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RECOMMENDATIONS FOR AND DOCUMENTATION OF BIOLOGICAL VALUES FOR USE IN RISK ASSESSMENT

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PREFACE

In the course of developing quantitative risk assessments it is frequently useful to equate exposure doses across studies and species in terms of mg of substance/kg body weight/day. In order to accomplish this for dietary or drinking water exposures, food or fluid intake as well as body weight must be known. Similarly, for inhalation exposures a first step toward estimating dose requires information concerning ventilatory volume. Unfortunately, especially in the older literature, food and fluid consumption are frequently not reported. Body weights may be given only as a single terminal value at studies end. Whole body inhalation exposures generally provide no information concerning ventilatory volumes. As a result, these values are frequently estimated for a particular species in order to facilitate dose estimates.

A need for default values for these parameters was recognized as early as 1980 when body weights and allometric relationships for food consumption, as well as ventilatory volumes were proposed for the rat and mouse (U.S. EPA, 1980). These values, while reasonable estimates, were based upon a very limited data set. Subsequently a variety of default values have been suggested, but a systematic search for and development of a comprehensive data base for this information had not been undertaken.

The goal of the present document was 1) to undertake a thorough and systematic search for biological values (both published and unpublished) including body weights, food consumption, water consumption and ventilatory volume for the species commonly used as toxicological models; 2) to utilize this data base to develop recommendations for default values for these parameters best supported by this data base; and 3) to develop the information in as much detail as possible so that strain and age-specific values could be reflected where possible.

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1. OVERVIEW

1.1. INTRODUCTION

This report provides recommendations for and documentation of some biological variables that are used most often in risk assessment: lifespan, body weight, inhalation rate, food consumption and water consumption. These values are used in risk assessment to adjust cancer potency factors or to convert exposure data (e.g., ppm chemical in air or water) to units of dose (mg chemical/kg body weight/day or mg chemical/day) for exposure assessment or route-to-route extrapolation. Values are presented for nonhuman animals only. For information concerning human biological values the reader is referred to U.S. EPA (1985a).

These recommended values should be used only when the study under review does not report values for the biological variables required for the risk assessment or when the values reported in the study under review are not plausible because of poor reporting or typographical error. In general, these recommended values should be used only for the kinds of adjustments or conversions discussed above and should not be used as a surrogate for "historical control" data by which the response in an animal group is assessed (e.g., decreased body weight or survival).

This report is a substantial expansion and revision of an earlier effort (U.S. EPA, 1985b) that was in turn an effort to provide further documentation of recommended values for humans, rats and mice, proposed and used by the Agency (U.S. EPA, 1980) to prepare ambient water quality criteria. When appropriate, the earlier reports are referred to for comparison. Since this report contains much information not used in the previous versions, virtually all of the recommended default values have been changed. Given the many uncertainties in risk assessment (relatively few of which are impacted by different recommended values), the continual review of the Agency's risk assessments by the RfD and CRAVE committees, and the inherent variability of the data on which the new recommended values are based, there does not appear to be a compelling reason to revise the existing risk assessments solely on the basis of revised recommended values. This effort to revise the recommended values is simply an ongoing component of Agency and risk assessment community efforts to improve the scientific basis from which risk assessments are made.

Well-documented and relatively accurate biological variables are needed to provide some level of consistency among risk assessments and to increase the quality and decrease the uncertainty of dose-response assessments. Inconsistency in assumptions concerning body weight and intake rates can be a source of unnecessary and fruitless controversy. As discussed in some detail by Snyder et al. (1981) in recommending standard biological values for the ICRP Reference Man, the actual magnitude of a recommended value may be less critical than the use of a uniform value. With this uniformity, assessments made by different individuals or groups at different times may be compared more clearly, allowing disagreements to focus on important scientific judgments rather than more mundane and trivial differences in assumptions of body weight and other biological variables. By documenting these biological variables and providing a rationale for the recommended values, this report at least provides a basis for further discussion from which a consensus can be reached.

While the absolute magnitude of the recommended values may be of secondary importance in risk assessment, biological values must be reasonably accurate and reflect the available information if dose-response assessments are to be made properly. This is obvious in considering the mechanics of risk assessment, in which data from several species must often be compared to determine differences in sensitivity among species. Such comparisons are usually made on mg/kg/day estimates of dose from studies involving exposure of the test animals to the compound in air, food or drinking water. In making such comparisons, the use of an inappropriately high assumed value for air, food or water intake along with an inappropriately low assumed value for body weight would overestimate the sensitivity of the species. This error combined with the converse error on a different species could substantially confound the risk assessment to the point where the most sensitive species and most critical effect are incorrectly identified. Consequently, this report attempts to be comprehensive in the summary and critical in the analysis of the biological variables of concern so that the recommended values accurately and consistently reflect what is known.

This report contains seven chapters:

1. Overview
2. Lifespan and Development
3. Body Weight and Growth
4. Inhalation Rates
5. Water Consumption
6. Food Consumption
7. Relationship of Food and Water Consumption

This chapter includes a summary of the recommended values needed most often and is intended to be used as a separate document, if needed. While it contains little documentation or discussion, the other chapters contain detailed data summaries and analyses as well as some less commonly used recommended values. For instance, Chapter 3 includes recommended body weights on >30 strains of mice, none of which are commonly (but all of which have been at times) used in toxicity studies. These recommended body weights could be used, based on the relationships discussed in other chapters, to estimate strain-specific rates for the intake of air, food and water. When such strain-specific information is available, it is noted in Chapter 1, and reference is made to the appropriate section or summary table.

1.2. LIFESPAN AND DEVELOPMENT

Table 1-1 provides recommended values for weaning, puberty and lifespan for most commonly used laboratory animals. Other developmental and reproductive data (e.g., gestation period, average litter size, breeding life) are given in Chapter 2. The recommended lifespans for mice and rats are the same as those in U.S. EPA (1980, 1985). These are not identical to actuarial life expectancies at birth or theoretical maximum lifespan potentials, which have very specific definitions in different bodies of literature. Nonetheless, the recommended values in Table 1-1 are representative of the species and consistent with the documented survival data. As noted in the footnote to Table 1-1, substantial differences have been documented in the survival rates of rats and mice, which are related to both differences in strain as well as holding conditions. Because of the many factors that can affect lifespan and survival, the recommended values for lifespan should not be used to assess the significance of survival data reported in toxicity studies unless the extent of the decrease is judged substantial, in which case, the specific recommended value is of little importance. The recommended values for weaning and puberty are reasonably well-documented. Estimates of ages at weaning and puberty could be, but have not been, made from allometric relationships. All of the recommended values summarized in Table 1-1, however, are typical and are taken from published observations.

TABLE 1-1

Recommended Values for Weaning, Puberty and Lifespan

Group Species	Weaning (days)	Puberty (days)	Lifespan (years)
PRIMATES			
Monkey, rhesus	130	1825 (5 years)	35
Baboon	NR	NR	55
Marmoset	NR	NR	40
LABORATORY RODENTS			
Mice	21	50	2*
Rats	21	56	2*
Guinea Pigs	14	70	6
Hamsters	21	60	2.5
Gerbils	21	70	3
OTHER LABORATORY MAMMALS			
Cats	49	240	15
Dogs, Beagles	42	240	15
Rabbits, (New Zealand)	56	195	6
OTHER ANIMALS			
Chicken	NA	NA	24
Pig	NR	150	27
Mink	56	300	NR

*Substantial strain variability

NA = Not applicable; NR = not reported

1.3. BODY WEIGHT AND GROWTH

Recommended body weights, given by species, strain and sex when possible, are given in Table 1-2. Unlike previous reports in which a single body weight was given for each animal, Table 1-2 provides four categories of body weights: weaning, "subchronic," "chronic" and mature. All weaning body weights are approximated from published growth curves. Since many toxicity studies provide information on the weight of the animals at the start of the study (usually at weaning or shortly thereafter), but may not give weights over the course of the study, the weaning weights are included to help the risk assessor determine if the reported weaning weight is typical for the strain of animal used or to identify a representative strain of the species if the strain is not specified in the study. As discussed in Chapter 2, weights at weaning have not been demonstrated to be reliable for estimating other weight values among or within species.

Mature weights are rough approximations of the animal weight as growth begins to plateau. These values are time-specific for each species and can be used to extend growth curves when needed.

The subchronic and chronic body weights are the time-weighted average (TWA) body weights for laboratory rodents and other laboratory mammals over the period from weaning to 90 days ("subchronic) and from weaning to 730 days postweaning (chronic). Subchronic and chronic are operationally defined in order to make the values applicable to standard 90-day and 2-year bioassays, respectively. These can be used not only to estimate average body weights but also, with the allometric relationships discussed below and summarized in Table 1-3, to calculate intake estimates for standard subchronic and chronic toxicity studies. The subchronic and chronic body weights for mammals are age-specific as specified in Table 1-2.

TABLE 1-2

Reference Body Weights (kg)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Primates	monkey, rhesus	M	1.0		10.9	12
		F	1.0		8.0	9
					(0-35 years)	(10-35 years)
	chimpanzee	N	3.8		19.25	20
					(0-55 years)	(adult)
Laboratory rodents	mice/BAF1	M	0.008	0.0223	0.0261	0.035
		F	0.007	0.0204	0.0222	0.030
						(1 year)
	mice/B6C3F1	M	0.009	0.0316	0.0373	0.040
		F	0.011	0.0246	0.0353	0.035
						(1 year)
	rats*/	M	0.031	0.180	0.380	0.40
	Fischer 344	F	0.030	0.124	0.229	0.25
						(1 year)
	rats/Long-Evans	M	0.040	0.248	0.472	0.50
		F	0.038	0.179	0.344	0.35
						(1 year)
	rats/	M	0.053	0.263	0.514	0.55
	Osborne-Mendel	F	0.052	0.201	0.389	0.40
						(1 year)

TABLE 1-2 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Laboratory rodents (cont.)	rats/ Sprague-Dawley	M	0.057	0.267	0.523	0.60
		F	0.056	0.204	0.338	0.35 (1 year)
	Wistar*	M	0.053	0.217	0.462	0.50
		F	0.052	0.156	0.297	0.32 (1 year)
	guinea pigs	M	0.156	0.48	0.89	1.0
		F	0.146	0.39	0.86	0.9
	hamsters/ golden Syrian	M	0.041	0.097	0.134	0.15
		F	0.038	0.095	0.145	0.16
	hamsters/Chinese and Djungarain	M	0.015	0.03	0.041	0.040
		F	0.015	0.025	0.038	0.035
	gerbils/ Mongolian*	M	0.017	0.048	0.084	0.10
		F	0.016	0.040	0.073	0.09
Other laboratory mammals	cats	M	0.62	1.72	3.66	4.0
		F	0.58	1.49	2.96	3.1
	dogs/beagles*	M	2.05	2.40	10.8	14
		F	1.82	1.97	10.1	14
	rabbits/ New Zealand*	M	1.95	2.86	3.76	4.0
		F	2.04	3.10	3.93	4.1

TABLE 1-2 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Other animals*	chicken*/ white leghorn	M		See growth curves		>1.3
		F		Figures 3-55 and 3-56		>1.6
	pig/domestic	N				200-250
	miniature					70-75
	mink	M	0.50	See growth curves		1.7
		F	0.48	Figures 3-60 and 3-61		1.0

*More specific values available. See Table 3-3 for mice, Table 3-5 for rats and Chapter 3 for other species.

For virtually all animal species, adequate data are available to construct growth curves from which TWA body weights for other durations could be calculated. For rats, mice, dogs, hamsters, chickens and gerbils, additional data are presented in Chapter 2, from which additional strain-specific values could be derived.

1.4. INHALATION RATES

Table 1-3 summarizes allometric equations for estimating the daily intake of air, water and food, based on body weight for all species combined as well as for several individual species and animals groups. Species-specific equations should be used, if available, but if they are not available, equations for the most specific animal subgroup (e.g., primates or laboratory mammals) should be used. If no group equation is available, the allometric equation for all species combined should be used. The rationale for this selection process is 2-fold. First, it best reflects the available data on the species or group of concern. Second, allometric relationships based on all species combined, while generally yielding high correlation coefficients and high levels of statistical significance, are not likely to be the same as true allometric relationships within a species. The reason for this is that young, growing members of a "heavier" species will consume more food and water than mature (nongrowing) members of a "lighter" species, both having the same body weight (e.g., a 10-pound dog and a 10-pound child). The significance of age specificity for allometric relationships in inhalation rates has been reviewed by Mortola (1987).

Based on the recommended body weights summarized in Table 1-2 and the appropriate allometric equations given in Table 1-3, corresponding recommended inhalation rates, water consumption rates and food consumption rates are given in Tables 1-4, 1-5 and 1-6, respectively.

TABLE 1-3

Allometric Relationships for Estimating Inhalation Rates (I in m^3/day), Water Consumption (C in ℓ/day) and Food Consumption (F in kg/day) from Data on Body Weight (kg)

Animal Group	Allometric Equation	r^2	Figure No.
	INHALATION RATES		
All species combined	$I = 0.66\ W^{0.7579}$	0.96	4-3
Monkeys	$I = 0.81\ W^{0.4862}$	0.72	4-5
Guinea pigs	$I = 0.44\ W^{0.5156}$	0.32	4-8
Hamsters	$I = 0.50\ W^{0.9017}$	0.86	4-9
Mice	$I = 1.99\ W^{1.0496}$	0.87	4-10
Rats	$I = 0.80\ W^{0.8206}$	0.77	4-11
Cats	$I = 0.32\ W^{0.5945}$	0.81	4-12
Dogs	$I = 0.67\ W^{0.7091}$	0.89	4-13
Rabbits	$I = 0.46\ W^{0.8307}$	0.88	4-14
	WATER CONSUMPTION RATES		
All species combined	$C = 0.11\ W^{0.7872}$	0.93	5-2
Primates	$C = 0.09\ W^{0.7945}$	0.95	5-3
Laboratory mammals	$C = 0.10\ W^{0.7377}$	0.88	5-4
Chickens	$C = 0.13\ W^{0.7555}$	0.74	5-6
	FOOD CONSUMPTION RATES		
All species combined	$F = 0.065\ W^{0.7919}$	0.95	6-2
Laboratory mammals	$F = 0.056\ W^{0.6611}$	0.87	6-4
Gerbils	$F = 0.112\ W^{1.0583}$	0.80	6-6
Guinea pigs	$F = 0.041\ W^{0.3308}$	0.75	6-7
Hamsters	$F = 0.082\ W^{0.9285}$	0.96	6-8
Rabbits	$F = 0.041\ W^{0.7898}$	0.73	6-13
Chickens	$F = 0.075\ W^{0.8449}$	0.97	6-14
	BODY WEIGHT TO FOOD OR WATER CONSUMPTION		
Dry diet: all species	$F = 0.049\ W^{0.6087}$	(0.90)	Eq. 7-5, 7-6
	$C = 0.093\ W^{0.7584}$	(0.89)	Eq. 7-6, 7-6
Wet diet: all species	$F = 0.054\ C^{0.9451}$	(0.95)	Eq. 7-7, 7-7
	$C = 0.009\ F^{1.2044}$	(0.91)	Eq. 7-8, 7-7

TABLE 1-3 (cont.)

Animal Group	Allometric Equation	r^2	Figure No.
	FOOD VS. WATER CONSUMPTION		
Dry diet: all species	$F = 0.31\ C^{0.7923}$	(0.95)	Eq. 7-1a, 7-2
	$C = 3.59\ F^{0.2041}$		Eq. 7-1b
Wet diet: all species	$F = 2.09\ C^{0.7389}$	(0.92)	Eq. 7-2a, 7-3
	$C = 0.39\ F^{1.2447}$		Eq. 7-2b
Laboratory mammals:	$F = 0.28\ C^{0.7613}$	(0.93)	Eq. 7-3a, 7-4
(dry diet)	$C = 0.31\ F^{1.2226}$		Eq. 7-3b
Laboratory rodents:	$F = 0.16\ C^{0.6426}$	(0.78)	Eq. 7-4a, 7-5
(dry diet)	$C = 0.25\ F^{1.2943}$		Eq. 7-4b

TABLE 1-4

Reference Inhalation Rates in m^3/day

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Primates	monkey, rhesus	M	0.81		2.6	2.7
		F	0.81		2.2	2.4
	chimpanzee	NS	1.5		3.4	3.5
Laboratory rodents	mice[a]/BAF1 hybrid	M	0.013	0.037	0.043	0.059
		F	0.007	0.033	0.037	0.050
	mice/B6C3F1	M	0.014	0.053	0.063	0.068
		F	0.017	0.040	0.060	0.059
	rats[a]/Fischer 344	M	0.046	0.19	0.36	0.37
		F	0.045	0.14	0.24	0.26
	mice/Long-Evans	M	0.057	0.25	0.43	0.45
		F	0.055	0.19	0.33	0.34
	mice/Osborne-Mendel	M	0.072	0.27	0.46	0.49
		F	0.071	0.21	0.37	0.38
	rat/Sprague-Dawley	M	0.076	0.27	0.50	0.53
		F	0.075	0.22	0.33	0.34

TABLE 1-4 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Laboratory rodents (cont.)	rat/Wistar[a]	M	0.072	0.23	0.42	0.45
		F	0.071	0.17	0.30	0.31
	guinea pigs	M	0.17	0.30	0.41	0.44
		F	0.16	0.27	0.41	0.42
	hamsters/golden Syrian	M	0.028	0.061	0.082	0.090
		F	0.026	0.060	0.088	0.096
	Chinese and Djungarain	M	0.011	0.021	0.028	0.027
		F	0.011	0.018	0.026	0.024
	gerbils[b]/Mongolian[a]	M	0.013	0.032	0.054	0.063
		F	0.012	0.027	0.047	0.057
Other Laboratory Mammals	cats	M	0.24	0.44	0.69	0.73
		F	0.23	0.41	0.61	0.63
	dogs/beagles[a]	M	1.11	1.24	3.62	4.35
		F	1.02	1.08	3.45	4.35
	rabbits/New Zealand[a]	M	0.80	1.10	1.38	1.46
		F	0.83	1.17	1.43	1.49

TABLE 1-4 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Other Animals[a,c]	pig/domestic	NS				40
	miniature					17
	mink	M	0.39	See growth curves		0.99
		F	0.36	Figures 3-60 and 3-61		0.66

[a]More specific values available. See Chapter 3.

[b]Species-specific allometric relationship not available. Based on allometric equation for hamsters that are similar in body weight.

[c]Values for this group are calculated from general allometric equation.

NS = Not specified

TABLE 1-5

Reference Water Consumption (ℓ/day) for Use with Reference Body Weights

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Primates	monkey, rhesus	M	0.090		0.60	0.65
		F	0.090		0.47	0.52
	chimpanzee	NS	0.26		0.94	0.97
Laboratory rodents[a]	mice[b]/BAF1 hybrid	M	0.0028	0.0060	0.0068	0.0084
		F	0.0026	0.0057	0.0060	0.0075
	mice/B6C3F1	M	0.0031	0.0078	0.0088	0.0093
		F	0.0036	0.0065	0.0085	0.0084
	rats[b]/Fischer 344	M	0.0077	0.028	0.049	0.051
		F	0.0075	0.021	0.033	0.036
	mice/Long-Evans	M	0.0093	0.036	0.057	0.060
		F	0.0090	0.028	0.046	0.046
	mice/Osborne-Mendel	M	0.011	0.037	0.061	0.064
		F	0.011	0.031	0.050	0.051
	rat/Sprague-Dawley	M	0.012	0.037	0.062	0.069
		F	0.012	0.031	0.045	0.046

TABLE 1-5 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Laboratory rodents[c] (cont.)	rat/Wistar[b]	M	0.011	0.032	0.057	0.060
		F	0.011	0.025	0.041	0.043
	guinea pigs[a]	M	0.025	0.058	0.092	0.010
		F	0.024	0.050	0.089	0.0092
	hamsters[a]/golden Syrian	M	0.0095	0.018	0.023	0.025
		F	0.0090	0.018	0.024	0.026
	Chinese and Djungarain	M	0.0045	0.0075	0.0095	0.0093
		F	0.0045	0.0066	0.0090	0.0084
	gerbils[a]/Mongolian[b]	M	0.0049	0.011	0.016	0.018
		F	0.0047	0.0093	0.015	0.017
Other laboratory mammals	cats[c]/dry diet	M	0.065	0.14	0.25	0.27
		F	0.062	0.13	0.21	0.22
	cats[c]/moist diet	M	0.005	0.017	0.043	0.048
		F	0.005	0.015	0.033	0.035
	dogs[c]/beagles[b] dry diet	M	1.16	0.18	0.57	0.69
		F	0.15	0.16	0.54	0.69
	dogs[c]/beagles[b] moist diet	M	0.021	0.025	0.16	0.22
		F	0.019	0.020	0.15	0.22
	rabbits[a]/New Zealand[b]	M	0.16	0.22	0.27	0.28
		F	0.17	0.23	0.27	0.28

TABLE 1-5 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Other Animals[b,c]	pig/domestic	NS				7.8
	miniature					3.2
	mink[d]	M	0.064	See growth curves		0.17
		F	0.062	Figures 3-60 and 3-61		0.11

[a]Based on allometric equation for laboratory mammals

[b]More specific values available. See Chapter 3

[c]For cats and dogs, separate equations are given for dry and moist diets. See Table 7-2.

[d]For mink, a moist diet is assumed. See Table 7-2.

NS = Not specified

TABLE 1-6

Recommended Values for Food Consumption (kg/day)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Primates[a]	monkey, rhesus	M	0.065		0.43	0.46
		F	0.065		0.33	0.37
	chimpanzee	NS	0.19		0.68	0.70
Laboratory rodents	mice[b,c]/BAF1 hybrid	M	0.0023	0.0045	0.0050	0.0061
		F	0.0021	0.0043	.0045	0.0055
	mice/B6C3F1	M	0.0025	0.0057	0.0064	0.0067
		F	0.0028	0.0048	0.0061	0.0061
	rats[b,c]/Fischer 344	M	0.0056	0.018	0.030	0.031
		F	0.0055	0.014	0.021	0.022
	mice/Long-Evans	M	0.0067	0.022	0.034	0.035
		F	0.0064	0.018	0.028	0.028
	mice/Osborne-Mendel	M	0.0080	0.023	0.036	0.037
		F	0.0080	0.019	0.030	0.031
	rat/Sprague-Dawley	M	0.0084	0.023	0.036	0.040
		F	0.0083	0.020	0.027	0.028

TABLE 1-6 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Laboratory rodents (cont.)	rat/Wistar[c]	M	0.080	0.020	0.034	0.035
		F	0.080	0.016	0.025	0.026
	guinea pigs	M	0.022	0.032	0.039	0.041
		F	0.022	0.030	0.039	0.040
	hamsters/golden Syrian	M	0.0042	0.0092	0.013	0.014
		F	0.0040	0.0092	0.014	0.015
	Chinese and Djungarain	M	0.0017	0.0032	0.0042	0.0041
		F	0.0017	0.0027	0.0040	0.0036
	gerbils/Mongolian[c]	M	0.0015	0.0045	0.0081	0.0098
		F	0.0014	0.0037	0.0070	0.0088
Other laboratory mammals	cats[d]/dry diet	M	0.036	0.068	0.11	0.11
		F	0.035	0.062	0.095	0.098
	cats[d]/moist diet	M	0.034	0.090	0.18	0.20
		F	0.032	0.078	0.15	0.16
	dogs[d]/beagles[c] dry diet	M	0.075	0.083	0.21	0.24
		F	0.071	0.074	0.20	0.24
	dogs[d]/beagles[c] moist diet	M	0.11	0.025	0.16	0.22
		F	1.82	0.10	0.48	0.65
	rabbits/New Zealand[c]	M	0.069	0.094	0.12	0.12
		F	0.072	0.100	0.12	0.12

TABLE 1-6 (cont.)

Group	Species/Strain	Sex	Weaning	Subchronic	Chronic	Mature
Other Animals[c]	pig/domestic miniature	NS				4.5 1.9
	mink[e]	M F	0.028 0.027	See growth curves Figures 3-60 and 3-61		0.089 0.054

[a]Based on general allometric equation. See Table 6-2.

[b]Based on allometric equation for laboratory mammals

[c]More specific values available. See Chapter 3.

[d]For cats and dogs, separate equations are given for dry and moist diets. See Table 7-2.

[e]For mink, a moist diet is assumed. See Table 7-2.

NS = Not specified

2. LIFESPAN, DEVELOPMENT AND REPRODUCTION

Table 2-1 summarizes data on lifespan, development and reproduction for a variety of species. Recommended values for weaning, puberty and lifespan are summarized in Table 2-2. Other values of interest in risk assessment (e.g., gestation period and average litter size) could be extracted from Table 2-1. The recommended values in Table 2-2 are intended to represent those reported in the literature but are not based on a rigorous analysis. Unlike the previous version of this report (U.S. EPA, 1985b), no use is made of calculated maximum lifespan potentials (Boxenbaum, 1983; Sacher, 1959). The expanded and reasonably consistent data base makes reliance on such calculations unnecessary.

The most important use of lifespan values in risk assessment is to adjust cancer potency factors used in the Agency's risk assessments for carcinogens (U.S. EPA, 1980, 1985). The lifespan values used by the Agency are consistent with the available lifespan data. Neither 70 years for humans nor 2 years for rodents, rats and mice approaches maximum recorded values, but both values are typical and of approximately equal proportion to maximum values.

