A17	1	0	2	3	2	2	2	1	1	1	1	1	1	3	2
A18	1	0	1	1	0	0	1	0	1	0	0	0	0	0	0
A19	1	0	1	3	1	1	1	2	0	2	1	1	2	3	1
A20	2	0	1	1	0	0	0	0	0	1	0	1	2	1	0
A21															

| A22 | 3 | 0 | 2 | 4 | 3 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 2 |
| A23 | | | | | | | | | | | | | | | |

Test day 8 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	1	0	1	0	0	0	2	0	1	0	1	2	3	0
A2															
A3															
A4	4	4	0	4	1	0	4	3	4	3	2	1	2	4	3
A5	2	2	0	1	0	0	0	2	0	1	0	0	3	3	1
A6	3	3	2	3	2	2	2	3	2	3	3	2	3	4	2
A7	2	2	0	1	0	0	1	1	0	1	1	1	1	2	0
A8	3	3	0	2	2	1	1	2	1	1	1	2	2	4	1
A9	2	2	0	1	0	0	1	1	2	2	1	2	2	3	1
A10	1	2	0	2	0	0	0	2	1	2	1	1	2	2	1
A11	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1
A12	2	2	0	1	0	1	1	1	1	1	1	1	1	2	1
A13	1	2	0	1	0	0	1	0	1	1	1	1	1	1	1
A14	2	3	0	2	1	1	2	1	1	2	2	2	2	2	2
A15	2	2	0	2	0	1	2	2	0	2	1	1	2	2	2
A16	2	3	0	2	0	1	1	1	1	2	1	1	2	3	2
A17	2	2	0	1	0	1	2	1	1	2	1	0	1	2	1
A18															
A19	2	3	0	2	0	0	1	0	1	1	1	1	3	3	1
A20	2	2	0	1	0	0	0	0	0	0	0	0	1	0	0
A21	1	2	0	0	0	0	1	0	2	1	1	0	1	3	1
A22	2	3	0	3	2	0	2	1	1	4	1	2	1	3	2
A23															

Test day 9 odor evaluation scores.

Tester #	Stndrd 1	Stndrd 2	Stndrd 3	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
A1	2	2	0	2	0	0	0	1	1	1	1	0	1	3	0
A2															
A3															
A4	3	4	0	4	1	2	4	4	4	4	3	4	2	3	3
A5	1	2	0	2	1	0	1	1	0	1	0	0	1	3	0
A6	2	3	0	3	2	2	2	4	2	4	3	2	3	4	2
A7	2	2	0	1	0	0	1	1	0	1	1	1	1	1	1
A8	2	1	0	2	1	1	1	2	2	1	1	2	3	4	1
A9	2	2	0	1	1	1	1	0	1	2	2	2	2	2	2
A10	2	2	0	2	0	0	1	1	0	2	1	1	1	2	0
A11	2	2	0	2	1	1	1	0	1	1	1	1	2	3	1
A12															
A13	1	2	0	1	0	0	1	0	0	1	1	0	1	2	1
A14	2	3	0	2	2	1	2	1	2	2	2	2	2	3	2
A15	2	2	0	2	1	0	2	2	1	2	2	1	2	3	1
A16	2	3	0	2	0	0	1	0	0	2	1	0	2	2	1
A17	2	3	0	2	2	2	2	1	1	0	1	2	2	2	2
A18															
A19	2	3	0	3	1	0	1	1	1	3	1	1	2	3	2
A20	1	2	0	0	0	0	0	0	0	0	0	0	0	2	1
A21	2	2	0	1	1	0	1	0	2	1	1	2	1	3	1

Appendix A

NASA Animal Enclosure Module Mouse Qualification, Sept-'99
Draft Sub Project Report 11/22/99 (Cooperative Agreement NCC2-1136, San Jose State University)

| A22 | 1 | 3 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 3 | 3 | 1 | 1 | 2 | 1 |
| A23 | | | | | | | | | | | | | | | |

NASA Animal Enclosure Module Mouse Qualification, Sept-'99
Draft Sub Project Report 11/22/99 (Cooperative Agreement NCC2-1136, San Jose State University)

Adjusted G from 2 by 2 independence test calculations for unoccupied AEMs in 136A vs. unoccupied AEMs in 136B and 136D. Odor evaluation scores for a test cage differ from the control if $G_{adj} > 3.84$ (Chi Square for [df=1, P=.05]). * indicates a significant difference. From Sokal and Rohlf 1987.

		Test Day Number									
		0	1	2	3	4	5	6	7	8	9
#101 0 mice	#CT 0 mice	0.00	2.00	0.21	2.03	0.22	5.37*	0.77	1.33	3.79	0.61
#101 0 mice	#ENG 0 mice	2.00	0.00	0.32	0.00	0.22	3.79	2.32	0.22	5.37*	2.14
SJSU 0 mice	#CT 0 mice	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.61	0.00
SJSU 0 mice	#ENG 0 mice	0.32	2.00	1.03	2.03	0.00	0.17	5.43*	3.80	0.14	0.48
#002 0 mice	#CT 0 mice	2.00	2.00	1.03	5.40*	1.06	0.75	0.77	0.55	0.21	0.61
#002 0 mice	#ENG 0 mice	0.00	0.00	0.00	0.94	1.06	0.21	2.32	0.77	0.75	2.14
#101 0 mice	#002 0 mice	2.00	0.00	0.32	0.94	0.32	2.31	0.00	0.17	2.31	0.00
#101 0 mice	SJSU 0 mice	0.74	2.00	0.21	2.03	0.22	5.37*	0.77	2.25	7.02*	0.61
SJSU 0 mice	#002 0 mice	0.32	2.00	1.03	5.40*	1.06	0.75	0.77	1.19	1.53	0.61
#CT 0 mice	#ENG 0 mice	2.00	2.00	1.03	2.03	0.00	0.17	5.43*	2.59	0.17	0.48

Sums over all test days of the adjusted G. This is a measure of the difference in scoring for the two compared cages. This shows that AEM S/N SJSU scores were closer to those of the unoccupied AEMs in 136B (CT) and 136D (ENG).

#101 0 mice	#CT 0 mice	16.32
#101 0 mice	#ENG 0 mice	16.38
SJSU 0 mice	#CT 0 mice	1.47
SJSU 0 mice	#ENG 0 mice	15.39
#002 0 mice	#CT 0 mice	14.38
#002 0 mice	#ENG 0 mice	8.20
#101 0 mice	#002 0 mice	15.88
#101 0 mice	SJSU 0 mice	21.21
SJSU 0 mice	#002 0 mice	8.37
#CT 0 mice	#ENG 0 mice	14.65