The use of recommended or typical lifespans, as well as ages at weaning and puberty, can be practical in risk assessment to determine the applicability of toxicity bioassays varying in exposure duration to potential human health effects. For instance, the "equivalency of lifespans" is an implicit assumption in many risk assessments: the exposure of an animal for the lifespan of the animal can be used without adjustment (i.e., without the application of an uncertainty factor of 10 for subchronic to chronic exposure) to assess potential human health effects over a lifespan. As illustrated in Figure 2-1, the growth curves of species for which lifespan growth data are available (humans, mice, rats and gerbils) are similar, but

TABLE 2-1

Data on Lifespan, Development and Reproduction for Various Groups of Animals

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Primates	baboon					35-40	Washburn, 1981
	baboon	P. anubis				42[3]	Tolmasoff et al., 1980
	baboon	P. cynocephalus				[32]	Cutler, 1975
	baboon	P. cynocephalus				[32]	Cutler, 1975
	chimpanzee					[>37.6]	Jones, 1962
	chimpanzee	P. troglodytes				[45]	Cutler, 1975
	chimpanzee	P. troglodytes				[45]	Cutler, 1975
	chimpanzee	P. troglodytes				55[4]	Tolmasoff et al., 1980
	gibbon	H. lar				[32]	Cutler, 1975
	gibbon	H. lar				[32]	Cutler, 1975
	gorilla	G. gorilla				[40]	Cutler, 1975
	gorilla	G. gorilla				[40]	Cutler, 1975
	gorilla	G. gorilla				50[4]	Tolmasoff et al., 1980
	gorilla	lowland				10 +	Jones, 1962
	gorilla	lowland				[33.4]	Jones, 1962
	great ape	several				50	Washburn, 1964
	human					95[5]	Tolmasoff et al., 1980
	human					[100]	Rosen et al., 1981
	langur	P. entellus				[22]	Cutler, 1975
	lemur	Galago craddic-				18[2]	Tolmasoff et al., 1980
	lemur	L. macaca fulvus				28[3]	Tolmasoff et al., 1980
	marmoset					15	Washburn, 1981
	monkey					35-40	Washburn, 1981
	monkey	African green				30[3]	Tolmasoff et al., 1980
	monkey	CAmer squirrel				[2.66]	Jones, 1962
	monkey	M. mulatta				[29]	Cutler, 1975
	monkey	M. mulatta				[29]	Cutler, 1975
	monkey	rhesus		1.5-2.5 years	165-170		Arrington, 1978
	monkey	rhesus				[15]	Arrington,1972
	monkey	rhesus	12-27 weeks	5 years	165 days [160-180]		Hafez, 1970
	monkey	rhesus				[15]	Templeton, 1968
	monkey	rhesus		3-4 years			Arrington, 1978
	monkey	rhesus				[15]	Arrington,1972
	monkey	rhesus		6 years			Hafez, 1970
	monkey	rhesus				[15]	Templeton, 1968
	monkey	rhesus				35[3]	Tolmasoff et al., 1980

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Primates (cont.)	monkey	rhesus	120 days	3-4 years			Wahman Manuf. Co., 1973
	monkey	rhesus				[19.5]	Jones, 1962
	monkey	SAmer squirrel				[6.33]	Jones, 1962
	monkey	squirrel				17[2]	Tolmasoff et al., 1980
	orangutan	P. pygmaeus				[50]	Cutler, 1975
	orangutan	P. pygmaeus				[50]	Cutler, 1975
	orangutan	P. pygmaeus				58[4]	Tolmasoff et al., 1980
	primate (NOS)		3-6 months	5 years	150-180 days	"	Ralston Purina Co., n.d.
	primate (NOS)		3-6 months	6 years			Ralston Purina Co., n.d.
	tamarin	mustached				19[2]	Tolmasoff et al., 1980
Laboratory rodents	gerbil			9-12 weeks	24-25 days		Arrington, 1978
	gerbil					[2-4]	Arrington,1972
	gerbil		3 weeks	10-12 weeks	24-26 days		Hafez, 1970
	gerbil					[3.7]	Rosen et al., 1981
	gerbil			10-12 weeks			Arrington, 1978
	gerbil					[2-4]	Arrington, 1972
	gerbil			10-12 weeks			Hafez, 1970
	gerbil					[3.7]	Rosen et al., 1981
	gerbil	Mongolian				3.1	Arrington et al., 1973
	gerbil	Mongolian				2-4	Templeton, 1968
	gerbil	Mongolian				2.9	Arrington et al., 1973
	gerbil	Mongolian				2-4	Templeton, 1968
	guinea pig		14 days	45-70 days	60-72 days		Wahman Manuf. Co., 1973
	guinea pig			10 weeks	65-72		Arrington, 1978
	guinea pig		3.5 weeks	1-5 months	68 days[65-71]		Hafez, 1970
	guinea pig				68 days average		Porter and Lane-Petter, 1962
	guinea pig					6	Templeton, 1968
	guinea pig			30-45 days	65-70		USDA, 1970
	guinea pig			8 weeks			Arrington, 1978
	guinea pig			3-5 months			Hafez, 1970
	guinea pig		10 days	90-150 days			Ralston Purina Co., n.d.
	guinea pig					6	Templeton, 1968
	guinea pig					6	Arrington, 1972
	guinea pig					6	Arrington, 1972
	hamster				15.875 days		Bond, 1945
	hamster		3-4 weeks		16-17 days		Porter and Lane-Petter, 1962
	hamster		21 days	30 days	16-19 days		Wahman Manuf. Co., 1973
	hamster		[21-28] days		[16-17] days		Porter and Lane-Petter, 1962
	hamster		20-24 days	60	15-19 days		Ralston Purina Co., n.d.
	hamster		[21-28] days	84 days	16 days+[1-2] days		Worden, 1947

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Laboratory rodents (cont.)	hamster			4-6 weeks			Arrington, 1978
	hamster		20-24 days	60 days			Ralston Purina Co., n.d.
	hamster					[3.16]	Rosen et al., 1981
	hamster					[2.5]	Rosen et al., 1981
	hamster	Chinese	21		20-21 days		Moore, 1965
	hamster	golden				1.69[0.09]	Grindeland et al., 1957
	hamster	golden	3 weeks	2 months	16 days		Hafez, 1970
	hamster	golden					Soderwall et al., 1960
	hamster	golden				1.94 [2.5]	Deyl et al., 1975
	hamster	golden				1.94 [2.9]	Deyl et al., 1975
	hamster	golden				1.65[0.09]	Grindeland et al., 1957
	hamster	golden		2 months			Hafez, 1970
	hamster	_M. auratus_		7-8 weeks	16 days		Bruce and Hindle, 1934
	hamster	_M. auratus_	4-5 weeks	8-12 weeks	16 days		Laidlaw, 1939
	hamster	Syrian				[2-3]	Arrington, 1972
	hamster	Syrian				2-3	Templeton, 1968
	hamster	Syrian				[2-3]	Arrington, 1972
	hamster	Syrian				2-3	Templeton, 1968
	mouse		4 weeks				Farris, 1950
	mouse		21 days	35-40 days	20 days		Wahman Manuf. Co., 1973
	mouse			5-7 weeks	19-21 days		Arrington, 1978
	mouse					[1-2]	Arrington, 1972
	mouse		3 weeks	35-60 days	19 days [17-21]		Hafez, 1970
	mouse		28 days				Farris, 1950
	mouse		16-21 days	50-60 days	17-21 days		Ralston Purina Co., n.d.
	mouse		21 days	35 days	19-21 days		Simmons and Brick, 1970
	mouse		[21-28] days	[42-56] days	~21 days		Worden, 1947
	mouse			6-7 weeks			Arrington, 1978
	mouse					[1-2]	Arrington, 1972
	mouse					1.71 [2.5]	Deyl et al., 1975
	mouse					1.71 [2.4]	Deyl et al., 1975
	mouse			50 days			Hafez, 1970
	mouse		16-21 days	50 days			Ralston Purina Co., n.d.
	mouse			35 days			Simmons and Brick, 1970
	mouse					[2.34]	Rosen et al., 1981
	mouse					[3.13]	Rosen et al., 1981
	mouse	129/J				1.38 (0.030)	Russell, 1966
	mouse	129/J				1.70 (0.049)	Russell, 1966
	mouse	A/HeJ				1.10 (0.014)	Russell, 1966
	mouse	A/HeJ				1.42 (0.025)	Russell, 1966
	mouse	A/HeJ				1.40 (0.030)	Russell, 1966
	mouse	A/HeJ				1.31 (0.019)	Russell, 1966
	mouse	A/J				1.11 (0.019)	Russell, 1966
	mouse	A/J				1.32 (0.022)	Russell, 1966
	mouse	A/J				1.40 (0.025)	Russell, 1966

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Laboratory rodents (cont.)	mouse	A/J				1.38 (0.030)	Russell, 1966
	mouse	AKD2Fsub1				1.49 (0.027)	Russell, 1966
	mouse	AKD2Fsub1				1.39 (0.030)	Russell, 1966
	mouse	AKR/J				0.74 (0.008)	Russell, 1966
	mouse	AKR/J				0.70 (0.008)	Russell, 1966
	mouse	AKR/J				0.75 (0.014)	Russell, 1966
	mouse	B6AFsub1				1.96 (0.038)	Russell, 1966
	mouse	B6AFsub1				1.84 (0.044)	Russell, 1966
	mouse	B6D2F-sub1				2.00 (0.033)	Russell, 1966
	mouse	B6D2F-sub1				1.98 (0.033)	Russell, 1966
	mouse	BALB/cJ				1.27 (0.019)	Russell, 1966
	mouse	BALB/cJ				1.46 (0.041)	Russell, 1966
	mouse	BALB/cJ				1.33 (0.025)	Russell, 1966
	mouse	BRB6F-sub1				2.04 (0.047)	Russell, 1966
	mouse	BRB6F-sub1				1.90 (0.055)	Russell, 1966
	mouse	C3H/J				0.77 (0.003)	Russell, 1966
	mouse	C3H/J				1.09 (0.016)	Russell, 1966
	mouse	C3H/J				1.12 (0.019)	Russell, 1966
	mouse	C3HeB/J				1.35 (0.025)	Russell, 1966
	mouse	C3HeB/J				1.69 (0.030)	Russell, 1966
	mouse	C3HeB/J				1.56 (0.030)	Russell, 1966
	mouse	C57B1/6J				1.54 (0.022)	Russell, 1966
	mouse	C57B1/6J				1.79 (0.036)	Russell, 1966
	mouse	C57B1/6J				1.90 (0.025)	Russell, 1966
	mouse	C57B1/6J				1.90 (0.025)	Russell, 1966
	mouse	C57B1/6J				1.48 (0.019)	Russell, 1966
	mouse	C57Br/cdJ				1.49 (0.027)	Russell, 1966
	mouse	C57Br/cdJ				1.61 (0.038)	Russell, 1966
	mouse	C57Br/cdJ				1.30 (0.036)	Russell, 1966
	mouse	C57L/J				1.35 (0.036)	Russell, 1966
	mouse	C57L/J				1.58 (0.052)	Russell, 1966
	mouse	C57L/J				1.46 (0.036)	Russell, 1966
	mouse	CAF-sub1				1.86 (0.030)	Russell, 1966
	mouse	CAF-sub1				1.81 (0.030)	Russell, 1966
	mouse	CBA/J				0.98 (0.030)	Russell, 1966
	mouse	CBA/J				1.43 (0.022)	Russell, 1966
	mouse	DBA/1J				1.12 (0.014)	Russell, 1966
	mouse	DBA/1J				1.59 (0.030)	Russell, 1966
	mouse	DBA/1J				1.65 (0.036)	Russell, 1966
	mouse	DBA/1J				1.20 (0.025)	Russell, 1966
	mouse	DBA/2J				1.12 (0.016)	Russell, 1966
	mouse	DBA/2J				1.50 (0.025)	Russell, 1966
	mouse	DBA/2J				1.81 (0.030)	Russell, 1966
	mouse	DBA/2J				1.14 (0.025)	Russell, 1966
	mouse	deer	35 days	50 days	23 days		Worden, 1947
	mouse	deer				8[1]	Tolmasoff et al., 1980
	mouse	house				3.5[0.5]	Tolmasoff et al., 1980

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Laboratory rodents (cont.)	mouse	LAF-sub1				1.99 (0.036)	Russell, 1966
	mouse	LAF-sub1				1.93 (0.038)	Russell, 1966
	mouse	NR				1.42 (0.019)	Russell, 1966
	mouse	NR				1.93 (0.030)	Russell, 1966
	mouse	MA/MyJ				1.33 (0.019)	Russell, 1966
	mouse	MA/MyJ				1.60 (0.022)	Russell, 1966
	mouse	<u>Notomys alexis</u>			29-47 days		Fox, 1985
	mouse	<u>P. eremicus</u>					Glazier, 1985
	mouse	<u>P. floridanus</u>					Glazier, 1985
	mouse	<u>P. leucopus</u>					Glazier, 1985
	mouse	<u>P. maniculatus</u>					Glazier, 1985
	mouse	<u>P. polionotus</u>					Glazier, 1985
	mouse	NR				1.01 (0.025)	Russell, 1966
	mouse	NR				1.23 (0.025)	Russell, 1966
	mouse	wood	14 days		21 days		Worden, 1947
	rat		21 days	60-72 days	22 days		Wahman Manuf. Co., 1973
	rat			7-9 weeks	21-23 days		Arrington, 1978
	rat					[2-3]	Arrington, 1972
	rat		3 weeks	100 days	21 days		Hafez, 1970
	rat		20 days	50-60 days	21-23		Porter and Lane-Petter, 1962
	rat		[20-28] days	[50-60] days	[21-23] days		Porter and Lane-Petter, 1962
	rat		21	100 days	20-22 days		Ralston Purina Co., n.d.
	rat					[3.15]	Rosen et al., 1981
	rat			6-8 weeks			Arrington, 1978
	rat					[2-3]	Arrington, 1972
	rat			100 days			Hafez, 1970
	rat		21 days	100 days			Ralston Purina Co., n.d.
	rat					[2.47]	Rosen et al., 1981
	rat					[3.01]	Rosen et al., 1981
	rat	BN/BiRij				3.2[2.7-3.4]	Hollander et al., 1984
	rat	BN/BiRij				3.0[2.7-3.3]	Hollander et al., 1984
	rat	CFY	21 days				NAS, 1971
	rat	Cotton	21 days	[42-49] days	27[26-28] days		Worden, 1947
	rat	F344				2.35 (50%)	Solleveld et al., 1984
	rat	F344				1.77 (90%)	Solleveld et al., 1984
	rat	F344				2.81 (10%)	Solleveld et al., 1984
	rat	F344				2.81 (10%)	Solleveld et al., 1984
	rat	F344				2.35 (50%)	Solleveld et al., 1984
	rat	F344				1.81 (90%)	Solleveld et al., 1984
	rat	F344				2.69 (10%)	Solleveld et al., 1984
	rat	Long-Evans				1.96 (90%)	Holloszy and Smith, 1986
	rat	Long-Evans				2.63 (50%)	Holloszy and Smith, 1986
	rat	Long-Evans				3.06(10%)	Holloszy and Smith, 1986
	rat	Long-Evans				2.53[0.44]	Holloszy et al., 1985
	rat	<u>R. lutreolus</u>			24.6-25.1 days		Fox, 1985
	rat	<u>R. sordidus</u>			21-22 days		Fox, 1985

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Laboratory rodents (cont.)	rat	WAG/Rij				3.3[2.6-3.7]	Hollander et al., 1984
	rat	WAG/Rij				3.3[2.6-3.7]	Hollander et al., 1984
	rat	WAG/Rij				2.9[2.6-3.0]	Hollander et al., 1984
	rat	WAG/Rij				2.9[2.6-3.0]	Hollander et al., 1984
	rat	Wistar				1.52	Deyl et al., 1975
	rat	Wistar				1.52[2.45]	Deyl et al., 1975
	rat	Wistar BH	21 days				Kahan and Rosen, 1984
Other laboratory animals	cat		42 days	180 days	63[52-69]		Wahman Manuf. Co., 1973
	cat			7 months	58-64		Arrington, 1978
	cat					[13-17]	Arrington, 1972
	cat					[13-17]	Arrington, 1978
	cat		7-8 weeks	5-7 months	65 days (4 days)		Hafez, 1970
	cat					[13-17]	Templeton, 1968
	cat			9 months			Arrington, 1978
	cat					[13-17]	Arrington, 1972
	cat					[13-17]	Arrington, 1978
	cat			9-12 months			Hafez, 1970
	cat					[13-17]	Templeton, 1968
	dog		42 days	180-240 days	63[53-71]		Wahman Manuf. Co., 1973
	dog		6-8 weeks	9-12 months	63 days		Hafez, 1970
	dog		6-8 weeks	9-12 months	60-65 days		Ralston Purina Co., n.d.
	dog			10-12 months			Hafez, 1970
	dog		6-8 weeks	10-12 months			Ralston Purina Co., n.d.
	dog	beagle		7-9 months	58-63		Arrington, 1978
	dog	beagle				[13-17]	Arrington,1972
	dog	beagle		12[2]months	63[1]days		NAS, 1971
	dog	beagle				[13-17]	Templeton, 1968
	dog	beagle	6-8 months				Arrington, 1978
	dog	beagle				[13-17]	Arrington,1972
	dog	beagle				[13-17]	Templeton, 1968
	rabbit		42 days	120-180 days	30-32 days		Wahman Manuf. Co., 1973
	rabbit			5-6 months	31-32 days		Arrington, 1978
	rabbit					[6-7]	Arrington, 1972
	rabbit		8 weeks	5-6 months	31 days		Hafez, 1970
	rabbit		8weeks	5-6 months	30-32 days		Ralston Purina Co., n.d.
	rabbit			6-7 month			Arrington, 1978
	rabbit					[6-7]	Arrington, 1972
	rabbit					[6-7]	Arrington, 1978
	rabbit			6-7 months			Hafez, 1970
	rabbit		8 weeks	6-7 months			Ralston Purina Co., n.d.
	rabbit	N. Zealand white	56 days	26 weeks			Altman and Ditmer, 1974

TABLE 2-1 (cont.)

Animal Group	Species	Strain	Age at Weaning	Age at Puberty	Gestation Period	Lifespan	Reference
Other laboratory animals (cont.)	rabbit	N. Zealand white				6	Templeton, 1968
	rabbit	N. Zealand white				6	Templeton, 1968
	rabbit (volcano)	_R. diazi_			39-41 days		Matsuzaki et al., 1985
Wildlife	chinchilla		6-8 weeks	6-8.5 months	111 days[105-115]		Hafez, 1970
	chinchilla			6 months			Hafez, 1970
	ferret		42 days		41.3 days		McLain et al., 1985
	ferret		2 months		42 days		Worden, 1947
	ferret	domestic				5-6	Moody et al., 1985
	ferret	domestic				5-6	Moody et al., 1985
	hedgehog		40[38-44] days		[34-42] days		Worden, 1947
	langur	_P. entellus_				[22]	Cutler, 1975
	mink				51.4 days (1.31)		Aulerich et al., 1979
	mink				49.7 days(1.39)		Aulerich et al., 1979
	mink		8 weeks	10 months	51 days[45-70]		Hafez, 1970
	mink			10 months			Hafez, 1970
	raccoon						Fiero and Verts, 1986
	raccoon						Fiero and Verts, 1986
	shrew	common tree				12[2]	Tolmasoff et al., 1980
	tarsier vole	bornean					Wright et al., 1986
	vole		[12-14] days	[21-30] days	21 days		Worden, 1947
	vole					[2]	Richmond and Conaway, 1969
	vole	_M. ochrogaster_	21 days	40 days	21-23 days		Richmond and Conaway, 1969
	vole	orkney	21 days		21 days		Worden, 1947

NOS = Not otherwise specified

TABLE 2-2

Recommended Values for Weaning, Puberty and Lifespan

Group/Species	Weaning (days)	Puberty (days)	Lifespan (years)
Primates			
Monkey, rhesus	130	1825 (5 years)	35
Baboon	NR	NR	55
Marmoset	NR	NR	40
Laboratory rodents			
Mice	21	50	2*
Rats	21	56	2*
Guinea pigs	14	70	6
Hamsters	21	60	2.5
Gerbils	21	70	3
Other laboratory mammals			
Cats	49	240	15
Dogs, beagles	42	240	15
Rabbits, New Zealand	56	195	6
Other animals			
Chicken	NA	NA	24
Pig	NR	150	28
Mink	56	300	NR

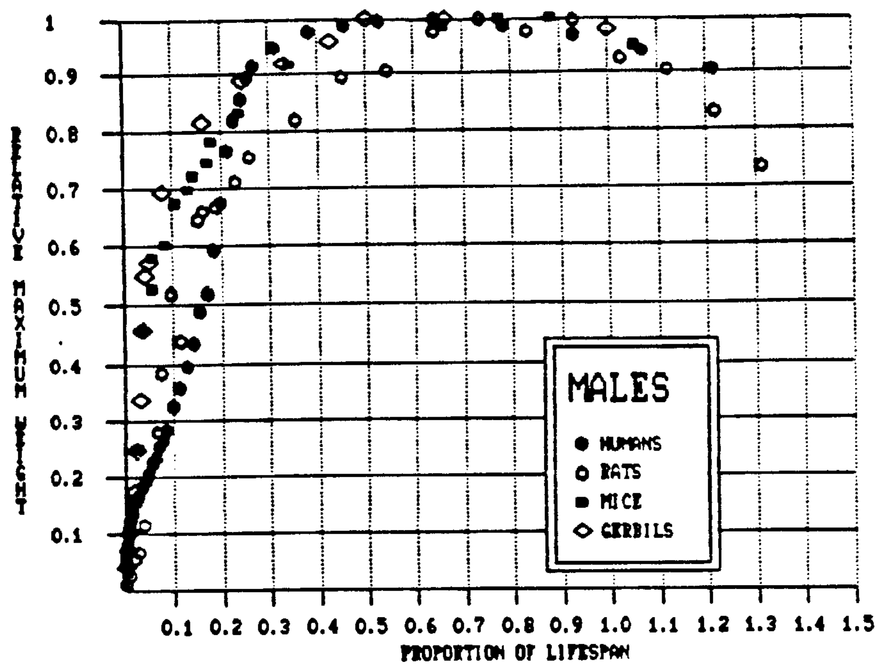
*Substantial strain variability

NA = Not applicable; NR = not reported

not identical, when weight is expressed as the proportion of maximum weight and age is expressed as the proportion of the recommended value for the lifespan. Given the intraspecies variability in growth (Chapter 3), the general shapes of the relative growth curves are consistent, when viewed over the lifespan of the animal, and provide some support for the equivalency of lifespan assumption. The growth patterns in Figure 2-1 also suggest a more explicit definition of the recommended lifespan value, the time at which body weight begins to decline.

In the early stages of growth, some substantial differences are apparent in relative growth rates among species. These differences are well illustrated in Figure 2-2, which presents the relative growth over the first 30% of the lifespan of the animals included in Figure 2-1. A similar difference in relative growth between humans and rats was noted by Brody (1945). During very early life (<1% of lifespan), humans grow more rapidly than experimental mammals. As lifespan progresses, however, the relative growth of the smaller animals exceeds that of humans for periods between 15 and 20% of lifespan. After this time, the growth curves are not remarkably different except for the slower and nearly linear growth of rats and female mice over the period between 20 and 70% of growth models such as the Bertalanffy, Gompertz and logistic equations were applied to many sets of growth data summarized in this report. While growth lifespan. For humans, rats and mice, sex-specific differences in growth are apparent; males grow more rapidly and reach a plateau sooner than females.

A large body of literature exists on growth kinetics and the interpretation of differences in growth patterns (Donhoffer, 1986; Kirkwood, 1985; Moore, 1985; Prothero, 1986; Ricker, 1979; Zullinger et al., 1984). Various growth models such as the Bertalanffy, Gompertz and logistic equations were applied to many sets of growth data summarized in this report. While growth



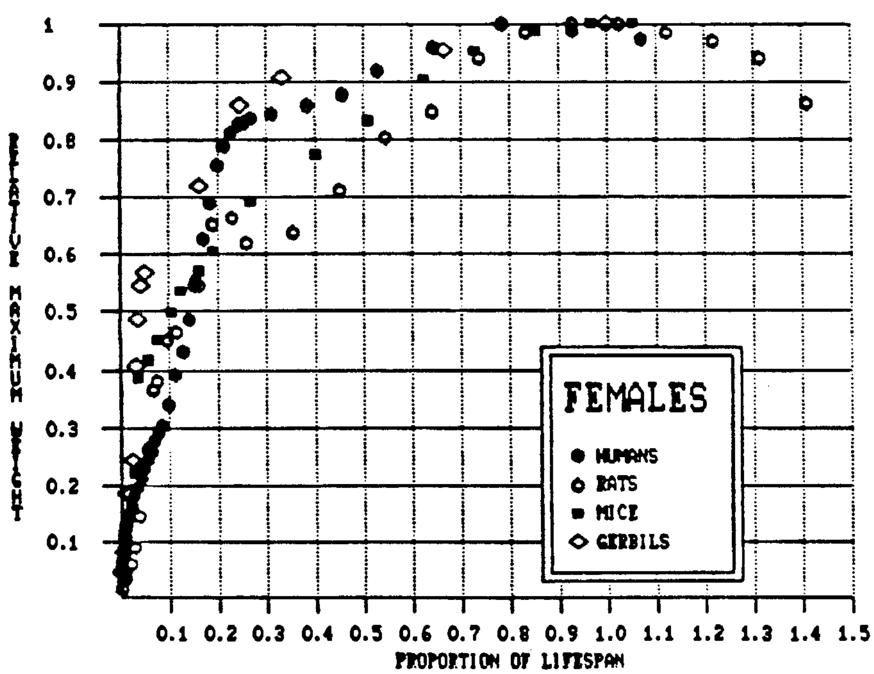
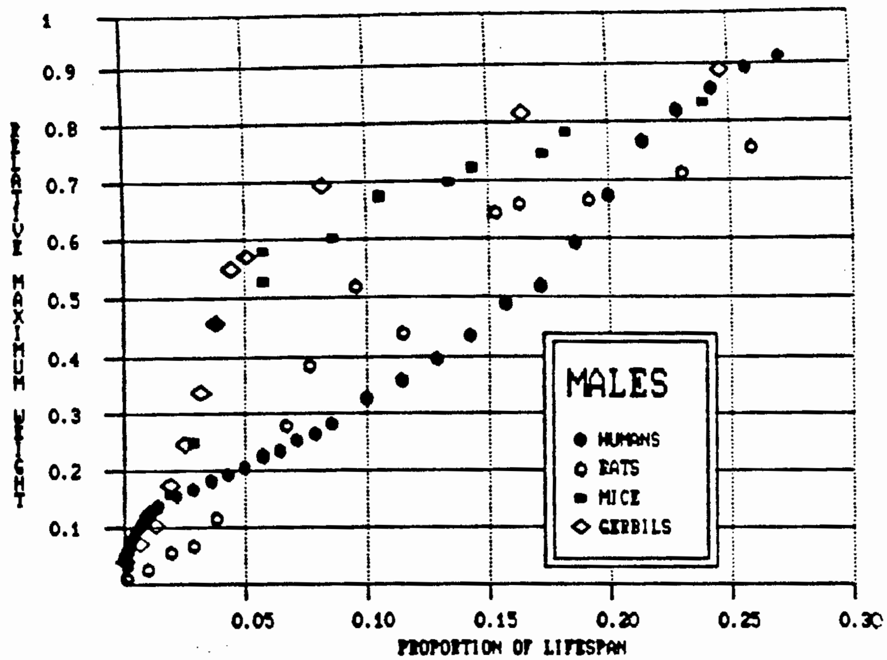


FIGURE 2-1

Plot of Relative Maximum Weight vs. Proportion of Recommended Lifespan for Male and Female Humans, Mice, Rats and Gerbils



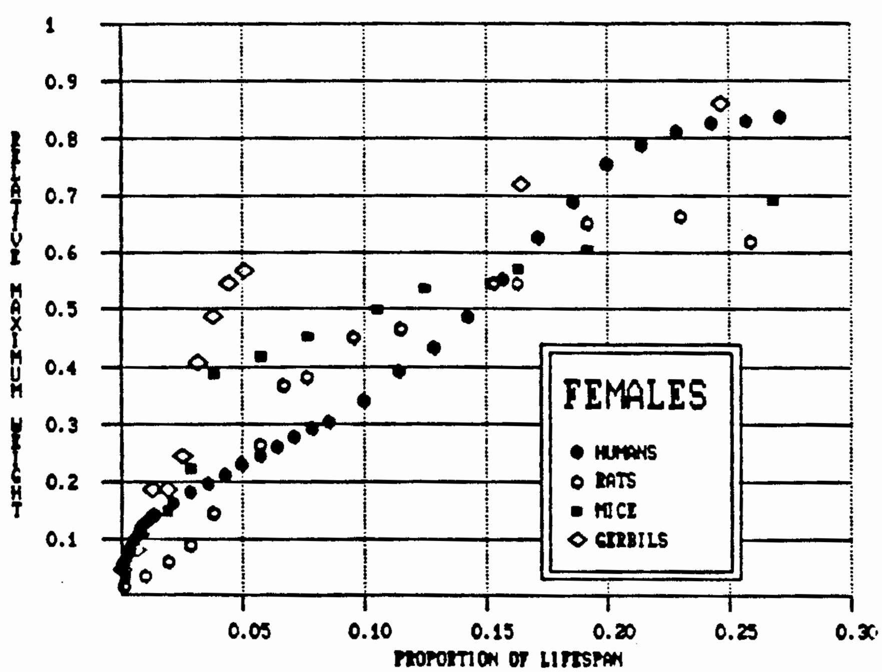


FIGURE 2-2

Plot of Relative Maximum Weight vs. Proportion of Recommended Lifespan for Male and Female Humans, Mice, Rats and Gerbils Over the First 30% of Recommended Value for Lifespan models could be useful for providing more explicit estimates of body weight and TWA weight, a general model for growth that incorporates the decrease in body weight seen in older animals has not been proposed. Given the large amount of available information on growth in the species often used in risk assessment, models have not been used in this report to estimate body weights. If the value for the recommended lifespan is redefined as the point at which body weight begins to decline, a general growth model could be developed that would lead to better estimates of the body weight values recommended in this report.

The practical aspect of these differences in early growth rates for risk assessment is that the more rapid growth of the small animals is parallelled by more rapid sexual maturation. Consequently, in the standard 90-day subchronic study on weanling animals, mice reach puberty during the first third of the study; however, cats, dogs, rabbits and other larger animals do not reach puberty during the course of the 90-day study. Data on the proportion of time between weaning and puberty covered by a standard 90-day bioassay are summarized in Table 2-3.

While the methodological application of these relationships to risk assessment is beyond the scope of this report, the term, subchronic, is ill-defined in the literature on risk assessment. The "standard 90-day subchronic study" does not cover the same developmental periods among species commonly used in toxicity studies, and it may be inappropriate to treat such studies in the same way (i.e., same uncertainty factor). If puberty is taken as a key developmental event during growth, a species-specific definition of a subchronic study could be proposed as a study that covers the period from weaning to puberty and an equal period beyond puberty. This would correspond to a value of 2 in the third column of Table 2-3 for each species.

TABLE 2-3

Proportion of Time from Weaning to Puberty Covered by 90-Day Study

Group/Species	Weaning (days)	Puberty (days)	Proportion of Time to Puberty
<u>Primates</u>			
Monkey, Rhesus	130	1825	0.053
<u>Laboratory rodents</u>			
Mice	21	50	3.10
Rats	21	56	2.57
Guinea pigs	14	70	1.61
Hamsters	21	60	2.12
Gerbils	21	70	1.84
<u>Other laboratory mammals</u>			
Cats	49	240	0.47
Dogs, beagles	42	240	0.23
Rabbits, New Zealand	56	195	0.65
<u>Other animals</u>			
Mink	56	300	0.37

3. GROWTH

In this chapter, information on body weight and growth is presented for primates, laboratory rodents, other laboratory mammals, livestock, and wildlife. Some plots of growth data contain both large closed circles and small open circles; the latter are connected by solid lines. The large closed circles are the actual reported body weights. The small open circles are TWA body weights calculated from the start of the observation period (To) to the time specified on the graph. TWA body weights between any two time periods (T1 and T2) can be calculated by using the cumulative TWA body weights at each period (BW1 and BW2) by the following equation:

$$TWA = [(T1 \times BW1) - (T2 \times BW2)]/T1-T2 \qquad (3\text{-}1)$$

Figures in this chapter that have titles beginning with "Recommended Growth Curve" are those from which recommended body weights have been estimated. Figures that have titles beginning with "Growth and Body Weight Data" are provided for information or comparison with the recommended growth curve. Whenever all of the available growth data are not used in recommending body weights, both kinds of figures are provided.

3.1. PRIMATES

Data on the growth and body weight of primates are summarized in Table 3-1. Growth and body weight data over the entire lifespan are available only for humans. The most complete published information on human growth is provided by Stoudt et al. (1960) on male and female Caucasians. The Stoudt et al. (1960) data are generally consistent with other published information.

TABLE 3-1

Growth and Body Weight Data on Primates

Species	Strain	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Chimpanzees	NS	both	NS	1	1.90000	2.50E-003	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	183	4.85000	3.06E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	365	6.55000	1.56E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	548	8.15000	3.06E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	730	9.60000	2.25E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	913	11.80000	2.25E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	1,095	13.25000	3.06E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	1,278	14.75000	5.06E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	1,460	16.60000	9.00E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	1,643	18.50000	6.25E-002	Lane-Peter et al., 1967
Chimpanzees	NS	both	NS	1,825	19.75000	1.41E-001	Lane-Peter et al., 1967
Humans	Caucasian	female	many	1	3.40000	2.50E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	15	3.72000	2.50E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	45	4.26000	2.92E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	75	5.08000	3.48E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	105	5.81000	4.62E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	135	6.44000	5.33E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	165	7.08000	6.72E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	195	7.71000	7.40E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	225	8.12000	8.28E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	255	8.44000	9.02E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	285	8.80000	9.02E-001	Stoudt et al., 1960
Humans	Caucasian	female	many	315	9.12000	1.00E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	345	9.43000	1.08E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	365	9.53000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	548	10.89000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	730	12.25000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	913	13.15000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	1,095	14.06000	3.28E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	1,278	15.42000	3.28E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	1,460	16.33000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	1,643	17.24000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	1,825	18.60000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	2,008	19.50000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	2,190	20.41000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	female	many	2,555	22.68000	1.01E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	2,920	26.31000	2.49E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	3,285	29.03000	2.49E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	3,650	32.66000	4.03E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	4,015	37.19000	6.66E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	4,380	42.18000	6.66E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	4,745	46.27000	6.66E0001	Stoudt et al., 1960

TABLE 3-1 (cont.)

Species	Strain	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Humans	Caucasian	female	many	5,110	50.80000	7.43E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	5,475	53.07000	8.23E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	5,840	54.43000	9.08E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	6,205	55.34000	7.43E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	6,570	55.79000	5.94E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	6,935	56.25000	5.94E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	8,030	56.70000	7.43E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	9,855	57.61000	9.08E0001	Stoudt et al., 1960
Humans	Caucasian	female	many	11,680	58.97000	1.19E0002	Stoudt et al., 1960
Humans	Caucasian	female	many	13,505	61.69000	1.29E0002	Stoudt et al., 1960
Humans	Caucasian	female	many	16,425	64.41000	1.50E0002	Stoudt et al., 1960
Humans	Caucasian	female	many	20,075	67.13000	1.61E0002	Stoudt et al., 1960
Humans	Caucasian	female	many	23,725	66.23000	1.61E0002	Stoudt et al., 1960
Humans	Caucasian	female	many	27,375	65.32000	1.50E0002	Stoudt et al., 1960
Humans	NS	female	many	7,665	60.78200	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	many	10,950	64.41078	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	many	14,600	67.13236	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	many	18,250	68.03955	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	many	21,900	68.03955	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	many	25,550	66.67876	NS	U.S. Bureau of the Census, 1985
Humans	Caucasian	male	many	1	3.45000	3.48E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	15	3.86000	3.48E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	45	4.49000	5.33E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	75	5.49000	5.93E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	105	6.30000	7.40E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	135	6.99000	6.72E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	165	7.62000	8.28E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	195	8.16000	9.02E-001	Stoudt et al., 1960
Humans	Caucasian	male	many	225	8.71000	1.08E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	255	9.16000	1.08E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	285	9.48000	1.19E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	315	9.84000	1.28E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	345	10.16000	1.28E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	365	10.43000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	548	11.79000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	730	12.70000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	913	13.61000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	1,095	14.52000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	1,278	15.42000	1.85E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	1,460	16.78000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	1,643	17.69000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	1,825	19.05000	5.15E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	2,008	19.96000	5.15E0000	Stoudt et al., 1960

TABLE 3-1 (cont.)

Species	Strain	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Humans	Caucasian	male	many	2,190	21.32000	7.40E0000	Stoudt et al., 1960
Humans	Caucasian	male	many	2,555	24.49000	1.01E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	2,920	27.22000	1.32E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	3,285	29.94000	1.32E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	3,650	33.11000	2.06E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	4,015	37.19000	2.49E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	4,380	39.46000	2.96E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	4,745	44.91000	3.48E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	5,110	51.26000	4.62E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	5,475	58.06000	5.27E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	5,840	62.14000	5.27E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	6,205	64.86000	7.43E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	6,570	67.59000	8.23E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	6,935	69.40000	9.08E0001	Stoudt et al., 1960
Humans	Caucasian	male	many	8,030	71.67000	1.09E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	9,855	73.94000	1.19E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	11,680	74.84000	1.29E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	13,505	75.30000	1.29E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	16,425	75.75000	1.29E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	20,075	74.84000	1.29E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	23,725	73.48000	1.19E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	27,375	71.21000	1.19E0002	Stoudt et al., 1960
Humans	Caucasian	male	many	31,025	68.49000	1.19E0002	Stoudt et al., 1960
Humans	NS	male	many	7,665	73.93631	NS	U.S. Bureau of the Census, 1985
Humans	NS	male	many	10,950	78.47229	NS	U.S. Bureau of the Census, 1985
Humans	NS	male	many	14,600	80.74027	NS	U.S. Bureau of the Census, 1985
Humans	NS	male	many	8,250	80.74027	NS	U.S. Bureau of the Census, 1985
Humans	NS	male	many	21,900	78.92588	NS	U.S. Bureau of the Census, 1985
Humans	NS	male	many	25,550	74.84351	NS	U.S. Bureau of the Census, 1985
Humans	NS	female	29	9,527	59.50000	1.01E0002	Aitken et al., 1986
Humans	NS	female	20	7	3.42000	NS	Cross, 1949
Humans	NS	male	37	9,477	77.00000	5.70E0002	Aitken et al., 1986
Humans	NS	male	16	5	3.67000	NS	Cross, 1949
Humans	NS	male	24	9,308	78.60000	9.00E-002	Luft et al., 1983
Humans	NS	both	21	17,885	74.00000	1.21E0002	White et al., 1985
Humans	NS	NS	23	1	3.43000	NS	Fisher et al., 1982
Humans	NS	NS	4	1	3.47000	NS	Fisher et al., 1982
Humans	NS	NS	12	1	3.50000	NS	Fisher et al., 1982
Humans	NS	NS	22	1	3.40000	NS	Fisher et al., 1982
Marmosets	common	female	6	107	0.11500	9.00E-004	Yarbrough et al., 1984
Marmosets	common	female	14	274	0.23400	5.04E-003	Yarbrough et al., 1984
Marmosets	common	female	5	457	0.27300	2.50E-003	Yarbrough et al., 1984
Marmosets	common	female	7	746	0.34600	9.00E-004	Yarbrough et al., 1984

TABLE 3-1 (cont.)

Species	Strain	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Marmosets	common	male	7	95	0.10300	3.36E-003	Yarbrough et al., 1984
Marmosets	common	male	14	274	0.22000	4.76E-003	Yarbrough et al., 1984
Marmosets	common	male	10	457	0.32000	4.62E-003	Yarbrough et al., 1984
Marmosets	common	male	12	746	0.37500	1.44E-003	Yarbrough et al., 1984
Monkeys	rhesus	female	1	1	0.41800	NS	Farris, 1950
Monkeys	rhesus	female	1	5	0.45000	NS	Farris, 1950
Monkeys	rhesus	female	1	10	0.51000	NS	Farris, 1950
Monkeys	rhesus	female	1	15	0.54000	NS	Farris, 1950
Monkeys	rhesus	female	1	20	0.55000	NS	Farris, 1950
Monkeys	rhesus	female	1	25	0.62000	NS	Farris, 1950
Monkeys	rhesus	female	1	30	0.63000	NS	Farris, 1950
Monkeys	rhesus	female	NS	6	0.44000	3.60E-003	NAS, 1981
Monkeys	rhesus	female	NS	183	1.30000	2.25E-002	NAS, 1981
Monkeys	rhesus	female	NS	365	1.90000	4.00E-002	NAS, 1981
Monkeys	rhesus	female	NS	557	2.50000	4.00E-002	NAS, 1981
Monkeys	rhesus	female	NS	730	2.90000	4.00E-002	NAS, 1981
Monkeys	rhesus	female	NS	1,112	4.20000	1.60E-001	NAS, 1981
Monkeys	rhesus	female	NS	1,460	5.20000	6.40E-001	NAS, 1981
Monkeys	rhesus	female	50	1	0.46500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	30	0.60000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	60	0.77000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	91	0.91500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	122	1.08500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	152	1.25500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	182	1.41500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	213	1.56000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	243	1.68000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	274	1.81500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	304	1.94000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	335	2.07000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	50	365	2.18500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	43	730	3.40500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	34	1,095	4.82000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	31	1,460	5.95000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	28	1,825	6.66000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	25	2,190	7.29000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	female	21	2,555	8.00500	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	28	1	0.49000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	28	91	0.96000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	28	182	1.44000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	28	274	1.84000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	28	365	2.20000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	22	548	2.88000	NR	Van Wagener and Catchpole, 1956

TABLE 3-1 (cont.)

Species	Strain	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Monkeys	rhesus	male	17	730	3.45000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	12	1,095	5.72000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	10	1,460	7.52000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	9	1,825	8.71000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	7	2,190	9.97000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	6	2,555	10.97000	NR	Van Wagener and Catchpole, 1956
Monkeys	rhesus	male	NS	6	0.48000	2.50E-003	NAS, 1981
Monkeys	rhesus	male	NS	183	1.50000	1.00E-002	NAS, 1981
Monkeys	rhesus	male	NS	183	1.50000	1.00E-002	NAS, 1981
Monkeys	rhesus	male	NS	365	2.20000	4.00E-002	NAS, 1981
Monkeys	rhesus	male	NS	557	3.00000	2.50E-001	NAS, 1981
Monkeys	rhesus	male	NS	730	3.50000	3.60E-001	NAS, 1981
Monkeys	rhesus	male	NS	1,112	5.10000	1.21E0000	NAS, 1981
Monkeys	rhesus	male	NS	1,460	7.40000	1.96E0000	NAS, 1981
Monkeys	rhesus	male	NS	1,825	9.70000	2.25E0000	NAS, 1981

NR = Not reported; NS = not specified

For other primate species, growth data over the lifespan were not encountered. Nonetheless, relatively good early growth data are available on the rhesus monkey, chimpanzee and common marmoset. Since toxicity studies are seldom conducted over the complete lifespan of these species, the available growth data are adequate for proposing practical recommended values.

3.1.1. **Humans.** All of the body weight data on human males and females summarized in Table 3-1 are plotted in Figure 3-1. These data are generally consistent, although the data presented by the U.S. Bureau of the Census (1985) and Aitken et al. (1986) give somewhat greater weights than the data of Stoudt et al. (1960), for comparable ages. This difference in reported body weights may be related to a general, although slight, increase in the body weight of the U.S. population that occurred between the 1960s and 1980s. This trend is illustrated in Figures 3-2 and 3-3 for males and females, respectively, from data provided by the U.S. Bureau of the Census (1985). [In Table 3-1, only the data from 1976-1980 are presented.]

The reference values recommended by Snyder et al. (1975) are based largely on the data presented by Stoudt et al. (1960). The relationship of age to body weight for human females based on the data provided by Stoudt et al. (1960) and U.S. Bureau of the Census (1985) are plotted in Figure 3-4. Corresponding data on human males are plotted in Figure 3-5. Body weights for children are shown in Figure 3-6, which is based on the data of Stoudt et al. (1960) for males and females <20 years of age. As with many animal species, differences in body weight between males and females are not remarkable until after puberty.

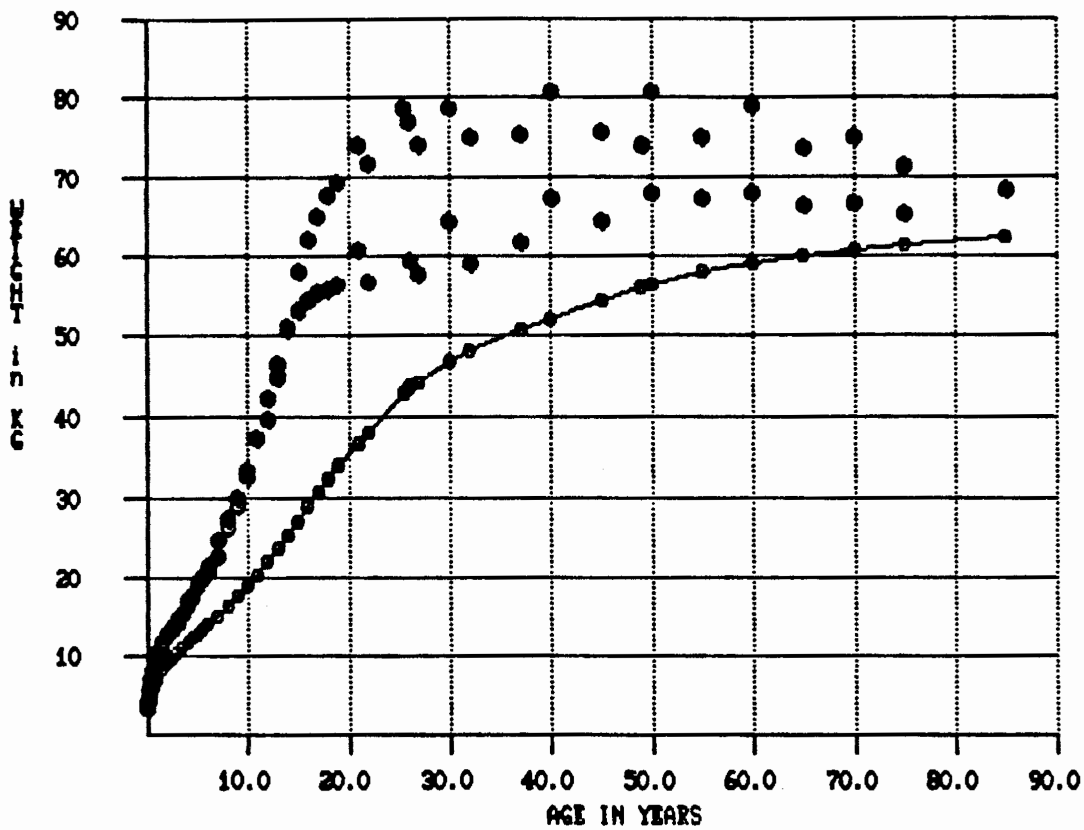


FIGURE 3-1

Body Weight Data on Male and Female Humans
[All data combined (see Table 3-1 for references)]

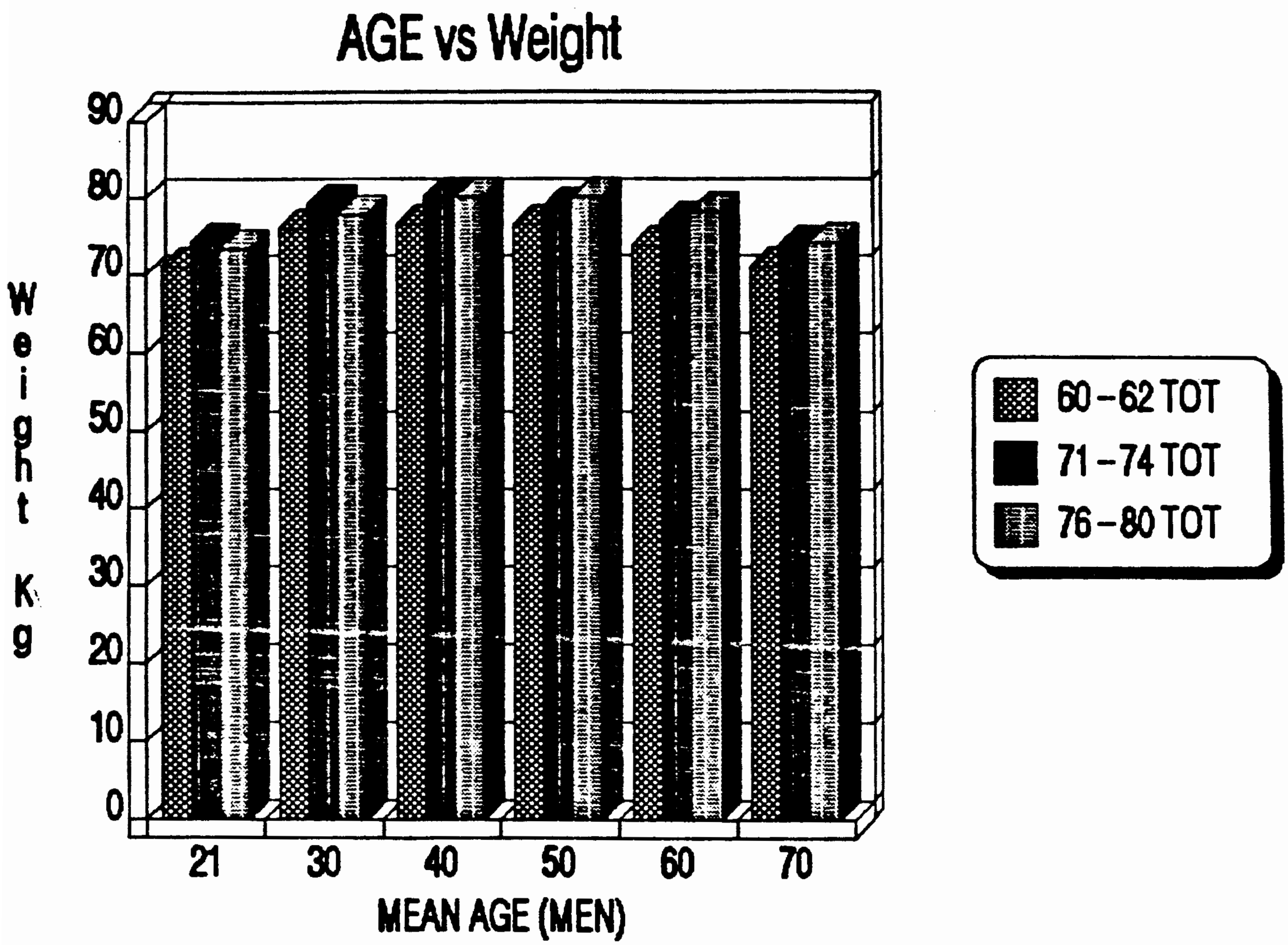


FIGURE 3-2

Mean Body Weights of Human Males of Various Ages Over the Periods 1960-1962, 1971-1974 and 1976-1980

Source: U.S. Bureau of the Census, 1985

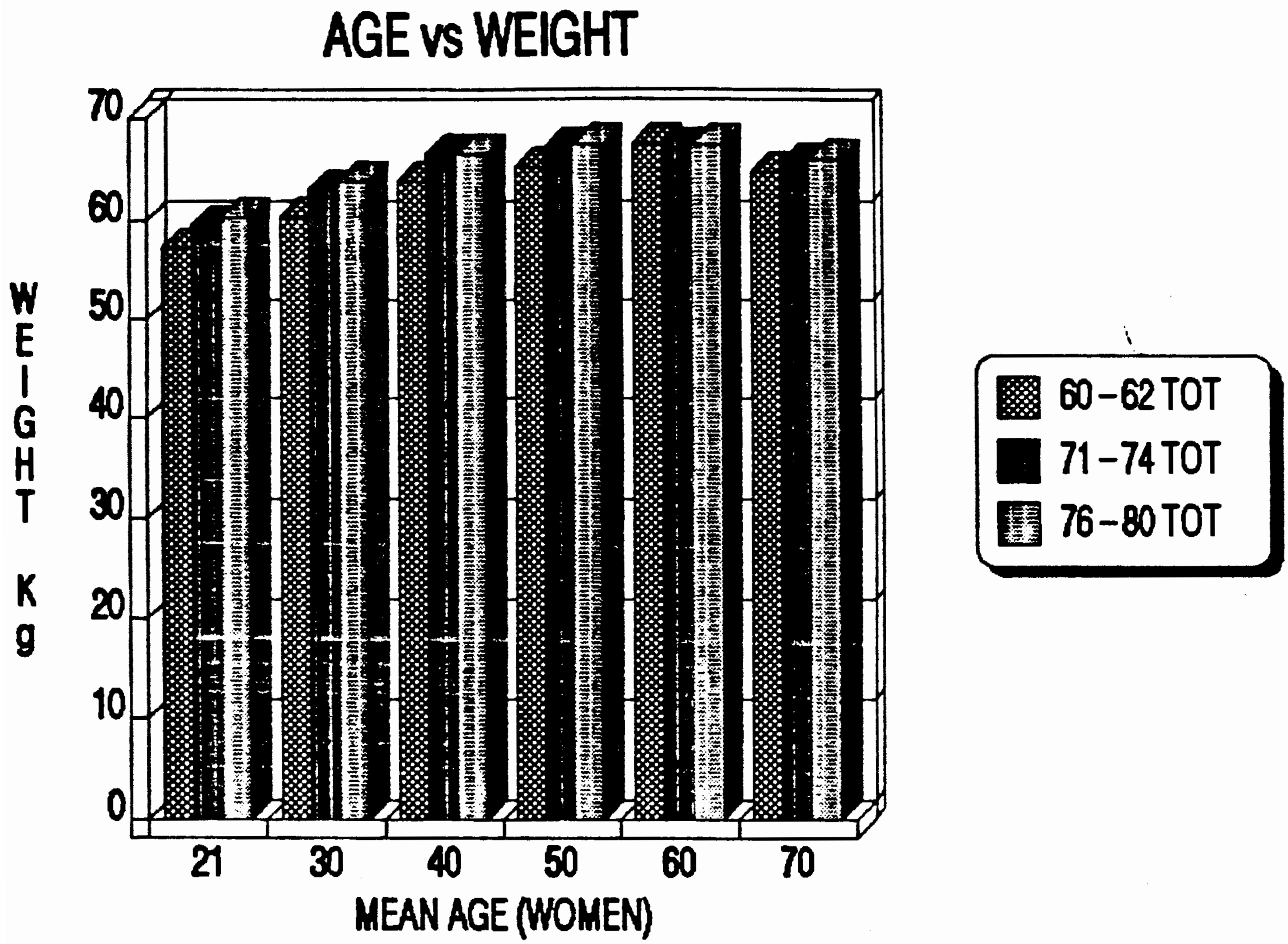


FIGURE 3-3

Mean Body Weights of Human Females of Various Ages Over the Periods 1960-1962, 1971-1974 and 1976-1980

Source: U.S. Bureau of the Census, 1985

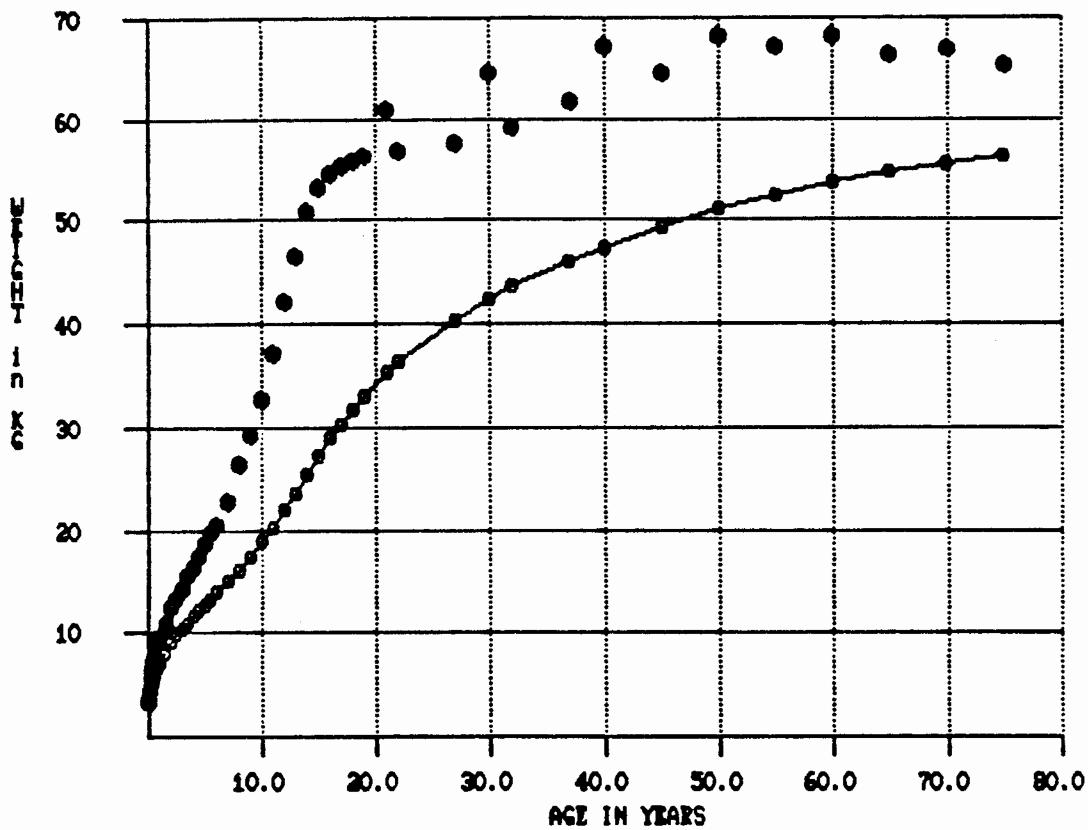


FIGURE 3-4

Recommended Growth Curves for Human Females

Sources: U.S. Bureau of the Census, 1985; Stoudt et al., 1960

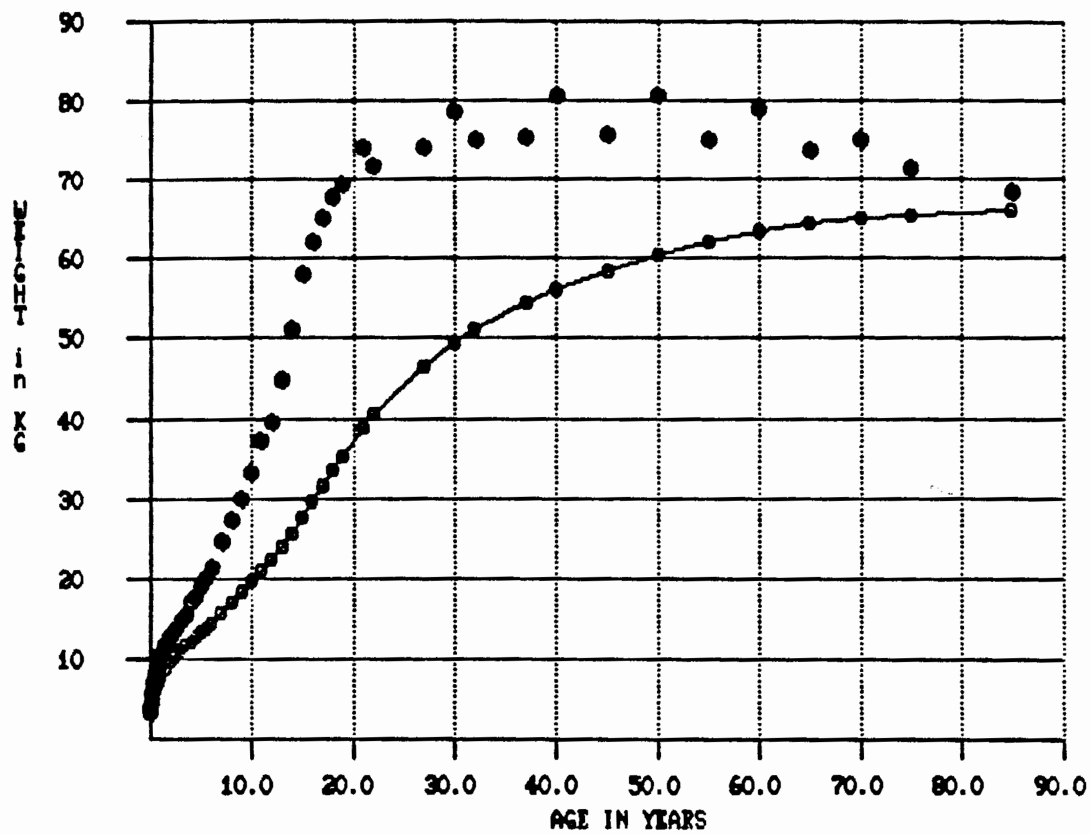


FIGURE 3-5

Recommended Growth Curves for Human Males

Sources: U.S. Bureau of the Census, 1985; Stoudt et al., 1960

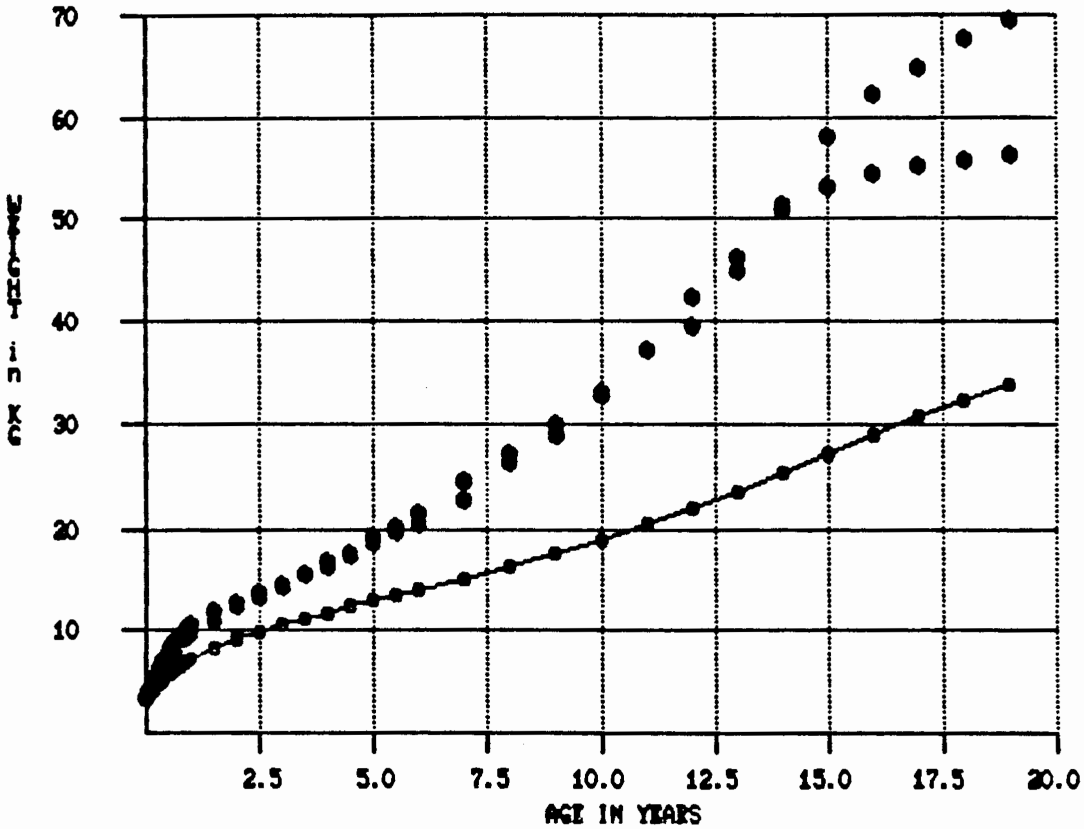


FIGURE 3-6

Body Weight Data on Male and Female Humans
From Birth to 20 Years of Age

Sources: U.S. Bureau of the Census, 1985

Height is also strongly correlated with weight, and in 21- to 71-year-old adults, variations in height have a greater effect on body weight than do variations in age. This is illustrated in Figures 3-7 and 3-8 for males and females, respectively, based on the 1976-1980 data provided by the U.S. Bureau of the Census (1985).

3.1.2. Rhesus Monkeys. The U.S. EPA has not recommended a standard body weight for monkeys. Body weights for "adult" monkeys reported in the literature are 3.5 kg (ARS/Sprague-Dawley, 1974; Hertzberg and Dourson, 1983), 4.7 kg for the rhesus monkey (Boxenbaum, 1983) and 5.0 kg (Lehman, 1959). Table 3-1 summarizes available growth data on male and female rhesus monkeys. The data on male rhesus monkeys are plotted in Figure 3-9. As illustrated in Figure 3-9, no plateau in body weight is apparent over the 7-year observation period. Taking the recommended lifespan of 35 years for the rhesus monkey and using 12 kg as an estimate of adult body weight, a lifespan TWA body weight of ~10.9 kg can be estimated, as illustrated in Figure 3-10. A similar approach can be used for the data on female rhesus monkeys as illustrated in Figures 3-11 and 3-12 from which a lifespan TWA body weight of ~8 kg can be estimated. Both of these lifespan TWA body weights are probably underestimated; thus, they are somewhat conservative when used to estimate mg/kg/day doses. Most toxicity studies available on rhesus monkeys are not standardized in terms of the age of the animals at the start of the study, and the durations of exposure generally accepted as subchronic and chronic are also not standardized. Thus, the only recommended values proposed for the rhesus monkey are lifespan TWAs of 10.9 kg for males and 8 kg for females. For calculating doses from less than lifespan toxicity studies in which body weights are not reported or incompletely reported, Figures 3-9 through 3-12 should be used to estimate body weights.

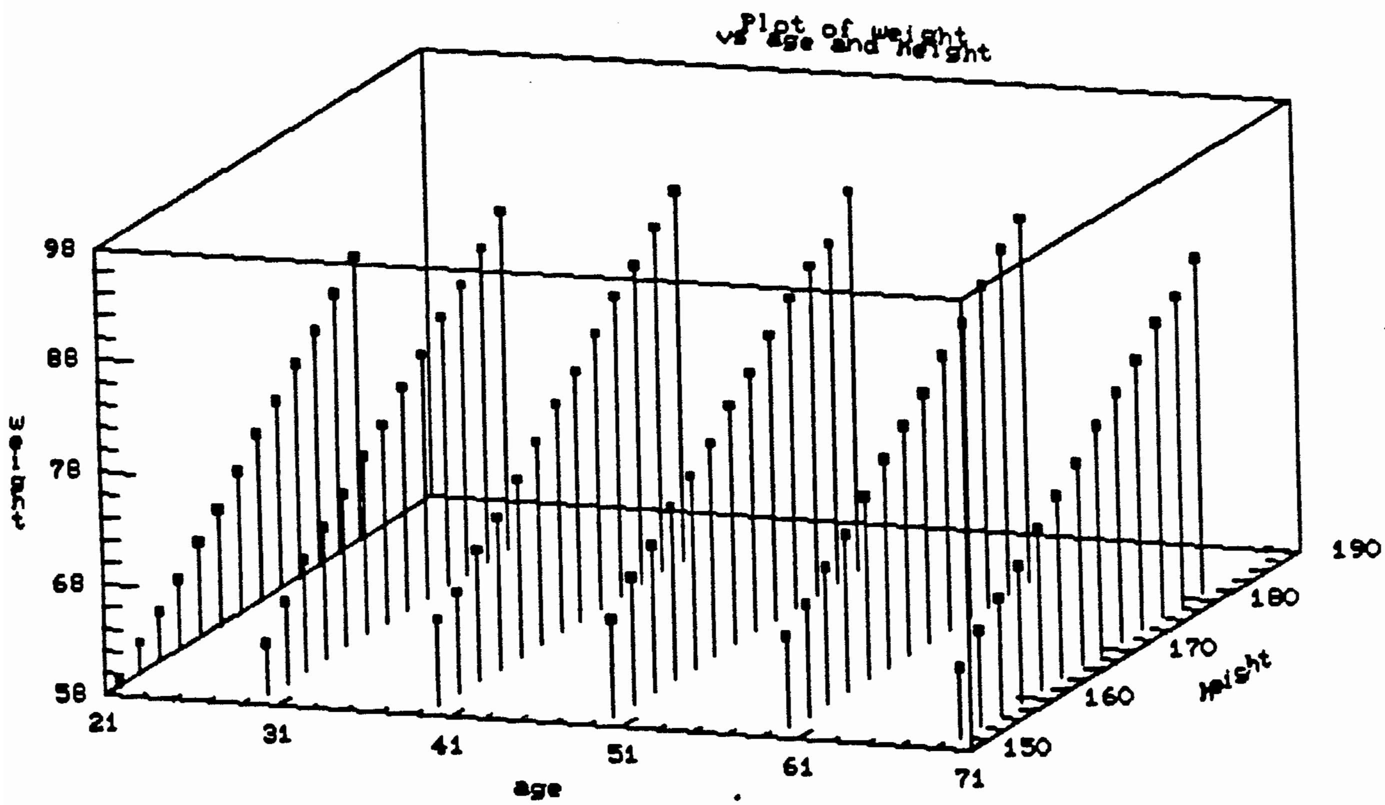


FIGURE 3-7

The Relationship of Height, Weight and Age of Human Males Over the Period 1976-1980

Source: U.S. Bureau of the Census, 1985

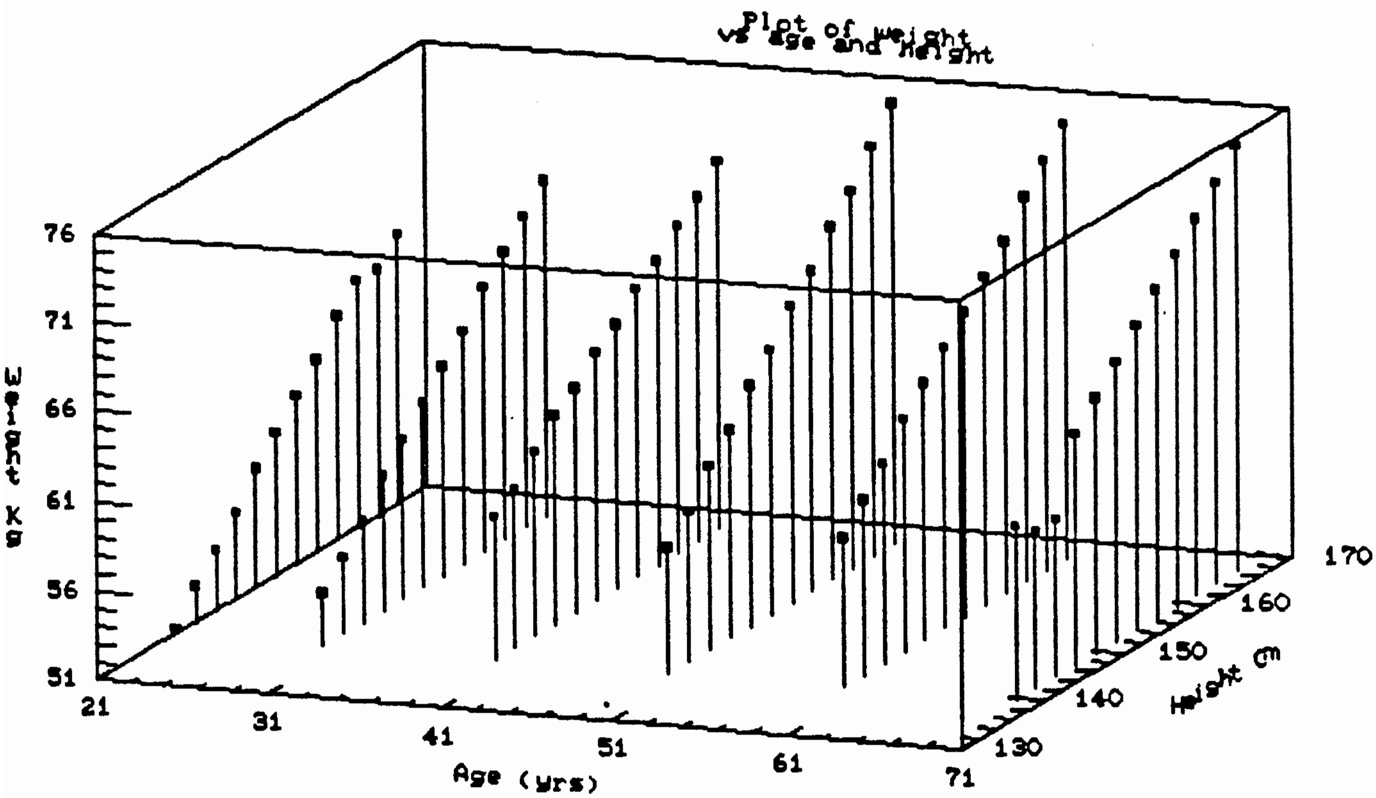


FIGURE 3-8

The Relationship of Height, Weight and Age
of Human Females Over the Period 1976-1980

Source: U.S. Bureau of the Census, 1985

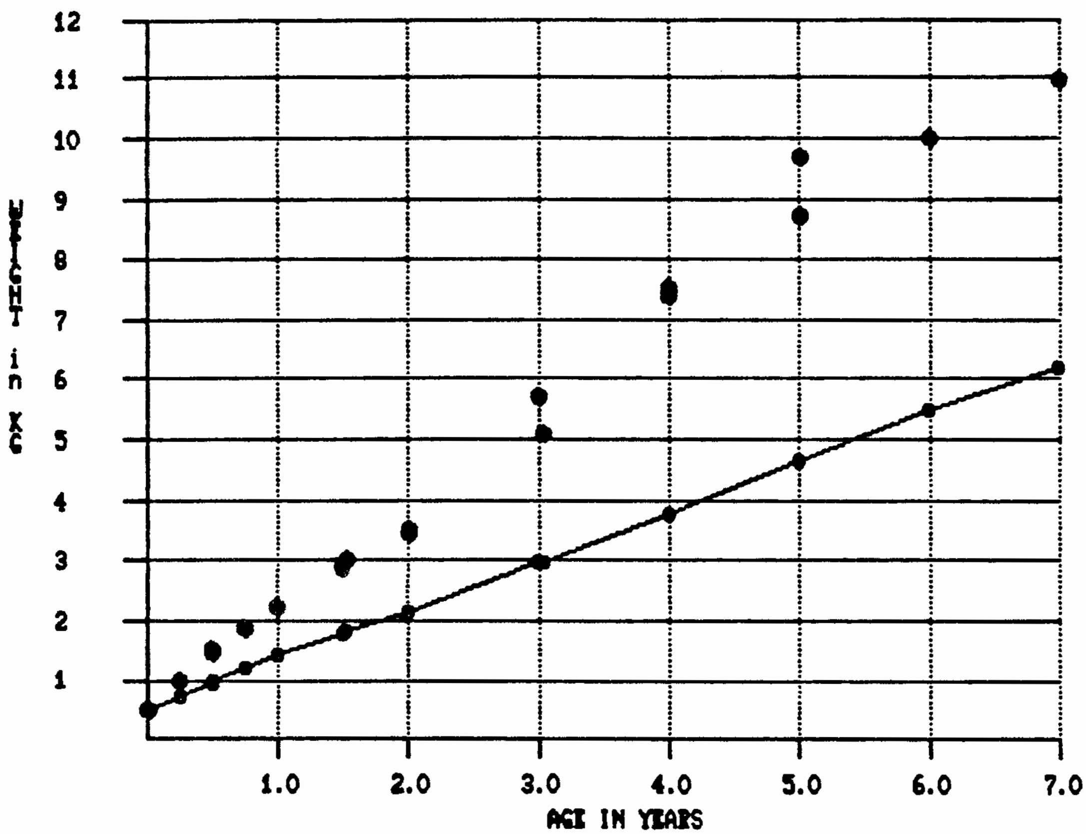


FIGURE 3-9

Body Weight Data on Male Rhesus Monkeys

Source: NAS, 1981

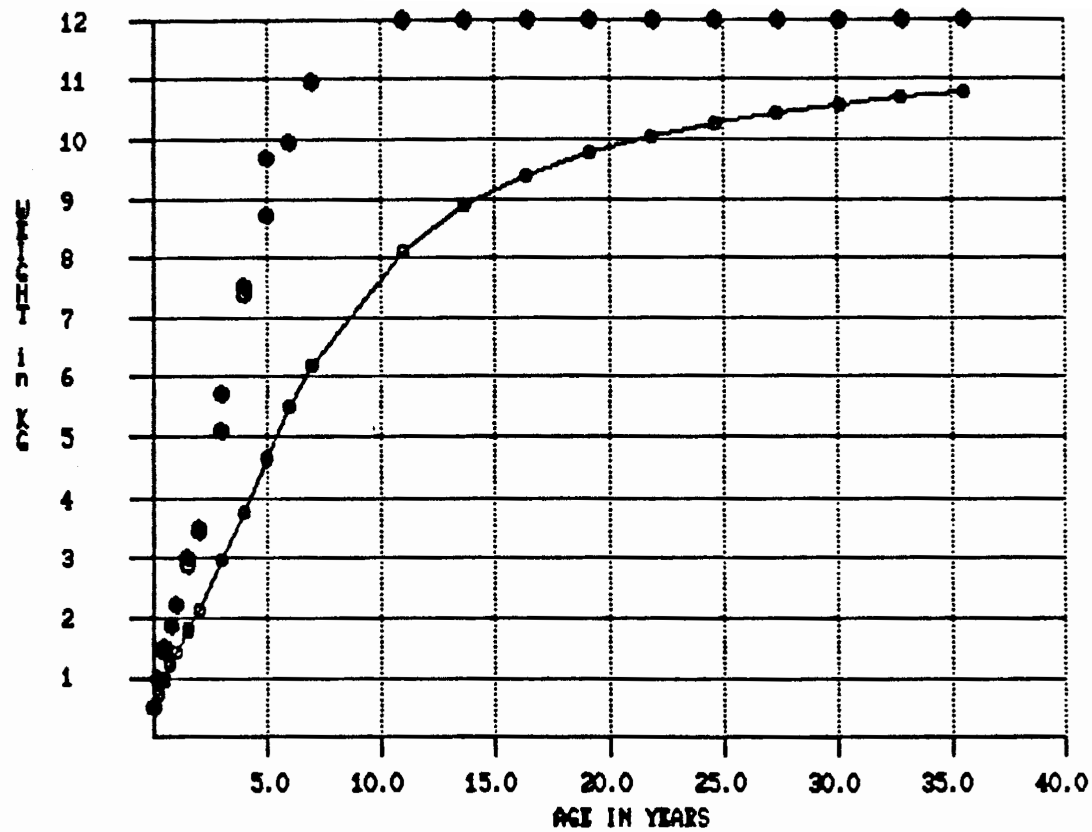


FIGURE 3-10

Recommended Growth Curve for Male Rhesus Monkeys, Extended by Assuming a Mature Body Weight of 12 kg

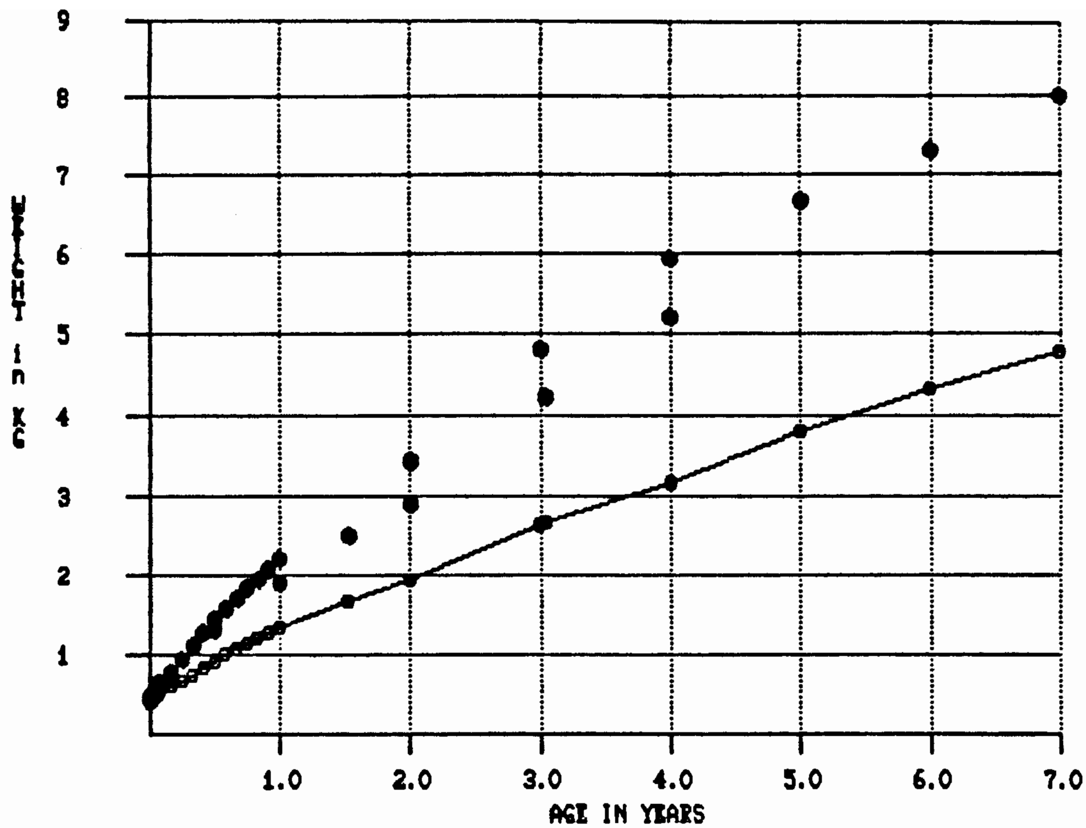


FIGURE 3-11

Body Weight Data on Female Rhesus Monkeys

Sources: NAS, 1981; Farris, 1950

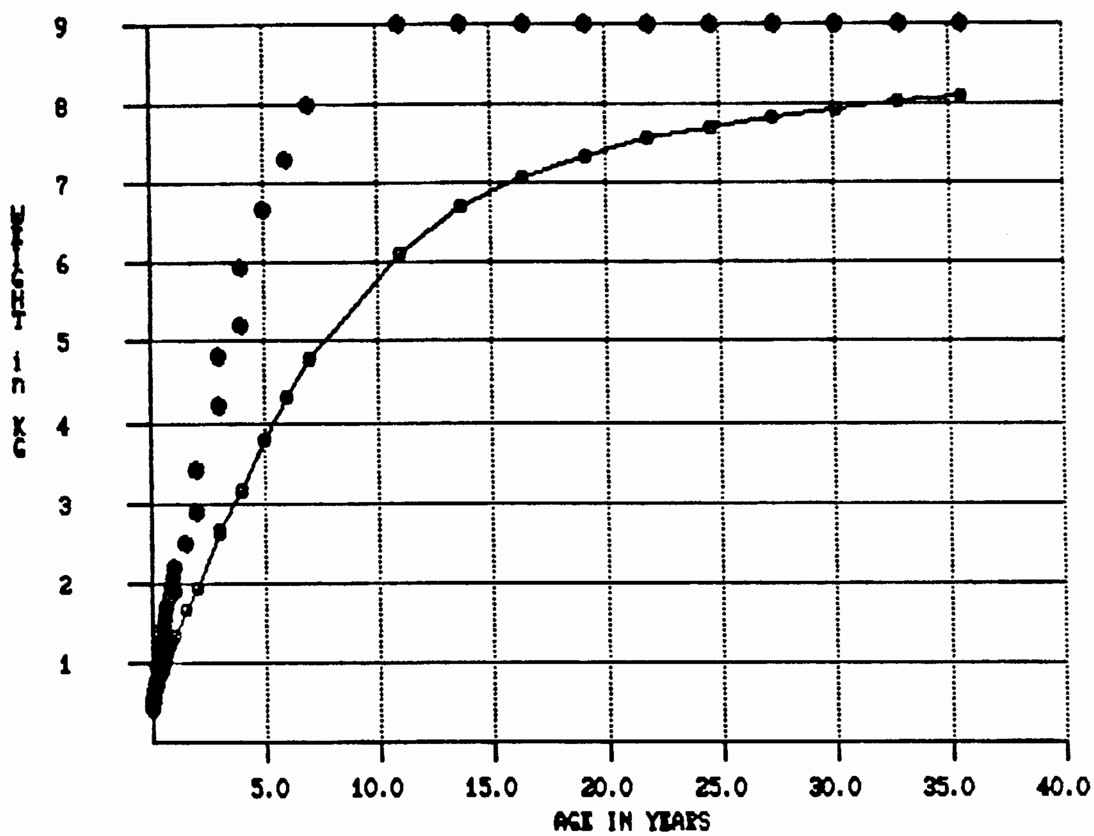


FIGURE 3-12

Recommended Growth Curve for Female Rhesus Monkeys, Extended by Assuming a Mature Body Weight of 9 kg

3.1.3. Other Primates. Growth data are also available on chimpanzees (Lane-Peter et al., 1967) and the common marmoset (Yarbrough et al., 1984). For chimpanzees, growth data categorized by sex are not available. As illustrated in Figure 3-13, the body weight of chimpanzees at birth is ~2 kg and reaches ~20 kg after 5 years. Taking 55 years as the recommended life-span, the lifespan TWA body weight is ~19.25 kg. For marmosets, growth data are available over only a small and early portion of the 40-year lifespan (Figures 3-14 and 3-15). Because of this limited data and because marmosets are a very uncommon test species in toxicity studies, recommended values are not derived.

3.2. LABORATORY RODENTS

3.2.1. Mice. The U.S. EPA (1980) has recommended a reference body weight of 0.03 kg for adult mice. Other reported recommended values are 0.035 kg (ARS/Sprague-Dawley, 1974), 0.023 kg (Boxenbaum, 1983) and 0.02 kg (Lehman, 1959).

Table 3-2 summarizes the extensive amount of body weight and growth data that are available on many strains of mice, including those most often used in toxicity testing. As illustrated in Figure 3-16, body weights of different strains of mice vary substantially; most reported body weights for mature mice range from 0.03-0.045 kg.

The most comprehensive published source of growth data on laboratory animals includes >50 strains of mice (Poiley, 1972). These data were taken from several animal colonies operated by academic, research and commercial organizations under the sponsorship of the National Cancer Institute. For most strains of mice, the record of growth covered a period from birth to at least 90 days postweaning. Growth data over the lifespan, however, are not presented for any of the strains of mice.

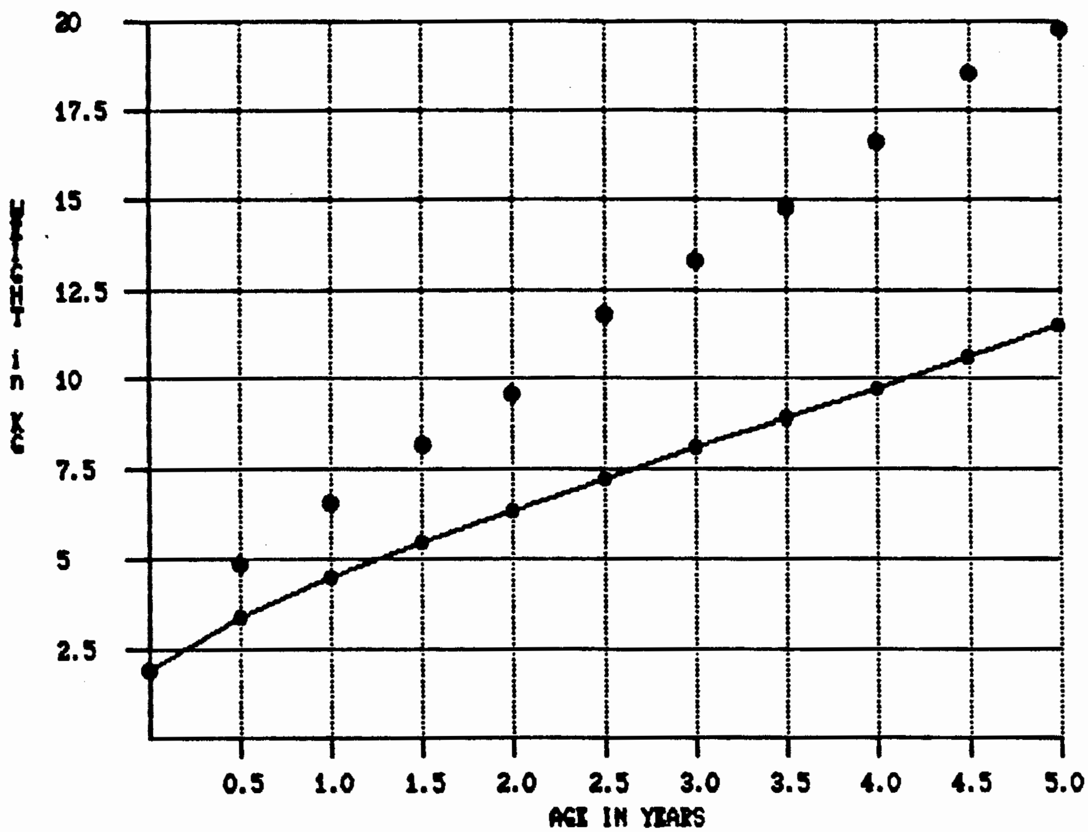


FIGURE 3-13

Body Weight Data on Male and Female Chimpanzees

Source: Lane-Peter et al., 1967

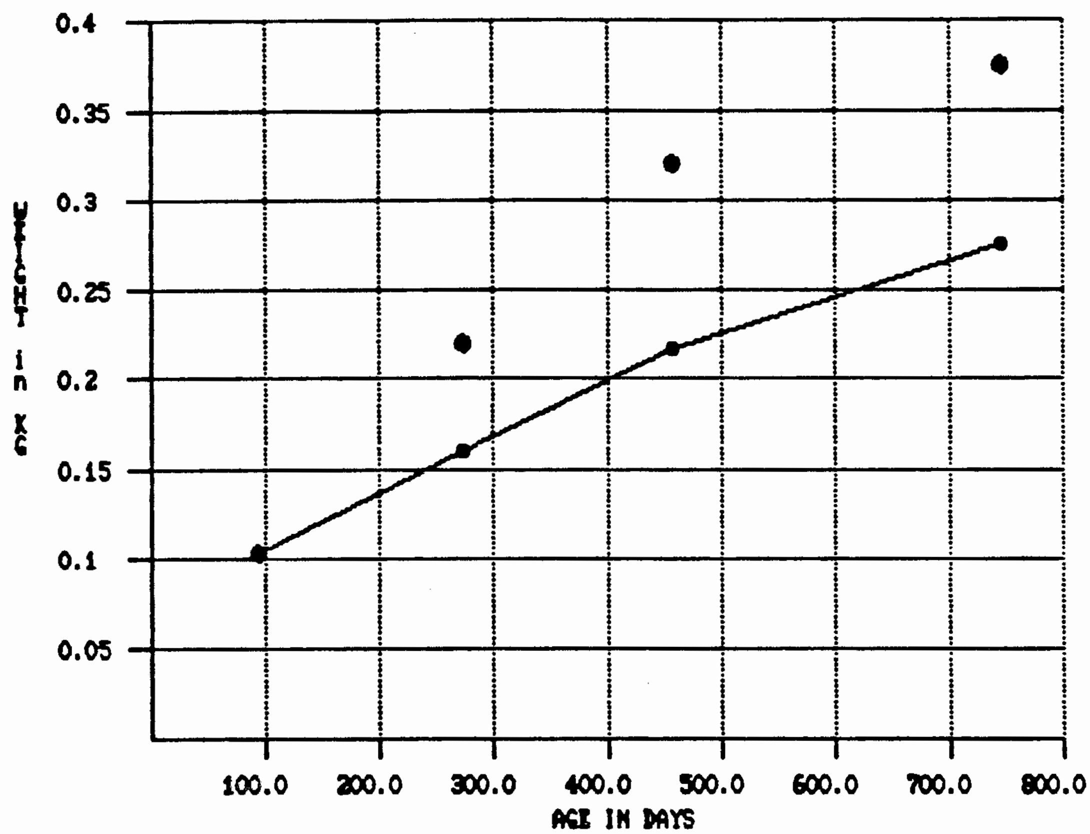


FIGURE 3-14

Body Weight Data on Male Marmosets

[Data estimated from Yarbrough et al. (1984)]

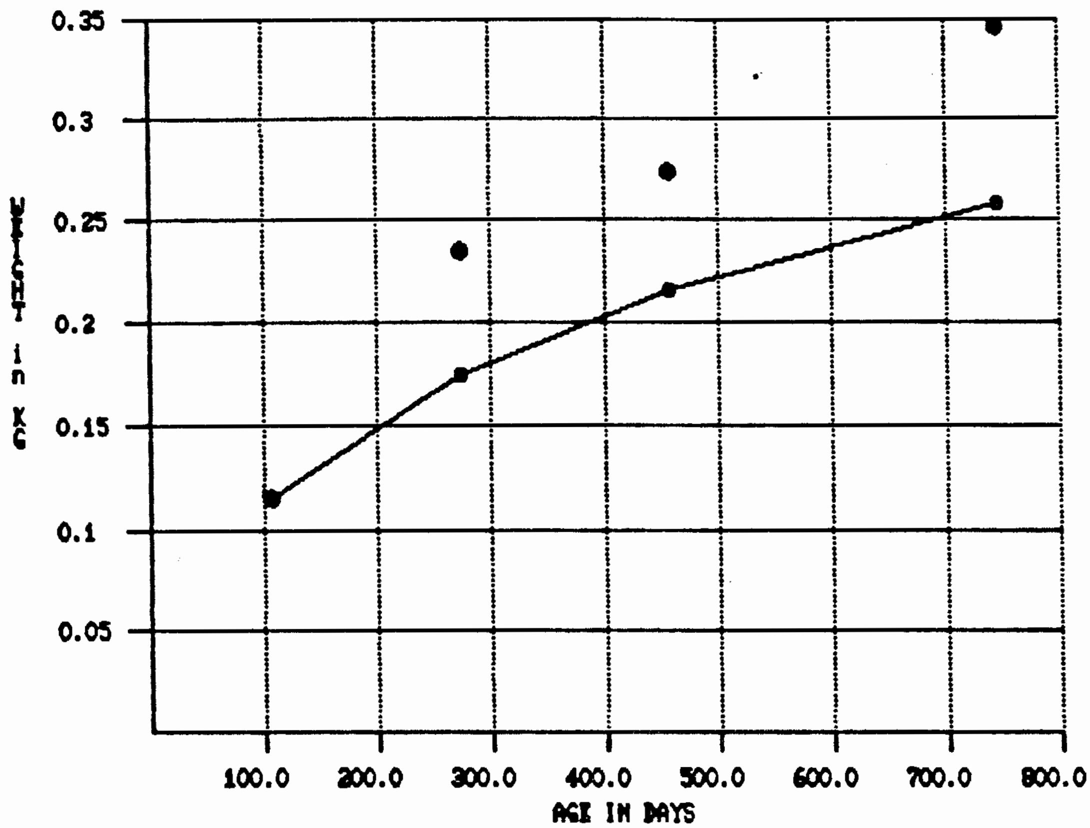


FIGURE 3-15

Body Weight Data on Female Marmosets

[Data estimated from Yarbrough et al. (1984)]

TABLE 3-2

Growth and Body Weight Data on Mice

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
AKD2F1 Hybrid	female	45	1	0.00200	1.06E-007	Polley, 1972
AKD2F1 Hybrid	female	45	7	0.00470	1.06E-007	Polley, 1972
AKD2F1 Hybrid	female	40	14	0.00580	1.60E-007	Polley, 1972
AKD2F1 Hybrid	female	50	21	0.00850	9.51E-007	Polley, 1972
AKD2F1 Hybrid	female	43	28	0.01210	9.00E-008	Polley, 1972
AKD2F1 Hybrid	female	46	42	0.01770	7.66E-007	Polley, 1972
AKD2F1 Hybrid	female	49	56	0.01910	7.66E-007	Polley, 1972
AKD2F1 Hybrid	female	47	70	0.02290	7.66E-007	Polley, 1972
AKD2F1 Hybrid	female	41	84	0.02440	1.27E-006	Polley, 1972
AKD2F1 Hybrid	female	49	112	0.02630	1.89E-006	Polley, 1972
AKD2F1 Hybrid	male	40	1	0.00200	1.60E-007	Polley, 1972
AKD2F1 Hybrid	male	40	7	0.00480	1.81E-007	Polley, 1972
AKD2F1 Hybrid	male	44	14	0.00590	2.02E-007	Polley, 1972
AKD2F1 Hybrid	male	45	21	0.00950	6.40E-007	Polley, 1972
AKD2F1 Hybrid	male	44	28	0.01340	1.23E-007	Polley, 1972
AKD2F1 Hybrid	male	44	42	0.02280	1.00E-006	Polley, 1972
AKD2F1 Hybrid	male	44	56	0.02370	1.00E-006	Polley, 1972
AKD2F1 Hybrid	male	45	70	0.02700	1.00E-006	Polley, 1972
AKD2F1 Hybrid	male	45	84	0.02850	1.89E-006	Polley, 1972
AKD2F1 Hybrid	male	44	112	0.03030	1.56E-006	Polley, 1972
AKR/LwCr	female	224	1	0.00140	9.00E-008	Polley, 1972
AKR/LwCr	female	281	7	0.00430	3.06E-006	Polley, 1972
AKR/LwCr	female	214	14	0.00670	2.64E-006	Polley, 1972
AKR/LwCr	female	236	21	0.00870	6.63E-006	Polley, 1972
AKR/LwCr	female	262	28	0.01270	1.14E-005	Polley, 1972
AKR/LwCr	female	216	42	0.01840	1.58E-005	Polley, 1972
AKR/LwCr	female	213	56	0.02110	1.60E-005	Polley, 1972
AKR/LwCr	female	106	70	0.02300	9.00E-006	Polley, 1972
AKR/LwCr	female	187	84	0.02690	2.84E-005	Polley, 1972
AKR/LwCr	female	177	112	0.02850	1.62E-005	Polley, 1972
AKR/LwCr	female	182	140	0.03090	2.14E-005	Polley, 1972
AKR/LwCr	female	169	168	0.03600	1.14E-005	Polley, 1972
AKR/LwCr	male	256	1	0.00150	9.00E-008	Polley, 1972
AKR/LwCr	male	263	7	0.00440	3.33E-006	Polley, 1972
AKR/LwCr	male	211	14	0.00700	2.98E-006	Polley, 1972
AKR/LwCr	male	243	21	0.00900	6.38E-006	Polley, 1972
AKR/LwCr	male	237	28	0.01390	1.02E-005	Polley, 1972
AKR/LwCr	male	226	42	0.02050	1.41E-005	Polley, 1972
AKR/LwCr	male	179	56	0.02330	1.22E-005	Polley, 1972
AKR/LwCr	male	126	70	0.02480	5.64E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
AKR/LwCr	male	89	84	0.03030	1.54E-005	Polley, 1972
AKR/LwCr	male	102	112	0.03190	1.68E-005	Polley, 1972
AKR/LwCr	male	93	140	0.03480	8.85E-006	Polley, 1972
AKR/LwCr	male	82	168	0.03740	2.68E-005	Polley, 1972
AL/NCr	female	43	1	0.00140	3.06E-008	Polley, 1972
AL/NCr	female	43	7	0.00320	4.56E-007	Polley, 1972
AL/NCr	female	34	14	0.00540	1.81E-007	Polley, 1972
AL/NCr	female	44	21	0.00880	1.10E-006	Polley, 1972
AL/NCr	female	56	28	0.01390	5.21E-004	Polley, 1972
AL/NCr	female	47	42	0.02060	1.01E-005	Polley, 1972
AL/NCr	female	45	56	0.02460	1.16E-006	Polley, 1972
AL/NCr	female	41	70	0.02900	3.61E-006	Polley, 1972
AL/NCr	female	35	84	0.03030	1.00E-006	Polley, 1972
AL/NCr	female	44	112	0.03100	3.06E-006	Polley, 1972
AL/NCr	female	45	140	0.03360	1.82E-006	Polley, 1972
AL/NCr	male	49	1	0.00150	1.56E-008	Polley, 1972
AL/NCr	male	32	7	0.00350	2.50E-007	Polley, 1972
AL/NCr	male	33	14	0.00560	4.56E-007	Polley, 1972
AL/NCr	male	50	21	0.00960	2.03E-006	Polley, 1972
AL/NCr	male	61	28	0.01580	2.64E-006	Polley, 1972
AL/NCr	male	38	42	0.02270	6.50E-006	Polley, 1972
AL/NCr	male	53	56	0.02690	2.10E-006	Polley, 1972
AL/NCr	male	53	70	0.02980	1.00E-006	Polley, 1972
AL/NCr	male	43	84	0.03100	3.06E-006	Polley, 1972
AL/NCr	male	42	112	0.03220	1.56E-006	Polley, 1972
AL/NCr	male	43	140	0.03400	1.56E-006	Polley, 1972
Aston	female	13	652	0.03020	2.03E-006	Richard and Trayhurn, 1985
A/HeN	male	8	61	0.02100	NS	Silverstein, 1960
A/HeN	male	12	152	0.02970	NS	Silverstein, 1960
A/JCr	female	34	1	0.00120	1.56E-008	Polley, 1972
A/JCr	female	23	7	0.00570	1.81E-007	Polley, 1972
A/JCr	female	23	14	0.00700	2.50E-007	Polley, 1972
A/JCr	female	23	21	0.01260	2.26E-007	Polley, 1972
A/JCr	female	23	28	0.01470	4.00E-008	Polley, 1972
A/JCr	female	23	42	0.01760	4.52E-006	Polley, 1972
A/JCr	female	23	56	0.01910	1.00E-006	Polley, 1972
A/JCr	female	23	70	0.02450	7.66E-007	Polley, 1972
A/JCr	female	22	84	0.02590	8.27E-006	Polley, 1972
A/JCr	female	22	112	0.02950	4.00E-006	Polley, 1972
A/JCr	female	22	140	0.03400	1.27E-006	Polley, 1972
A/JCr	female	22	168	0.03770	3.06E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
A/JCr	male	35	1	0.00120	2.25E-008	Polley, 1972
A/JCr	male	36	7	0.00540	2.02E-007	Polley, 1972
A/JCr	male	26	14	0.00760	3.06E-008	Polley, 1972
A/JCr	male	29	21	0.01370	1.56E-006	Polley, 1972
A/JCr	male	29	28	0.01700	4.22E-007	Polley, 1972
A/JCr	male	29	42	0.01840	2.64E-006	Polley, 1972
A/JCr	male	29	56	0.02040	1.00E-006	Polley, 1972
A/JCr	male	29	70	0.02560	1.56E-006	Polley, 1972
A/JCr	male	29	84	0.02700	3.06E-006	Polley, 1972
A/JCr	male	27	112	0.03180	3.52E-006	Polley, 1972
A/JCr	male	27	140	0.03650	2.64E-006	Polley, 1972
A/JCr	male	25	168	0.03910	3.52E-006	Polley, 1972
A/J	female	15	100	0.02090	3.61E-006	Kutscher, 1974
A/J	male	15	100	0.02520	2.25E-006	Kutscher, 1974
A/LN	male	7	152	0.02410	NS	Silverstein, 1960
BAF1 Hybrid	female	30	1	0.00210	2.26E-007	Polley, 1972
BAF1 Hybrid	female	25	7	0.00450	8.10E-007	Polley, 1972
BAF1 Hybrid	female	36	14	0.00540	1.23E-007	Polley, 1972
BAF1 Hybrid	female	45	21	0.00670	2.10E-006	Polley, 1972
BAF1 Hybrid	female	40	28	0.00850	2.40E-006	Polley, 1972
BAF1 Hybrid	female	41	42	0.01580	1.56E-006	Polley, 1972
BAF1 Hybrid	female	44	56	0.01870	2.64E-006	Polley, 1972
BAF1 Hybrid	female	38	70	0.02240	1.00E-006	Polley, 1972
BAF1 Hybrid	female	37	84	0.02460	1.00E-006	Polley, 1972
BAF1 Hybrid	female	42	112	0.02700	2.64E-006	Polley, 1972
BAF1 Hybrid	male	42	1	0.00220	1.81E-007	Polley, 1972
BAF1 Hybrid	male	35	7	0.00470	6.40E-007	Polley, 1972
BAF1 Hybrid	male	56	14	0.00540	1.41E-007	Polley, 1972
BAF1 Hybrid	male	59	21	0.00770	2.89E-006	Polley, 1972
BAF1 Hybrid	male	43	28	0.01040	2.10E-006	Polley, 1972
BAF1 Hybrid	male	38	42	0.01670	2.25E-006	Polley, 1972
BAF1 Hybrid	male	35	56	0.02330	2.25E-006	Polley, 1972
BAF1 Hybrid	male	32	70	0.02550	3.06E-006	Polley, 1972
BAF1 Hybrid	male	33	84	0.02740	3.52E-006	Polley, 1972
BAF1 Hybrid	male	35	112	0.03090	2.64E-006	Polley, 1972
BALB/cAnCr	female	386	1	0.00170	2.03E-007	Polley, 1972
BALB/cAnCr	female	377	7	0.00510	5.64E-006	Polley, 1972
BALB/cAnCr	female	360	14	0.00800	5.29E-006	Polley, 1972
BALB/cAnCr	female	440	21	0.01080	6.50E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
BALB/cAnCr	female	480	28	0.01430	8.12E-006	Polley, 1972
BALB/cAnCr	female	277	42	0.01690	9.77E-006	Polley, 1972
BALB/cAnCr	female	203	56	0.01940	1.17E-005	Polley, 1972
BALB/cAnCr	female	72	70	0.02020	4.31E-006	Polley, 1972
BALB/cAnCr	female	57	84	0.02290	5.29E-006	Polley, 1972
BALB/cAnCr	female	96	112	0.02500	1.56E-005	Polley, 1972
BALB/cAnCr	female	87	140	0.02480	1.09E-005	Polley, 1972
BALB/cAnCr	female	92	168	0.02670	1.68E-005	Polley, 1972
BALB/cAnCr	female	92	196	0.02740	8.70E-006	Polley, 1972
BALB/cAnCr	female	106	224	0.02800	1.22E-005	Polley, 1972
BALB/cAnCr	female	107	252	0.02810	1.17E-005	Polley, 1972
BALB/cAnCr	male	547	1	0.00130	1.81E-007	Polley, 1972
BALB/cAnCr	male	362	7	0.00510	4.00E-006	Polley, 1972
BALB/cAnCr	male	352	14	0.00820	3.90E-006	Polley, 1972
BALB/cAnCr	male	419	21	0.01130	1.28E-005	Polley, 1972
BALB/cAnCr	male	424	28	0.01540	1.79E-005	Polley, 1972
BALB/cAnCr	male	306	42	0.01950	6.89E-006	Polley, 1972
BALB/cAnCr	male	153	56	0.02080	2.19E-005	Polley, 1972
BALB/cAnCr	male	62	70	0.02200	6.13E-006	Polley, 1972
BALB/cAnCr	male	53	84	0.02520	2.48E-006	Polley, 1972
BALB/cAnCr	male	66	112	0.02760	9.46E-006	Polley, 1972
BALB/cAnCr	male	56	140	0.02820	8.70E-006	Polley, 1972
BALB/cAnCr	male	67	168	0.02860	1.72E-005	Polley, 1972
BALB/cAnCr	male	65	196	0.02900	1.46E-005	Polley, 1972
BALB/cAnCr	male	71	224	0.02930	6.38E-006	Polley, 1972
BALB/cAnCr	male	56	252	0.03030	1.02E-005	Polley, 1972
BALB/cAnN	male	8	152	0.02560	NS	Silverstein, 1960
BALB/c	female	15	100	0.02010	3.61E-006	Kutscher, 1974
BALB/c	female	48	NS	0.01660	NS	Oller et al., 1985
BALB/c	female	48	NS	0.01800	NS	Oller et al., 1985
BALB/c	female	48	NS	0.01890	NS	Oller et al., 1985
BALB/c	female	48	NS	0.02000	NS	Oller et al., 1985
BALB/c	female	48	NS	0.02190	NS	Oller et al., 1985
BALB/c	male	15	100	0.02700	2.56E-006	Kutscher, 1974
BALB/c	male	48	NS	0.02560	NS	Oller et al., 1985
BALB/c	male	48	NS	0.01970	NS	Oller et al., 1985
BALB/c	male	48	NS	0.01970	NS	Oller et al., 1985
BALB/c	male	48	NS	0.02240	NS	Oller et al., 1985
BALB/c	male	48	NS	0.02420	NS	Oller et al., 1985
BALB/c	male	48	NS	0.02850	NS	Oller et al., 1985

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
BDF1*B6D2F1 Hyb	female	292	1	0.00140	6.25E-008	Polley, 1972
BDF1*B6D2F1 Hyb	female	306	7	0.00410	1.16E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	306	14	0.00540	1.56E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	263	21	0.00770	1.16E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	309	28	0.01510	4.62E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	325	35	0.01740	3.06E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	270	42	0.01890	5.52E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	287	49	0.02280	1.63E-006	Polley, 1972
BDF1*B6D2F1 Hyb	female	314	56	0.02400	2.89E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	291	1	0.00140	6.25E-008	Polley, 1972
BDF1*B6D2F1 Hyb	male	313	7	0.00410	1.05E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	319	14	0.00640	1.76E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	269	21	0.00860	1.69E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	314	28	0.01680	5.64E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	313	35	0.01960	2.72E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	275	42	0.02180	4.52E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	285	49	0.02430	2.56E-006	Polley, 1972
BDF1*B6D2F1 Hyb	male	305	56	0.02690	5.76E-006	Polley, 1972
BRVR/SrCr	female	25	1	0.00130	1.06E-007	Polley, 1972
BRVR/SrCr	female	24	7	0.00380	1.00E-006	Polley, 1972
BRVR/SrCr	female	25	14	0.00780	7.66E-007	Polley, 1972
BRVR/SrCr	female	25	21	0.00970	2.64E-006	Polley, 1972
BRVR/SrCr	female	24	28	0.01530	3.80E-006	Polley, 1972
BRVR/SrCr	female	24	42	0.01840	2.25E-006	Polley, 1972
BRVR/SrCr	female	24	56	0.02040	6.25E-006	Polley, 1972
BRVR/SrCr	male	25	1	0.00130	1.06E-007	Polley, 1972
BRVR/SrCr	male	24	7	0.00410	3.91E-007	Polley, 1972
BRVR/SrCr	male	24	14	0.00810	1.16E-006	Polley, 1972
BRVR/SrCr	male	24	21	0.01160	1.56E-006	Polley, 1972
BRVR/SrCr	male	24	28	0.01910	2.25E-006	Polley, 1972
BRVR/SrCr	male	24	42	0.02190	8.27E-006	Polley, 1972
BRVR/SrCr	male	24	56	0.02590	4.00E-006	Polley, 1972
BRVS/SrCr	female	42	1	0.00240	1.81E-007	Polley, 1972
BRVS/SrCr	female	49	7	0.00500	2.26E-007	Polley, 1972
BRVS/SrCr	female	48	14	0.00780	7.22E-007	Polley, 1972
BRVS/SrCr	female	55	21	0.01050	3.90E-006	Polley, 1972
BRVS/SrCr	female	64	28	0.01590	3.06E-006	Polley, 1972
BRVS/SrCr	female	65	42	0.01960	1.44E-006	Polley, 1972
BRVS/SrCr	female	43	56	0.02190	1.76E-006	Polley, 1972
BRVS/SrCr	female	48	70	0.02360	2.18E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
BRVS/SrCr	male	36	1	0.00240	2.03E-007	Polley, 1972
BRVS/SrCr	male	48	7	0.00530	2.76E-007	Polley, 1972
BRVS/SrCr	male	53	14	0.00830	9.02E-007	Polley, 1972
BRVS/SrCr	male	59	21	0.01120	3.31E-007	Polley, 1972
BRVS/SrCr	male	61	28	0.01700	4.95E-006	Polley, 1972
BRVS/SrCr	male	61	42	0.02190	2.48E-006	Polley, 1972
BRVS/SrCr	male	48	56	0.02370	2.10E-006	Polley, 1972
BRVS/SrCr	male	49	70	0.02610	2.25E-006	Polley, 1972
BSVR/SrCr	female	24	1	0.00140	2.50E-009	Polley, 1972
BSVR/SrCr	female	24	7	0.00490	2.25E-008	Polley, 1972
BSVR/SrCr	female	29	14	0.00780	1.44E-006	Polley, 1972
BSVR/SrCr	female	28	21	0.01080	2.25E-006	Polley, 1972
BSVR/SrCr	female	24	28	0.01740	1.76E-006	Polley, 1972
BSVR/SrCr	female	25	42	0.02280	5.26E-007	Polley, 1972
BSVR/SrCr	female	25	56	0.02480	7.66E-007	Polley, 1972
BSVR/SrCr	female	25	70	0.02610	6.01E-007	Polley, 1972
BSVR/SrCr	male	24	1	0.00150	2.50E-009	Polley, 1972
BSVR/SrCr	male	24	7	0.00530	4.00E-008	Polley, 1972
BSVR/SrCr	male	26	14	0.00950	1.38E-006	Polley, 1972
BSVR/SrCr	male	22	21	0.01110	1.38E-006	Polley, 1972
BSVR/SrCr	male	31	28	0.01950	2.50E-007	Polley, 1972
BSVR/SrCr	male	25	42	0.02870	2.18E-006	Polley, 1972
BSVR/SrCr	male	25	56	0.03080	2.10E-006	Polley, 1972
BSVR/SrCr	male	24	70	0.03130	1.21E-006	Polley, 1972
BSVS/SrCr	female	24	1	0.00130	5.63E-009	Polley, 1972
BSVS/SrCr	female	24	7	0.00510	3.03E-007	Polley, 1972
BSVS/SrCr	female	25	14	0.00780	1.00E-006	Polley, 1972
BSVS/SrCr	female	28	21	0.01070	2.25E-006	Polley, 1972
BSVS/SrCr	female	25	28	0.01540	3.91E-007	Polley, 1972
BSVS/SrCr	female	26	35	0.01760	2.64E-006	Polley, 1972
BSVS/SrCr	female	24	42	0.01840	2.25E-006	Polley, 1972
BSVS/SrCr	female	25	49	0.02030	1.89E-006	Polley, 1972
BSVS/SrCr	female	25	63	0.02260	3.52E-006	Polley, 1972
BSVS/SrCr	female	27	71	0.02480	1.76E-006	Polley, 1972
BSVS/SrCr	male	24	1	0.00130	1.00E-008	Polley, 1972
BSVS/SrCr	male	24	7	0.00590	2.50E-007	Polley, 1972
BSVS/SrCr	male	24	14	0.00940	2.03E-006	Polley, 1972
BSVS/SrCr	male	24	21	0.01150	1.56E-006	Polley, 1972
BSVS/SrCr	male	29	28	0.01750	1.27E-006	Polley, 1972
BSVS/SrCr	male	24	35	0.02120	1.00E-006	Polley, 1972
BSVS/SrCr	male	24	42	0.02340	2.98E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
BSVS/SrCr	male	26	49	0.02490	5.06E-006	Polley, 1972
BSVS/SrCr	male	25	63	0.02750	5.06E-006	Polley, 1972
BSVS/SrCr	male	24	71	0.02920	5.64E-006	Polley, 1972
B10pd/CzCr	female	24	1	0.00200	7.56E-008	Polley, 1972
B10pd/CzCr	female	25	3	0.00310	1.23E-007	Polley, 1972
B10pd/CzCr	female	24	9	0.00420	6.40E-007	Polley, 1972
B10pd/CzCr	female	29	14	0.00890	1.76E-006	Polley, 1972
B10pd/CzCr	female	32	21	0.01070	1.89E-006	Polley, 1972
B10pd/CzCr	female	32	28	0.01450	1.96E-006	Polley, 1972
B10pd/CzCr	female	25	35	0.01530	2.10E-006	Polley, 1972
B10pd/CzCr	female	24	42	0.01760	1.89E-006	Polley, 1972
B10pd/CzCr	female	24	49	0.01930	2.25E-006	Polley, 1972
B10pd/CzCr	female	29	70	0.02350	4.00E-006	Polley, 1972
B10pd/CzCr	male	24	1	0.00210	6.25E-008	Polley, 1972
B10pd/CzCr	male	24	3	0.00330	3.60E-007	Polley, 1972
B10pd/CzCr	male	24	9	0.00480	6.40E-007	Polley, 1972
B10pd/CzCr	male	28	14	0.00980	2.33E-006	Polley, 1972
B10pd/CzCr	male	31	21	0.01150	3.52E-006	Polley, 1972
B10pd/CzCr	male	27	28	0.01760	3.15E-006	Polley, 1972
B10pd/CzCr	male	28	35	0.01860	1.44E-006	Polley, 1972
B10pd/CzCr	male	24	42	0.02100	1.00E-006	Polley, 1972
B10pd/CzCr	male	26	49	0.02330	2.81E-006	Polley, 1972
B10pd/CzCr	male	24	70	0.02870	5.18E-006	Polley, 1972
B10*A/Cr	female	35	1	0.00150	2.25E-008	Polley, 1972
B10*A/Cr	female	46	7	0.00470	3.03E-007	Polley, 1972
B10*A/Cr	female	39	14	0.00780	1.00E-006	Polley, 1972
B10*A/Cr	female	58	21	0.01040	2.33E-006	Polley, 1972
B10*A/Cr	female	49	28	0.01530	1.89E-006	Polley, 1972
B10*A/Cr	female	43	42	0.01840	6.81E-007	Polley, 1972
B10*A/Cr	female	41	56	0.02130	1.63E-006	Polley, 1972
B10*A/Cr	female	42	70	0.02320	1.44E-006	Polley, 1972
B10*A/Cr	male	32	1	0.00160	2.25E-008	Polley, 1972
B10*A/Cr	male	44	7	0.00490	2.50E-007	Polley, 1972
B10*A/Cr	male	38	14	0.00840	9.51E-007	Polley, 1972
B10*A/Cr	male	61	21	0.01180	3.15E-006	Polley, 1972
B10*A/Cr	male	48	28	0.01700	4.62E-006	Polley, 1972
B10*A/Cr	male	39	42	0.02260	3.80E-006	Polley, 1972
B10*A/Cr	male	40	56	0.02490	3.52E-006	Polley, 1972
B10*A/Cr	male	38	70	0.02620	4.41E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
B10*A(5R)/Cr	female	25	1	0.00150	4.00E-008	Polley, 1972
B10*A(5R)/Cr	female	24	7	0.00430	2.50E-007	Polley, 1972
B10*A(5R)/Cr	female	24	14	0.00870	2.25E-006	Polley, 1972
B10*A(5R)/Cr	female	25	21	0.01060	4.52E-006	Polley, 1972
B10*A(5R)/Cr	female	25	28	0.01580	1.89E-006	Polley, 1972
B10*A(5R)/Cr	female	24	42	0.01870	1.89E-006	Polley, 1972
B10*A(5R)/Cr	female	24	56	0.02340	2.64E-006	Polley, 1972
B10*A(5R)/Cr	female	25	70	0.02480	1.00E-006	Polley, 1972
B10*A(5R)/Cr	female	24	84	0.02620	2.64E-006	Polley, 1972
B10*A(5R)/Cr	male	25	1	0.00150	4.00E-008	Polley, 1972
B10*A(5R)/Cr	male	24	7	0.00500	1.41E-007	Polley, 1972
B10*A(5R)/Cr	male	24	14	0.00900	2.64E-006	Polley, 1972
B10*A(5R)/Cr	male	24	21	0.01130	4.52E-006	Polley, 1972
B10*A(5R)/Cr	male	25	28	0.01630	2.64E-006	Polley, 1972
B10*A(5R)/Cr	male	24	42	0.02060	3.52E-006	Polley, 1972
B10*A(5R)/Cr	male	24	56	0.02450	2.25E-006	Polley, 1972
B10*A(5R)/Cr	male	25	70	0.02870	1.00E-006	Polley, 1972
B10*A(5R)/Cr	male	24	84	0.03150	1.27E-006	Polley, 1972
B10*a(2R)/Cr	female	29	1	0.00150	4.00E-008	Polley, 1972
B10*a(2R)/Cr	female	28	7	0.00480	2.76E-007	Polley, 1972
B10*a(2R)/Cr	female	29	14	0.00820	1.89E-006	Polley, 1972
B10*a(2R)/Cr	female	25	21	0.01050	4.10E-006	Polley, 1972
B10*a(2R)/Cr	female	31	28	0.01500	1.76E-006	Polley, 1972
B10*a(2R)/Cr	female	25	42	0.01860	1.50E-006	Polley, 1972
B10*a(2R)/Cr	female	34	56	0.02140	6.38E-006	Polley, 1972
B10*a(2R)/Cr	female	35	70	0.02530	1.27E-006	Polley, 1972
B10*a(2R)/Cr	male	27	1	0.00160	3.06E-008	Polley, 1972
B10*a(2R)/Cr	male	28	7	0.00490	2.50E-007	Polley, 1972
B10*a(2R)/Cr	male	29	14	0.00910	1.96E-006	Polley, 1972
B10*a(2R)/Cr	male	25	21	0.01170	5.41E-006	Polley, 1972
B10*a(2R)/Cr	male	26	28	0.01620	3.42E-006	Polley, 1972
B10*a(2R)/Cr	male	28	42	0.02200	3.15E-006	Polley, 1972
B10*a(2R)/Cr	male	31	56	0.02470	2.72E-006	Polley, 1972
B10*a(2R)/Cr	male	32	70	0.02820	3.06E-006	Polley, 1972
B10*129(5M)/Cr	female	25	1	0.00160	9.00E-008	Polley, 1972
B10*129(5M)/Cr	female	25	7	0.00430	3.02E-007	Polley, 1972
B10*129(5M)/Cr	female	23	14	0.00820	1.10E-006	Polley, 1972
B10*129(5M)/Cr	female	28	21	0.01000	2.25E-006	Polley, 1972
B10*129(5M)/Cr	female	31	28	0.01490	2.25E-006	Polley, 1972
B10*129(5M)/Cr	female	32	42	0.01770	2.10E-006	Polley, 1972
B10*129(5M)/Cr	female	26	56	0.02140	4.73E-006	Polley, 1972
B10*129(5M)/Cr	female	25	70	0.02410	1.96E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
B10*129(5M)/Cr	male	25	1	0.00170	4.00E-008	Polley, 1972
B10*129(5M)/Cr	male	25	7	0.00460	2.76E-007	Polley, 1972
B10*129(5M)/Cr	male	26	14	0.00900	2.03E-006	Polley, 1972
B10*129(5M)/Cr	male	24	21	0.01160	4.73E-006	Polley, 1972
B10*129(5M)/Cr	male	31	28	0.01720	4.52E-006	Polley, 1972
B10*129(5M)/Cr	male	29	42	0.02240	2.18E-006	Polley, 1972
B10*129(5M)/Cr	male	30	56	0.02480	2.98E-006	Polley, 1972
B10*129(5M)/Cr	male	27	70	0.02720	4.31E-006	Polley, 1972
B6AKF1 Hybrid	female	50	1	0.00190	9.00E-008	Polley, 1972
B6AKF1 Hybrid	female	45	7	0.00450	2.76E-007	Polley, 1972
B6AKF1 Hybrid	female	40	14	0.00540	7.56E-008	Polley, 1972
B6AKF1 Hybrid	female	45	21	0.00770	4.90E-007	Polley, 1972
B6AKF1 Hybrid	female	44	28	0.01130	2.76E-007	Polley, 1972
B6AKF1 Hybrid	female	45	42	0.01540	2.64E-006	Polley, 1972
B6AKF1 Hybrid	female	45	49	0.01710	2.25E-006	Polley, 1972
B6AKF1 Hybrid	female	45	56	0.02010	3.06E-006	Polley, 1972
B6AKF1 Hybrid	female	45	63	0.02200	1.89E-006	Polley, 1972
B6AKF1 Hybrid	female	45	70	0.02240	2.64E-006	Polley, 1972
B6AKF1 Hybrid	female	45	77	0.02600	3.06E-006	Polley, 1972
B6AKF1 Hybrid	female	45	84	0.02700	5.06E-006	Polley, 1972
B6AKF1 Hybrid	female	25	112	0.02910	4.00E-006	Polley, 1972
B6AKF1 Hybrid	male	50	1	0.00190	1.22E-007	Polley, 1972
B6AKF1 Hybrid	male	48	7	0.00480	2.50E-007	Polley, 1972
B6AKF1 Hybrid	male	55	14	0.00600	3.60E-007	Polley, 1972
B6AKF1 Hybrid	male	50	21	0.00800	8.10E-007	Polley, 1972
B6AKF1 Hybrid	male	42	28	0.01170	3.31E-007	Polley, 1972
B6AKF1 Hybrid	male	45	42	0.01750	4.52E-006	Polley, 1972
B6AKF1 Hybrid	male	45	49	0.01830	5.06E-006	Polley, 1972
B6AKF1 Hybrid	male	45	56	0.02230	3.52E-006	Polley, 1972
B6AKF1 Hybrid	male	45	63	0.02310	4.00E-006	Polley, 1972
B6AKF1 Hybrid	male	45	70	0.02370	5.64E-006	Polley, 1972
B6AKF1 Hybrid	male	45	77	0.02880	1.89E-006	Polley, 1972
B6AKF1 Hybrid	male	45	84	0.03020	3.06E-006	Polley, 1972
B6AKF1 Hybrid	male	45	112	0.03270	2.25E-006	Polley, 1972
B6C3F1	female	3706	42	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	56	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	77	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	91	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	119	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	140	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	196	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	294	0.0	NS	Cameron et al., 1985

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
B6C3F1	female	3706	371	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	455	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	532	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	623	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	707	0.0	NS	Cameron et al., 1985
B6C3F1	female	3706	770	0.0	NS	Cameron et al., 1985
B6C3F1	female	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	female	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	female	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	female	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	female	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	female	36	1	0.0	4.00E-008	Polley, 1972
B6C3F1	female	23	7	0.0	7.23E-007	Polley, 1972
B6C3F1	female	42	14	0.0	1.89E-006	Polley, 1972
B6C3F1	female	33	21	0.0	2.33E-006	Polley, 1972
B6C3F1	female	38	28	0.0	3.52E-006	Polley, 1972
B6C3F1	female	37	42	0.0	6.38E-006	Polley, 1972
B6C3F1	male	3634	42	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	42	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	63	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	77	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	98	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	105	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	126	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	133	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	175	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	252	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	483	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	567	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	644	0.0	NS	Cameron et al., 1985
B6C3F1	male	3634	770	0.0	NS	Cameron et al., 1985
B6C3F1	male	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	male	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	male	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	male	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	male	48	NS	0.0	NS	Oller et al., 1985
B6C3F1	male	29	1	0.0	3.06E-008	Polley, 1972
B6C3F1	male	27	7	0.0	4.22E-007	Polley, 1972
B6C3F1	male	38	14	0.0	9.51E-007	Polley, 1972
B6C3F1	male	33	21	0.0	6.76E-006	Polley, 1972
B6C3F1	male	29	28	0.0	1.32E-006	Polley, 1972
B6C3F1	male	35	42	0.0	1.63E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
B6KC3FF1 Hybrid	female	45	1	0.0	5.06E-008	Polley, 1972
B6KC3FF1 Hybrid	female	51	7	0.0	4.90E-007	Polley, 1972
B6KC3FF1 Hybrid	female	51	14	0.0	1.16E-006	Polley, 1972
B6KC3FF1 Hybrid	female	52	21	0.0	1.82E-006	Polley, 1972
B6KC3FF1 Hybrid	female	49	28	0.0	4.31E-006	Polley, 1972
B6KC3FF1 Hybrid	female	39	42	0.0	2.18E-006	Polley, 1972
B6KC3FF1 Hybrid	female	20	56	0.0	1.16E-006	Polley, 1972
B6KC3FF1 Hybrid	male	46	1	0.0	4.00E-008	Polley, 1972
B6KC3FF1 Hybrid	male	37	7	0.0	2.26E-007	Polley, 1972
B6KC3FF1 Hybrid	male	39	14	0.0	2.18E-006	Polley, 1972
B6KC3FF1 Hybrid	male	39	21	0.0	2.72E-006	Polley, 1972
B6KC3FF1 Hybrid	male	38	28	0.0	6.25E-006	Polley, 1972
B6KC3FF1 Hybrid	male	31	42	0.0	3.33E-006	Polley, 1972
B6KC3FF1 Hybrid	male	20	56	0.0	1.21E-006	Polley, 1972
CBA/JCr	female	56	1	0.0	5.06E-008	Polley, 1972
CBA/JCr	female	52	7	0.0	2.50E-007	Polley, 1972
CBA/JCr	female	53	14	0.0	9.02E-007	Polley, 1972
CBA/JCr	female	56	21	0.0	4.22E-007	Polley, 1972
CBA/JCr	female	56	28	0.0	7.66E-007	Polley, 1972
CBA/JCr	female	45	42	0.0	1.27E-006	Polley, 1972
CBA/JCr	female	45	49	0.0	1.27E-006	Polley, 1972
CBA/JCr	female	47	56	0.0	3.52E-006	Polley, 1972
CBA/JCr	female	52	63	0.0	1.56E-006	Polley, 1972
CBA/JCr	female	64	70	0.0	2.64E-006	Polley, 1972
CBA/JCr	female	48	77	0.0	3.06E-006	Polley, 1972
CBA/JCr	female	65	84	0.0	5.06E-006	Polley, 1972
CBA/JCr	female	53	112	0.0	5.06E-006	Polley, 1972
CBA/JCr	male	49	1	0.0	7.56E-008	Polley, 1972
CBA/JCr	male	49	7	0.0	1.41E-007	Polley, 1972
CBA/JCr	male	49	14	0.0	1.00E-006	Polley, 1972
CBA/JCr	male	53	21	0.0	8.56E-007	Polley, 1972
CBA/JCr	male	53	28	0.0	1.05E-006	Polley, 1972
CBA/JCr	male	45	42	0.0	1.89E-006	Polley, 1972
CBA/JCr	male	45	49	0.0	3.06E-006	Polley, 1972
CBA/JCr	male	45	56	0.0	3.06E-006	Polley, 1972
CBA/JCr	male	49	63	0.0	5.64E-006	Polley, 1972
CBA/JCr	male	55	70	0.0	8.27E-006	Polley, 1972
CBA/JCr	male	51	77	0.0	4.52E-006	Polley, 1972
CBA/JCr	male	55	84	0.0	9.00E-006	Polley, 1972
CBA/JCr	male	41	112	0.0	6.25E-006	Polley, 1972
CBA/J	female	15	100	0.0	2.56E-006	Kutscher, 1974
CBA/J	male	15	100	0.0	2.56E-006	Kutscher, 1974

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
CBF1 Hybrid	female	40	1	0.0	3.03E-007	Polley, 1972
CBF1 Hybrid	female	45	1	0.0	1.81E-007	Polley, 1972
CBF1 Hybrid	female	40	14	0.0	1.41E-007	Polley, 1972
CBF1 Hybrid	female	45	21	0.0	1.22E-007	Polley, 1972
CBF1 Hybrid	female	55	28	0.0	3.60E-007	Polley, 1972
CBF1 Hybrid	female	45	42	0.0	1.27E-006	Polley, 1972
CBF1 Hybrid	female	55	49	0.0	1.56E-006	Polley, 1972
CBF1 Hybrid	female	45	56	0.0	3.06E-006	Polley, 1972
CBF1 Hybrid	female	45	63	0.0	2.25E-006	Polley, 1972
CBF1 Hybrid	female	45	70	0.0	3.52E-006	Polley, 1972
CBF1 Hybrid	female	45	77	0.0	4.00E-006	Polley, 1972
CBF1 Hybrid	female	45	84	0.0	4.52E-006	Polley, 1972
CBF1 Hybrid	female	45	112	0.0	3.06E-006	Polley, 1972
CBF1 Hybrid	male	40	1	0.0	3.03E-007	Polley, 1972
CBF1 Hybrid	male	50	7	0.0	2.26E-007	Polley, 1972
CBF1 Hybrid	male	40	14	0.0	2.02E-007	Polley, 1972
CBF1 Hybrid	male	40	21	0.0	3.03E-007	Polley, 1972
CBF1 Hybrid	male	52	28	0.0	1.96E-006	Polley, 1972
CBF1 Hybrid	male	45	42	0.0	3.52E-006	Polley, 1972
CBF1 Hybrid	male	55	49	0.0	1.56E-006	Polley, 1972
CBF1 Hybrid	male	45	56	0.0	2.25E-006	Polley, 1972
CBF1 Hybrid	male	45	63	0.0	6.25E-006	Polley, 1972
CBF1 Hybrid	male	45	70	0.0	6.25E-006	Polley, 1972
CBF1 Hybrid	male	45	77	0.0	9.00E-006	Polley, 1972
CBF1 Hybrid	male	45	84	0.0	1.31E-005	Polley, 1972
CBF1 Hybrid	male	45	112	0.0	5.64E-006	Polley, 1972
CD.CDBA.CD2 Hyb	female	201	1	0.0	6.25E-008	Polley, 1972
CD.CDBA.CD2 Hyb	female	204	7	0.0	2.25E-006	Polley, 1972
CD.CDBA.CD2 Hyb	female	205	14	0.0	2.89E-005	Polley, 1972
CD.CDBA.CD2 Hyb	female	205	21	0.0	5.29E-006	Polley, 1972
CD.CDBA.CD2 Hyb	female	201	28	0.0	3.33E-006	Polley, 1972
CD.CDBA.CD2 Hyb	female	152	42	0.0	5.52E-006	Polley, 1972
CD.CDBA.CD2 Hyb	female	147	56	0.0	6.89E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	203	1	0.0	6.25E-008	Polley, 1972
CD.CDBA.CD2 Hyb	male	205	7	0.0	1.56E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	205	14	0.0	3.80E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	204	21	0.0	4.41E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	202	28	0.0	7.98E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	152	42	0.0	2.81E-006	Polley, 1972
CD.CDBA.CD2 Hyb	male	155	56	0.0	4.73E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
CD-1	male	19	37	0.0	NS	Fairchild, 1972
CD-1	male	9	56	0.0	NS	Fairchild, 1972
CD-1	male	10	74	0.0	NS	Fairchild, 1972
CFW/PlCr	female	24	1	0.0	9.00E-008	Polley, 1972
CFW/PlCr	female	24	7	0.0	1.81E-007	Polley, 1972
CFW/PlCr	female	24	14	0.0	3.31E-007	Polley, 1972
CFW/PlCr	female	24	21	0.0	1.63E-006	Polley, 1972
CFW/PlCr	female	24	28	0.0	3.52E-006	Polley, 1972
CFW/PlCr	female	24	42	0.0	3.52E-006	Polley, 1972
CFW/PlCr	female	24	56	0.0	2.48E-006	Polley, 1972
CFW/PlCr	female	24	70	0.0	2.72E-006	Polley, 1972
CFW/PlCr	male	24	1	0.0	1.41E-007	Polley, 1972
CFW/PlCr	male	24	7	0.0	1.81E-007	Polley, 1972
CFW/PlCr	male	24	14	0.0	4.56E-007	Polley, 1972
CFW/PlCr	male	24	21	0.0	2.40E-006	Polley, 1972
CFW/PlCr	male	24	28	0.0	2.40E-006	Polley, 1972
CFW/PlCr	male	24	42	0.0	3.52E-006	Polley, 1972
CFW/PlCr	male	24	56	0.0	3.52E-006	Polley, 1972
CFW/PlCr	male	24	70	0.0	3.24E-006	Polley, 1972
Charles River	male	8	NS	0.0	NS	Delaey et al., 1975
Charles River	male	7	NS	0.0	NS	Delaey et al., 1975
Crl,CD-1,CR,BR	female	40	70	0.0	7.66E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	140	0.0	1.41E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	182	0.0	3.91E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	210	0.0	5.63E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	280	0.0	1.00E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	364	0.0	1.27E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	420	0.0	1.56E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	490	0.0	1.00E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	female	40	546	0.0	3.91E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	70	0.0	1.00E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	140	0.0	1.00E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	182	0.0	5.63E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	210	0.0	1.27E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	280	0.0	5.62E-007	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	364	0.0	1.56E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	420	0.0	2.64E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	490	0.0	1.00E-006	Chvedoff et al., 1980
Crl,CD-1,CR,BR	male	40	546	0.0	5.64E-006	Chvedoff et al., 1980

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Cr:GP(S).Swiss	female	52	1	0.0	1.56E-008	Polley, 1972
Cr:GP(S).Swiss	female	62	7	0.0	1.81E-007	Polley, 1972
Cr:GP(S).Swiss	female	46	14	0.0	3.03E-007	Polley, 1972
Cr:GP(S).Swiss	female	63	21	0.0	7.66E-007	Polley, 1972
Cr:GP(S).Swiss	female	69	28	0.0	1.89E-006	Polley, 1972
Cr:GP(S).Swiss	female	63	42	0.0	3.06E-006	Polley, 1972
Cr:GP(S).Swiss	female	67	56	0.0	2.50E-007	Polley, 1972
Cr:GP(S).Swiss	female	61	70	0.0	5.62E-007	Polley, 1972
Cr:GP(S).Swiss	female	58	84	0.0	1.27E-006	Polley, 1972
Cr:GP(S).Swiss	female	55	112	0.0	2.25E-006	Polley, 1972
Cr:GP(S).Swiss	female	49	140	0.0	9.00E-008	Polley, 1972
Cr:GP(S).Swiss	female	38	168	0.0	5.29E-006	Polley, 1972
Cr:GP(S).Swiss	male	37	1	0.0	1.56E-008	Polley, 1972
Cr:GP(S).Swiss	male	50	7	0.0	9.00E-008	Polley, 1972
Cr:GP(S).Swiss	male	45	14	0.0	6.81E-007	Polley, 1972
Cr:GP(S).Swiss	male	48	21	0.0	7.66E-007	Polley, 1972
Cr:GP(S).Swiss	male	55	28	0.0	3.06E-006	Polley, 1972
Cr:GP(S).Swiss	male	51	42	0.0	5.62E-007	Polley, 1972
Cr:GP(S).Swiss	male	54	56	0.0	1.27E-006	Polley, 1972
Cr:GP(S).Swiss	male	49	70	0.0	5.62E-007	Polley, 1972
Cr:GP(S).Swiss	male	35	84	0.0	2.40E-006	Polley, 1972
Cr:GP(S).Swiss	male	33	112	0.0	4.20E-006	Polley, 1972
Cr:GP(S).Swiss	male	30	140	0.0	4.16E-005	Polley, 1972
Cr:GP(S).Swiss	male	34	168	0.0	6.63E-006	Polley, 1972
Cr:MGAPS(SW)	female	105	1	0.0	6.25E-008	Polley, 1972
Cr:MGAPS(SW)	female	107	7	0.0	3.03E-007	Polley, 1972
Cr:MGAPS(SW)	female	100	14	0.0	5.63E-007	Polley, 1972
Cr:MGAPS(SW)	female	99	21	0.0	1.56E-006	Polley, 1972
Cr:MGAPS(SW)	female	106	28	0.0	3.33E-006	Polley, 1972
Cr:MGAPS(SW)	female	107	42	0.0	5.06E-006	Polley, 1972
Cr:MGAPS(SW)	female	109	56	0.0	4.20E-006	Polley, 1972
Cr:MGAPS(SW)	female	108	70	0.0	2.64E-006	Polley, 1972
Cr:MGAPS(SW)	female	101	84	0.0	2.14E-005	Polley, 1972
Cr:MGAPS(SW)	female	99	112	0.0	8.85E-006	Polley, 1972
Cr:MGAPS(SW)	female	77	140	0.0	9.77E-006	Polley, 1972
Cr:MGAPS(SW)	female	77	168	0.0	1.22E-005	Polley, 1972
Cr:MGAPS(SW)	male	104	1	0.0	6.25E-008	Polley, 1972
Cr:MGAPS(SW)	male	98	7	0.0	3.02E-007	Polley, 1972
Cr:MGAPS(SW)	male	105	14	0.0	4.90E-007	Polley, 1972
Cr:MGAPS(SW)	male	106	21	0.0	2.25E-006	Polley, 1972
Cr:MGAPS(SW)	male	101	28	0.0	3.52E-006	Polley, 1972
Cr:MGAPS(SW)	male	101	42	0.0	6.63E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Cr:MGAPS(SW)	male	96	56	0.0	9.15E-006	Polley, 1972
Cr:MGAPS(SW)	male	105	70	0.0	3.15E-006	Polley, 1972
Cr:MGAPS(SW)	male	107	84	0.0	4.20E-006	Polley, 1972
Cr:MGAPS(SW)	male	100	112	0.0	1.10E-006	Polley, 1972
Cr:MGAPS(SW)	male	85	140	0.0	1.30E-005	Polley, 1972
Cr:MGAPS(SW)	male	84	168	0.0	1.31E-005	Polley, 1972
C3HF/HeCr	female	50	1	0.0	1.56E-008	Polley, 1972
C3HF/HeCr	female	51	7	0.0	3.31E-007	Polley, 1972
C3HF/HeCr	female	52	14	0.0	1.32E-006	Polley, 1972
C3HF/HeCr	female	56	21	0.0	3.02E-007	Polley, 1972
C3HF/HeCr	female	51	28	0.0	2.64E-006	Polley, 1972
C3HF/HeCr	female	59	42	0.0	2.18E-006	Polley, 1972
C3HF/HeCr	female	59	56	0.0	2.03E-006	Polley, 1972
C3HF/HeCr	female	49	70	0.0	1.50E-006	Polley, 1972
C3HF/HeCr	female	69	84	0.0	1.89E-006	Polley, 1972
C3HF/HeCr	female	71	112	0.0	4.00E-006	Polley, 1972
C3HF/HeCr	female	48	140	0.0	4.95E-006	Polley, 1972
C3HF/HeCr	female	63	168	0.0	1.04E-005	Polley, 1972
C3HF/HeCr	male	50	1	0.0	2.25E-008	Polley, 1972
C3HF/HeCr	male	51	7	0.0	1.60E-007	Polley, 1972
C3HF/HeCr	male	53	14	0.0	9.51E-007	Polley, 1972
C3HF/HeCr	male	56	21	0.0	1.69E-006	Polley, 1972
C3HF/HeCr	male	54	28	0.0	6.38E-006	Polley, 1972
C3HF/HeCr	male	57	42	0.0	3.15E-006	Polley, 1972
C3HF/HeCr	male	47	56	0.0	2.48E-006	Polley, 1972
C3HF/HeCr	male	46	70	0.0	1.38E-006	Polley, 1972
C3HF/HeCr	male	66	84	0.0	2.10E-006	Polley, 1972
C3HF/HeCr	male	71	112	0.0	5.06E-006	Polley, 1972
C3HF/HeCr	male	46	140	0.0	1.69E-006	Polley, 1972
C3HF/HeCr	male	35	168	0.0	4.31E-006	Polley, 1972
C3H/BlCr	female	35	1	0.0	6.25E-008	Polley, 1972
C3H/BlCr	female	35	7	0.0	6.25E-008	Polley, 1972
C3H/BlCr	female	34	14	0.0	3.31E-007	Polley, 1972
C3H/BlCr	female	34	21	0.0	7.23E-007	Polley, 1972
C3H/BlCr	female	34	28	0.0	6.40E-007	Polley, 1972
C3H/BlCr	female	56	35	0.0	1.27E-006	Polley, 1972
C3H/BlCr	female	70	42	0.0	1.27E-006	Polley, 1972
C3H/BlCr	female	64	49	0.0	7.66E-007	Polley, 1972
C3H/BlCr	female	61	56	0.0	9.02E-007	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
C3H/B1Cr	male	51	1	0.0	6.25E-008	Polley, 1972
C3H/B1Cr	male	41	7	0.0	2.26E-007	Polley, 1972
C3H/B1Cr	male	42	14	0.0	3.60E-007	Polley, 1972
C3H/B1Cr	male	41	21	0.0	4.56E-007	Polley, 1972
C3H/B1Cr	male	43	28	0.0	1.00E-006	Polley, 1972
C3H/B1Cr	male	50	35	0.0	1.00E-006	Polley, 1972
C3H/B1Cr	male	62	42	0.0	2.64E-006	Polley, 1972
C3H/B1Cr	male	58	49	0.0	1.16E-006	Polley, 1972
C3H/B1Cr	male	57	56	0.0	1.21E-006	Polley, 1972
C3H/HeCr	female	160	1	0.0	6.25E-008	Polley, 1972
C3H/HeCr	female	176	7	0.0	8.10E-007	Polley, 1972
C3H/HeCr	female	118	14	0.0	2.48E-006	Polley, 1972
C3H/HeCr	female	110	21	0.0	2.98E-006	Polley, 1972
C3H/HeCr	female	100	28	0.0	4.84E-006	Polley, 1972
C3H/HeCr	female	43	42	0.0	2.33E-006	Polley, 1972
C3H/HeCr	female	45	56	0.0	1.56E-006	Polley, 1972
C3H/HeCr	female	66	70	0.0	4.31E-006	Polley, 1972
C3H/HeCr	female	80	84	0.0	3.06E-006	Polley, 1972
C3H/HeCr	female	84	112	0.0	2.25E-006	Polley, 1972
C3H/HeCr	female	41	140	0.0	2.81E-006	Polley, 1972
C3H/HeCr	female	32	168	0.0	2.48E-006	Polley, 1972
C3H/HeCr	male	178	1	0.0	5.06E-008	Polley, 1972
C3H/HeCr	male	189	7	0.0	1.38E-006	Polley, 1972
C3H/HeCr	male	115	14	0.0	1.56E-006	Polley, 1972
C3H/HeCr	male	103	21	0.0	4.73E-006	Polley, 1972
C3H/HeCr	male	100	28	0.0	6.63E-006	Polley, 1972
C3H/HeCr	male	53	42	0.0	4.20E-006	Polley, 1972
C3H/HeCr	male	55	56	0.0	5.76E-006	Polley, 1972
C3H/HeCr	male	68	70	0.0	7.43E-006	Polley, 1972
C3H/HeCr	male	79	84	0.0	1.11E-005	Polley, 1972
C3H/HeCr	male	67	112	0.0	2.33E-006	Polley, 1972
C3H/HeCr	male	46	140	0.0	2.72E-006	Polley, 1972
C3H/HeCr	male	41	168	0.0	1.05E-006	Polley, 1972
C3H/HeJ	female	15	100	0.0	1.00E-006	Kutscher, 1974
C3H/HeJ	male	15	100	0.0	1.00E-006	Kutscher, 1974
C57B1/10ScCr	female	34	1	0.0	8.56E-007	Polley, 1972
C57B1/10ScCr	female	32	7	0.0	3.31E-007	Polley, 1972
C57B1/10ScCr	female	29	14	0.0	4.56E-007	Polley, 1972
C57B1/10ScCr	female	29	21	0.0	2.03E-006	Polley, 1972
C57B1/10ScCr	female	27	28	0.0	3.06E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
C57Bl/10ScCr	female	27	42	0.0	2.72E-006	Polley, 1972
C57Bl/10ScCr	female	24	56	0.0	2.50E-007	Polley, 1972
C57Bl/10ScCr	female	21	70	0.0	4.41E-006	Polley, 1972
C57Bl/10ScCr	female	21	84	0.0	2.33E-006	Polley, 1972
C57Bl/10ScCr	female	22	112	0.0	4.62E-006	Polley, 1972
C57Bl/10ScCr	female	19	140	0.0	3.24E-006	Polley, 1972
C57Bl/10ScCr	female	21	168	0.0	3.90E-006	Polley, 1972
C57Bl/10ScCr	male	33	1	0.0	4.90E-007	Polley, 1972
C57Bl/10ScCr	male	32	7	0.0	2.76E-007	Polley, 1972
C57Bl/10ScCr	male	31	14	0.0	3.02E-007	Polley, 1972
C57Bl/10ScCr	male	30	21	0.0	2.72E-006	Polley, 1972
C57Bl/10ScCr	male	28	28	0.0	3.42E-006	Polley, 1972
C57Bl/10ScCr	male	29	42	0.0	1.96E-006	Polley, 1972
C57Bl/10ScCr	male	28	56	0.0	7.66E-007	Polley, 1972
C57Bl/10ScCr	male	25	70	0.0	1.00E-006	Polley, 1972
C57Bl/10ScCr	male	23	84	0.0	2.89E-006	Polley, 1972
C57Bl/10ScCr	male	21	112	0.0	3.33E-006	Polley, 1972
C57Bl/10ScCr	male	22	140	0.0	2.64E-006	Polley, 1972
C57Bl/10ScCr	male	21	168	0.0	4.84E-006	Polley, 1972
C57Bl/6CR	female	423	1	0.0	1.23E-007	Polley, 1972
C57Bl/6CR	female	377	7	0.0	1.44E-006	Polley, 1972
C57Bl/6CR	female	375	14	0.0	1.50E-006	Polley, 1972
C57Bl/6CR	female	366	21	0.0	9.41E-005	Polley, 1972
C57Bl/6CR	female	428	28	0.0	5.29E-006	Polley, 1972
C57Bl/6CR	female	342	42	0.0	5.06E-006	Polley, 1972
C57Bl/6CR	female	318	56	0.0	1.85E-005	Polley, 1972
C57Bl/6CR	female	180	70	0.0	1.39E-005	Polley, 1972
C57Bl/6CR	female	93	84	0.0	9.30E-006	Polley, 1972
C57Bl/6CR	female	125	112	0.0	9.61E-006	Polley, 1972
C57Bl/6CR	female	96	140	0.0	1.52E-005	Polley, 1972
C57Bl/6CR	female	96	168	0.0	9.00E-006	Polley, 1972
C57Bl/6CR	male	444	1	0.0	1.81E-007	Polley, 1972
C57Bl/6CR	male	366	7	0.0	2.03E-006	Polley, 1972
C57Bl/6CR	male	369	14	0.0	1.63E-006	Polley, 1972
C57Bl/6CR	male	359	21	0.0	3.71E-006	Polley, 1972
C57Bl/6CR	male	419	28	0.0	1.07E-005	Polley, 1972
C57Bl/6CR	male	270	42	0.0	1.62E-005	Polley, 1972
C57Bl/6CR	male	210	56	0.0	1.07E-005	Polley, 1972
C57Bl/6CR	male	117	70	0.0	1.04E-005	Polley, 1972
C57Bl/6CR	male	63	84	0.0	8.12E-006	Polley, 1972
C57Bl/6CR	male	100	112	0.0	1.98E-005	Polley, 1972
C57Bl/6CR	male	71	140	0.0	1.11E-005	Polley, 1972
C57Bl/6CR	male	88	168	0.0	1.21E-005	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
C57Bl/6KaCr	female	58	1	0.0	5.06E-008	Polley, 1972
C57Bl/6KaCr	female	58	7	0.0	1.10E-006	Polley, 1972
C57Bl/6KaCr	female	60	14	0.0	1.32E-006	Polley, 1972
C57Bl/6KaCr	female	59	21	0.0	2.33E-006	Polley, 1972
C57Bl/6KaCr	female	55	28	0.0	5.76E-006	Polley, 1972
C57Bl/6KaCr	female	32	42	0.0	8.12E-006	Polley, 1972
C57Bl/6KaCr	female	23	56	0.0	6.76E-006	Polley, 1972
C57Bl/6KaCr	male	58	1	0.0	4.00E-008	Polley, 1972
C57Bl/6KaCr	male	55	7	0.0	1.16E-006	Polley, 1972
C57Bl/6KaCr	male	54	14	0.0	1.56E-006	Polley, 1972
C57Bl/6KaCr	male	52	21	0.0	2.64E-006	Polley, 1972
C57Bl/6KaCr	male	45	28	0.0	1.06E-005	Polley, 1972
C57Bl/6KaCr	male	40	42	0.0	5.64E-006	Polley, 1972
C57Bl/6KaCr	male	20	56	0.0	5.18E-006	Polley, 1972
C57Bl/6	NS	15	71	0.0	4.95E-006	Hoover-Plow and Nelson, 1985
C57L/Cr	female	40	1	0.0	1.00E-008	Polley, 1972
C57L/Cr	female	40	7	0.0	7.56E-008	Polley, 1972
C57L/Cr	female	40	14	0.0	2.26E-007	Polley, 1972
C57L/Cr	female	40	21	0.0	1.05E-006	Polley, 1972
C57L/Cr	female	40	28	0.0	3.31E-007	Polley, 1972
C57L/Cr	female	40	42	0.0	4.22E-007	Polley, 1972
C57L/Cr	female	40	56	0.0	6.40E-007	Polley, 1972
C57L/Cr	female	40	70	0.0	1.63E-006	Polley, 1972
C57L/Cr	female	40	84	0.0	1.76E-006	Polley, 1972
C57L/Cr	female	40	112	0.0	2.25E-006	Polley, 1972
C57L/Cr	female	40	140	0.0	2.33E-006	Polley, 1972
C57L/Cr	male	40	1	0.0	1.56E-008	Polley, 1972
C57L/Cr	male	40	7	0.0	2.25E-008	Polley, 1972
C57L/Cr	male	40	14	0.0	3.91E-007	Polley, 1972
C57L/Cr	male	40	21	0.0	5.62E-007	Polley, 1972
C57L/Cr	male	40	28	0.0	1.06E-007	Polley, 1972
C57L/Cr	male	40	42	0.0	2.26E-007	Polley, 1972
C57L/Cr	male	40	56	0.0	9.02E-007	Polley, 1972
C57L/Cr	male	40	70	0.0	8.10E-007	Polley, 1972
C57L/Cr	male	40	84	0.0	9.02E-007	Polley, 1972
C57L/Cr	male	40	112	0.0	1.50E-006	Polley, 1972
C57L/Cr	male	40	140	0.0	3.52E-006	Polley, 1972
C57L/HeN	male	13	61	0.0	NS	Silverstein, 1960
C57L/HeN	male	13	152	0.0	NS	Silverstein, 1960
C57L/6J	female	15	100	0.0	1.00E-006	Kutscher, 1974
C57L/6J	male	15	100	0.0	4.84E-006	Kutscher, 1974

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
DBA/2Cr	female	423	1	0.0	2.02E-007	Polley, 1972
DBA/2Cr	female	408	7	0.0	1.82E-006	Polley, 1972
DBA/2Cr	female	478	14	0.0	2.64E-006	Polley, 1972
DBA/2Cr	female	412	21	0.0	8.12E-006	Polley, 1972
DBA/2Cr	female	436	28	0.0	8.56E-006	Polley, 1972
DBA/2Cr	female	393	42	0.0	6.89E-006	Polley, 1972
DBA/2Cr	female	242	56	0.0	1.44E-005	Polley, 1972
DBA/2Cr	female	167	70	0.0	1.22E-005	Polley, 1972
DBA/2Cr	female	149	84	0.0	8.12E-006	Polley, 1972
DBA/2Cr	female	83	112	0.0	1.16E-005	Polley, 1972
DBA/2Cr	female	89	140	0.0	7.98E-006	Polley, 1972
DBA/2Cr	female	105	168	0.0	1.11E-005	Polley, 1972
DBA/2Cr	male	407	1	0.0	1.81E-007	Polley, 1972
DBA/2Cr	male	423	7	0.0	2.89E-006	Polley, 1972
DBA/2Cr	male	470	14	0.0	2.81E-006	Polley, 1972
DBA/2Cr	male	398	21	0.0	7.02E-006	Polley, 1972
DBA/2Cr	male	451	28	0.0	1.09E-005	Polley, 1972
DBA/2Cr	male	249	42	0.0	8.41E-006	Polley, 1972
DBA/2Cr	male	165	56	0.0	6.63E-006	Polley, 1972
DBA/2Cr	male	150	70	0.0	9.77E-006	Polley, 1972
DBA/2Cr	male	139	84	0.0	8.85E-006	Polley, 1972
DBA/2Cr	male	89	112	0.0	1.43E-005	Polley, 1972
DBA/2Cr	male	64	140	0.0	8.27E-006	Polley, 1972
DBA/2Cr	male	96	168	0.0	1.44E-005	Polley, 1972
DBA/2JN	male	9	152	0.0	NS	Silverstein, 1960
DBA/2J	female	15	100	0.0	2.56E-006	Kutscher, 1974
DBA/2J	male	15	100	0.0	4.41E-006	Kutscher, 1974
Deer	NS	NS	NS	0.0	NS	Bruce, 1950
D2AKF1 Hybrid	female	35	1	0.0	7.56E-008	Polley, 1972
D2AKF1 Hybrid	female	40	7	0.0	6.01E-007	Polley, 1972
D2AKF1 Hybrid	female	29	14	0.0	8.10E-007	Polley, 1972
D2AKF1 Hybrid	female	22	21	0.0	4.90E-007	Polley, 1972
D2AKF1 Hybrid	female	28	28	0.0	3.91E-007	Polley, 1972
D2AKF1 Hybrid	female	39	42	0.0	1.27E-006	Polley, 1972
D2AKF1 Hybrid	female	39	56	0.0	1.00E-006	Polley, 1972
D2AKF1 Hybrid	female	51	70	0.0	4.52E-006	Polley, 1972
D2AKF1 Hybrid	female	40	84	0.0	1.56E-006	Polley, 1972
D2AKF1 Hybrid	female	47	112	0.0	1.89E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
D2AKF1 Hybrid	male	40	1	0.0	9.00E-008	Polley, 1972
D2AKF1 Hybrid	male	35	7	0.0	5.26E-007	Polley, 1972
D2AKF1 Hybrid	male	30	14	0.0	1.27E-006	Polley, 1972
D2AKF1 Hybrid	male	25	21	0.0	6.01E-007	Polley, 1972
D2AKF1 Hybrid	male	26	28	0.0	3.03E-007	Polley, 1972
D2AKF1 Hybrid	male	38	42	0.0	1.00E-006	Polley, 1972
D2AKF1 Hybrid	male	46	56	0.0	4.00E-006	Polley, 1972
D2AKF1 Hybrid	male	49	70	0.0	2.64E-006	Polley, 1972
D2AKF1 Hybrid	male	40	84	0.0	4.52E-006	Polley, 1972
D2AKF1 Hybrid	male	44	112	0.0	3.52E-006	Polley, 1972
HA/ICR	male	8	69	0.0	NS	Fairchild, 1972
HA/ICR	male	8	90	0.0	NS	Fairchild, 1972
House	male	NS	NS	0.0	1.00E-004	Tolmasoff et al., 1980
I	NS	14	71	0.0	3.71E-006	Hoover-Plow and Nelson, 1985
NIH/PlCr	female	24	1	0.0	1.00E-008	Polley, 1972
NIH/PlCr	female	24	7	0.0	2.76E-007	Polley, 1972
NIH/PlCr	female	24	14	0.0	2.03E-006	Polley, 1972
NIH/PlCr	female	24	21	0.0	2.18E-006	Polley, 1972
NIH/PlCr	female	24	28	0.0	1.00E-006	Polley, 1972
NIH/PlCr	female	24	42	0.0	2.03E-006	Polley, 1972
NIH/PlCr	female	24	56	0.0	1.44E-006	Polley, 1972
NIH/PlCr	female	24	70	0.0	1.38E-006	Polley, 1972
NIH/PlCr	male	24	1	0.0	2.25E-008	Polley, 1972
NIH/PlCr	male	24	7	0.0	2.02E-007	Polley, 1972
NIH/PlCr	male	24	14	0.0	1.21E-006	Polley, 1972
NIH/PlCr	male	24	21	0.0	6.40E-007	Polley, 1972
NIH/PlCr	male	24	28	0.0	2.64E-006	Polley, 1972
NIH/PlCr	male	24	42	0.0	2.03E-006	Polley, 1972
NIH/PlCr	male	24	56	0.0	2.48E-006	Polley, 1972
NIH/PlCr	male	24	70	0.0	1.76E-006	Polley, 1972
NZB/Cr	female	36	1	0.0	1.56E-008	Polley, 1972
NZB/Cr	female	49	7	0.0	6.25E-008	Polley, 1972
NZB/Cr	female	38	14	0.0	3.91E-007	Polley, 1972
NZB/Cr	female	45	21	0.0	6.81E-007	Polley, 1972
NZB/Cr	female	41	28	0.0	1.10E-006	Polley, 1972
NZB/Cr	female	47	42	0.0	1.27E-006	Polley, 1972
NZB/Cr	female	46	56	0.0	3.06E-006	Polley, 1972
NZB/Cr	female	51	70	0.0	3.52E-006	Polley, 1972
NZB/Cr	female	53	84	0.0	1.56E-006	Polley, 1972
NZB/Cr	female	51	112	0.0	1.00E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
NZB/Cr	male	37	1	0.0	1.56E-008	Polley, 1972
NZB/Cr	male	53	7	0.0	1.00E-008	Polley, 1972
NZB/Cr	male	36	14	0.0	5.63E-007	Polley, 1972
NZB/Cr	male	42	21	0.0	9.51E-007	Polley, 1972
NZB/Cr	male	42	28	0.0	9.02E-007	Polley, 1972
NZB/Cr	male	45	42	0.0	2.64E-006	Polley, 1972
NZB/Cr	male	49	56	0.0	3.06E-006	Polley, 1972
NZB/Cr	male	47	70	0.0	1.56E-006	Polley, 1972
NZB/Cr	male	47	84	0.0	1.56E-006	Polley, 1972
NZB/Cr	male	48	112	0.0	1.27E-006	Polley, 1972
NZW/Cr	female	43	1	0.0	3.06E-008	Polley, 1972
NZW/Cr	female	49	7	0.0	1.41E-007	Polley, 1972
NZW/Cr	female	48	14	0.0	4.23E-007	Polley, 1972
NZW/Cr	female	46	21	0.0	9.51E-007	Polley, 1972
NZW/Cr	female	46	28	0.0	2.03E-006	Polley, 1972
NZW/Cr	female	49	42	0.0	1.56E-006	Polley, 1972
NZW/Cr	female	48	56	0.0	1.89E-006	Polley, 1972
NZW/Cr	female	51	70	0.0	1.00E-006	Polley, 1972
NZW/Cr	female	56	84	0.0	1.50E-006	Polley, 1972
NZW/Cr	female	54	112	0.0	1.69E-006	Polley, 1972
NZW/Cr	male	42	1	0.0	6.25E-008	Polley, 1972
NZW/Cr	male	42	7	0.0	6.25E-008	Polley, 1972
NZW/Cr	male	46	14	0.0	7.66E-007	Polley, 1972
NZW/Cr	male	46	21	0.0	1.63E-006	Polley, 1972
NZW/Cr	male	46	28	0.0	2.81E-006	Polley, 1972
NZW/Cr	male	44	42	0.0	6.63E-006	Polley, 1972
NZW/Cr	male	45	56	0.0	4.00E-006	Polley, 1972
NZW/Cr	male	52	70	0.0	1.56E-006	Polley, 1972
NZW/Cr	male	50	84	0.0	7.66E-007	Polley, 1972
NZW/Cr	male	49	112	0.0	7.66E-007	Polley, 1972
NS	female	NS	567	0.0	NS	NAS, 1971
NS	female	NS	614	0.0	NS	NAS, 1971
NS	female	NS	614	0.0	NS	NAS, 1971
NS	female	NS	659	0.0	NS	NAS, 1971
NS	female	NS	750	0.0	NS	NAS, 1971
NS	male	NS	389	0.0	NS	NAS, 1971
NS	male	NS	395	0.0	NS	NAS, 1971
NS	male	NS	399	0.0	NS	NAS, 1971
NS	male	NS	709	0.0	NS	NAS, 1971
NS	male	NS	842	0.0	NS	NAS, 1971
NS	male	NS	933	0.0	NS	NAS, 1971

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
NS	NS	NS	NS	0.0	NS	Bruce, 1950
NS	NS	NS	NS	0.0	NS	Bruce, 1950
NS	NS	NS	NS	0.0	NS	Lane-Peter et al., 1967
NS	NS	NS	NS	0.0	NS	Lane-Peter et al., 1967
NS	NS	5	3	0.0	2.25E-006	Mortola, 1984
NS	NS	NS	NS	0.0	1.56E-006	Bruce, 1950
PRI/PlCr	female	45	1	0.0	1.56E-008	Polley, 1972
PRI/PlCr	female	44	7	0.0	1.27E-006	Polley, 1972
PRI/PlCr	female	41	14	0.0	2.48E-006	Polley, 1972
PRI/PlCr	female	33	21	0.0	6.40E-007	Polley, 1972
PRI/PlCr	female	29	28	0.0	5.41E-006	Polley, 1972
PRI/PlCr	female	26	42	0.0	4.84E-006	Polley, 1972
PRI/PlCr	female	25	56	0.0	2.64E-006	Polley, 1972
PRI/PlCr	female	23	70	0.0	1.89E-006	Polley, 1972
PRI/PlCr	female	23	84	0.0	2.50E-007	Polley, 1972
PRI/PlCr	female	31	112	0.0	4.84E-006	Polley, 1972
PRI/PlCr	female	29	140	0.0	7.70E-006	Polley, 1972
PRI/PlCr	female	33	168	0.0	5.52E-006	Polley, 1972
PRI/PlCr	male	47	1	0.0	3.06E-008	Polley, 1972
PRI/PlCr	male	46	7	0.0	1.16E-006	Polley, 1972
PRI/PlCr	male	45	14	0.0	3.06E-006	Polley, 1972
PRI/PlCr	male	44	21	0.0	1.05E-006	Polley, 1972
PRI/PlCr	male	30	28	0.0	5.64E-006	Polley, 1972
PRI/PlCr	male	26	42	0.0	5.18E-006	Polley, 1972
PRI/PlCr	male	29	56	0.0	1.27E-006	Polley, 1972
PRI/PlCr	male	23	70	0.0	1.82E-006	Polley, 1972
PRI/PlCr	male	21	84	0.0	3.90E-006	Polley, 1972
PRI/PlCr	male	20	112	0.0	2.40E-006	Polley, 1972
PRI/PlCr	male	22	140	0.0	2.64E-006	Polley, 1972
PRI/PlCr	male	24	168	0.0	1.50E-006	Polley, 1972
SJL/JCr	female	69	1	0.0	5.06E-008	Polley, 1972
SJL/JCr	female	74	7	0.0	3.60E-007	Polley, 1972
SJL/JCr	female	67	14	0.0	1.56E-008	Polley, 1972
SJL/JCr	female	69	21	0.0	5.63E-007	Polley, 1972
SJL/JCr	female	76	28	0.0	8.56E-007	Polley, 1972
SJL/JCr	female	74	35	0.0	6.25E-006	Polley, 1972
SJL/JCr	female	77	42	0.0	5.06E-006	Polley, 1972
SJL/JCr	female	70	49	0.0	3.52E-006	Polley, 1972
SJL/JCr	female	68	56	0.0	3.06E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
SJL/JCr	female	70	63	0.0	3.06E-006	Polley, 1972
SJL/JCr	female	75	70	0.0	2.64E-006	Polley, 1972
SJL/JCr	female	83	77	0.0	3.06E-006	Polley, 1972
SJL/JCr	female	69	84	0.0	5.64E-006	Polley, 1972
SJL/JCr	female	68	112	0.0	1.27E-006	Polley, 1972
SJL/JCr	male	73	1	0.0	3.06E-008	Polley, 1972
SJL/JCr	male	82	7	0.0	1.60E-007	Polley, 1972
SJL/JCr	male	74	14	0.0	1.41E-007	Polley, 1972
SJL/JCr	male	73	21	0.0	1.50E-006	Polley, 1972
SJL/JCr	male	79	28	0.0	1.76E-006	Polley, 1972
SJL/JCr	male	79	35	0.0	4.00E-006	Polley, 1972
SJL/JCr	male	79	42	0.0	4.00E-006	Polley, 1972
SJL/JCr	male	75	49	0.0	4.00E-006	Polley, 1972
SJL/JCr	male	72	56	0.0	4.52E-006	Polley, 1972
SJL/JCr	male	65	63	0.0	2.25E-006	Polley, 1972
SJL/JCr	male	71	70	0.0	2.25E-006	Polley, 1972
SJL/JCr	male	84	77	0.0	4.00E-006	Polley, 1972
SJL/JCr	male	64	84	0.0	3.06E-006	Polley, 1972
SJL/JCr	male	71	112	0.0	2.25E-006	Polley, 1972
SM/JCr	female	51	1	0.0	5.06E-008	Polley, 1972
SM/JCr	female	46	7	0.0	4.00E-008	Polley, 1972
SM/JCr	female	59	14	0.0	4.90E-007	Polley, 1972
SM/JCr	female	48	21	0.0	1.16E-006	Polley, 1972
SM/JCr	female	41	28	0.0	1.00E-006	Polley, 1972
SM/JCr	female	53	35	0.0	1.89E-006	Polley, 1972
SM/JCr	female	46	42	0.0	1.56E-006	Polley, 1972
SM/JCr	female	50	49	0.0	1.89E-006	Polley, 1972
SM/JCr	female	51	56	0.0	2.25E-006	Polley, 1972
SM/JCr	female	49	63	0.0	3.06E-006	Polley, 1972
SM/JCr	female	46	70	0.0	3.52E-006	Polley, 1972
SM/JCr	female	45	77	0.0	3.06E-006	Polley, 1972
SM/JCr	female	47	84	0.0	3.06E-006	Polley, 1972
SM/JCr	female	49	112	0.0	4.00E-006	Polley, 1972
SM/JCr	male	49	1	0.0	4.00E-008	Polley, 1972
SM/JCr	male	55	7	0.0	5.06E-008	Polley, 1972
SM/JCr	male	53	14	0.0	1.56E-008	Polley, 1972
SM/JCr	male	61	21	0.0	1.05E-006	Polley, 1972
SM/JCr	male	49	28	0.0	9.51E-007	Polley, 1972
SM/JCr	male	49	35	0.0	1.00E-006	Polley, 1972
SM/JCr	male	53	42	0.0	2.25E-006	Polley, 1972
SM/JCr	male	50	49	0.0	1.89E-006	Polley, 1972
SM/JCr	male	49	56	0.0	1.89E-006	Polley, 1972

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
SM/JCr	male	51	63	0.0	3.06E-006	Polley, 1972
SM/JCr	male	44	70	0.0	4.00E-006	Polley, 1972
SM/JCr	male	54	77	0.0	3.06E-006	Polley, 1972
SM/JCr	male	41	84	0.0	4.00E-006	Polley, 1972
SM/JCr	male	51	112	0.0	4.00E-006	Polley, 1972
STR/Cr	female	25	1	0.0	4.00E-008	Polley, 1972
STR/Cr	female	25	7	0.0	2.50E-007	Polley, 1972
STR/Cr	female	25	14	0.0	5.63E-007	Polley, 1972
STR/Cr	female	25	21	0.0	1.27E-006	Polley, 1972
STR/Cr	female	25	28	0.0	3.52E-006	Polley, 1972
STR/Cr	female	25	42	0.0	3.52E-006	Polley, 1972
STR/Cr	female	25	56	0.0	3.90E-006	Polley, 1972
STR/Cr	female	25	70	0.0	4.95E-006	Polley, 1972
STR/Cr	female	25	84	0.0	5.52E-006	Polley, 1972
STR/Cr	male	25	1	0.0	3.06E-008	Polley, 1972
STR/Cr	male	25	7	0.0	2.50E-007	Polley, 1972
STR/Cr	male	25	14	0.0	3.91E-007	Polley, 1972
STR/Cr	male	25	21	0.0	2.25E-006	Polley, 1972
STR/Cr	male	25	28	0.0	4.00E-006	Polley, 1972
STR/Cr	male	25	42	0.0	5.64E-006	Polley, 1972
STR/Cr	male	25	56	0.0	5.06E-006	Polley, 1972
STR/Cr	male	25	70	0.0	6.25E-006	Polley, 1972
STR/Cr	male	25	84	0.0	6.89E-006	Polley, 1972
STR/N	male	12	61	0.0	NS	Silverstein, 1960
STR/N	male	12	152	0.0	NS	Silverstein, 1960
STR/1N	female	13	152	0.0	NS	Silverstein, 1960
STR/1N	male	8	152	0.0	NS	Silverstein, 1960
SWR/J	female	15	100	0.0	1.96E-006	Kutscher, 1974
SWR/J	male	15	100	0.0	4.41E-006	Kutscher, 1974
Various inbred	female	NS	21	0.0	NS	NAS, 1978
Various inbred	female	NS	28	0.0	NS	NAS, 1978
Various inbred	female	NS	42	0.0	NS	NAS, 1978
Various inbred	female	NS	56	0.0	NS	NAS, 1978
Various inbred	female	NS	112	0.0	NS	NAS, 1978

TABLE 3-2 (cont.)

Species	Sex	Number of Animals	Age (days)	Weight (kg)	Variance	Reference
Various inbred	male	NS	21	0.0	NS	NAS, 1978
Various inbred	male	NS	28	0.0	NS	NAS, 1978
Various inbred	male	NS	42	0.0	NS	NAS, 1978
Various inbred	male	NS	56	0.0	NS	NAS, 1978
Various inbred	male	NS	112	0.0	NS	NAS, 1978
White-footed	female	16	102	0.0	7.23E-005	Steger et al., 1980
White-footed	female	4	159	0.0	6.25E-006	Steger et al., 1980
White-footed	female	16	184	0.0	1.69E-006	Steger et al., 1980
White-footed	female	17	268	0.0	8.28E-005	Steger et al., 1980
White-footed	female	13	394	0.0	6.89E-005	Steger et al., 1980
White-footed	female	10	411	0.0	5.18E-005	Steger et al., 1980
White	female	8	70	0.0	NS	Chew and Hinegardner, 1957
White	female	8	113	0.0	NS	Chew and Hinegardner, 1957
White	female	8	396	0.0	NS	Chew and Hinegardner, 1957
White	male	8	70	0.0	NS	Chew and Hinegardner, 1957
White	male	8	113	0.0	NS	Chew and Hinegardner, 1957
White	male	8	396	0.0	NS	Chew and Hinegardner, 1957
ZWZBF1 Hybrid	female	43	1	0.0	5.06E-008	Polley, 1972
ZWZBF1 Hybrid	female	43	7	0.0	7.56E-008	Polley, 1972
ZWZBF1 Hybrid	female	43	14	0.0	1.23E-007	Polley, 1972
ZWZBF1 Hybrid	female	46	21	0.0	8.10E-007	Polley, 1972
ZWZBF1 Hybrid	female	49	28	0.0	8.10E-007	Polley, 1972
ZWZBF1 Hybrid	female	48	42	0.0	1.27E-006	Polley, 1972
ZWZBF1 Hybrid	female	48	56	0.0	1.27E-006	Polley, 1972
ZWZBF1 Hybrid	female	40	70	0.0	1.56E-006	Polley, 1972
ZWZBF1 Hybrid	female	49	84	0.0	3.52E-006	Polley, 1972
ZWZBF1 Hybrid	female	42	112	0.0	3.52E-006	Polley, 1972
ZWZBF1 Hybrid	male	42	1	0.0	1.22E-007	Polley, 1972
ZWZBF1 Hybrid	male	42	7	0.0	1.23E-007	Polley, 1972
ZWZBF1 Hybrid	male	48	14	0.0	1.22E-007	Polley, 1972
ZWZBF1 Hybrid	male	41	21	0.0	5.26E-007	Polley, 1972
ZWZBF1 Hybrid	male	42	28	0.0	7.23E-007	Polley, 1972
ZWZBF1 Hybrid	male	45	42	0.0	6.89E-006	Polley, 1972
ZWZBF1 Hybrid	male	45	56	0.0	1.56E-006	Polley, 1972
ZWZBF1 Hybrid	male	45	70	0.0	1.00E-006	Polley, 1972
ZWZBF1 Hybrid	male	41	84	0.0	7.66E-007	Polley, 1972
ZWZBF1 Hybrid	male	42	112	0.0	7.66E-007	Polley, 1972

NS = Not specified

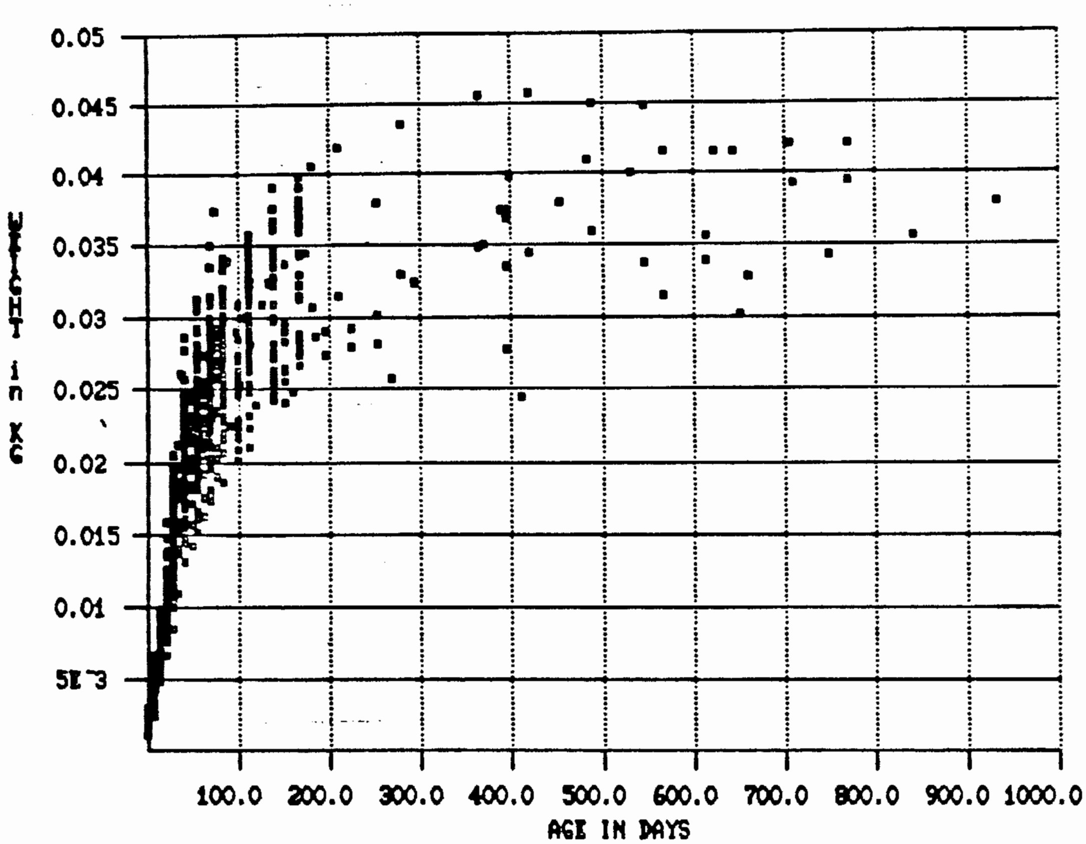


FIGURE 3-16

Body Weight Data on Male and Female Mice

(See Table 3-2 for data points and references)

For the purposes of estimating body weights over the lifespan, the most relevant data are provided by Cameron et al. (1985). This publication provides growth data on thousands of male and female B6C3F1 mice that were used as vehicle and untreated controls in bioassays for carcinogenicity. These bioassays were sponsored by the National Cancer Institute and conducted from 1971-1981. Body weight measurements were recorded from 6-110 weeks of age. The data summarized in Table 3-2 were estimated from Figures 1 and 2 in Cameron et al. (1985). Not all points from these figures are summarized in this report, but the points that are summarized adequately reflect the overall growth curve. For female mice, only the curve from the untreated animals was used, since the vehicle control female mice had a somewhat lower body weight than the untreated controls from weeks 26-110.

Most toxicity studies on mice, as well as other small laboratory rodents, are conducted over standard exposure periods. For subchronic studies, weanling mice are usually exposed for 90 days. For chronic toxicity studies, weanling mice are usually exposed for 2 years or ~730 days. Consequently, standard reference values will be recommended for both kinds of studies. For subchronic toxicity studies, the recommended body weight will be the TWA body weight from 21 days of age (the recommended age for weanling mice) to 111 days of age (90 days postweaning). This will be referred to as the recommended "subchronic" body weight. The corresponding recommended "chronic" body weight will refer to the TWA body weight from 21-751 days of age. Recommended subchronic and chronic body weights for various strains of mice are presented in Table 3-3.

The recommended chronic and subchronic body weights for B6C3F1 mice are calculated directly from a composite of the data provided by Poiley (1972) (days 1-42) and Cameron et al. (1985) (days 42-770). These data are presented in Figures 3-17 and 3-18, for male and female mice, respectively.

TABLE 3-3

Reference Values for Body Weights of Various Strains of Mice

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
AKD2F1	F	0.002	0.0085	0.209	0.233*	Poiley, 1972
AKD2F1	M	0.02	0.095	0.0246	0.0308*	Poiley, 1972
AKR/LwCr	F	0.0014	0.0087	0.0222	0.0259*	Poiley, 1972
AKR/LwCr	M	0.0015	0.0090	0.0252	0.0320*	Poiley, 1972
AL/NCr	F	0.0014	0.0088	0.0251	0.0318*	Poiley, 1972
AL/NCr	M	0.0015	0.0096	0.0274	0.0364*	Poiley, 1972
A/JCr	F	0.0012	0.0126	0.0224	0.0263*	Poiley, 1972
A/JCr	M	0.0012	0.0137	0.0243	0.0302*	Poiley, 1972
BAF1 Hybrid	F	0.0021	0.0067	0.0204	0.0222*	Poiley, 1972
BAF1 Hybrid	M	0.0022	0.0077	0.0223	0.0261*	Poiley, 1972
BALB/cAnCr	F	0.0017	0.0108	0.0200	0.0214*	Poiley, 1972
BALB/cAnCr	M	0.0013	0.0113	0.0218	0.0251*	Poiley, 1972
B6AKF1	F	0.0019	0.0077	0.0210	0.0235*	Poiley, 1972
B6AKF1	M	0.0019	0.0080	0.0234	0.0283*	Poiley, 1972

TABLE 3-3 (cont.)

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
B6C3F1	F	0.0014	0.0093	0.0246	0.0353	Poiley, 1972; Cameron et al., 1985
B6C3F1	M	0.0014	0.0103	0.0316	0.0373	Poiley, 1972; Cameron et al., 1985
CBA/JCr	F	0.0026	0.0106	0.0231	0.0277*	Poiley, 1972
CBA/JCr	M	0.0030	0.0113	0.0263	0.0342*	Poiley, 1972
CBF1	F	0.0030	0.0105	0.0218	0.0251*	Poiley, 1972
CBF1	M	0.0030	0.0112	0.0254	0.0324*	Poiley, 1972
Cr:GP(S).Swiss	F	0.0019	0.0096	0.0246	0.0308*	Poiley, 1972
Cr:GP(S).Swiss	M	0.0019	0.0107	0.0270	0.0356*	Poiley, 1972
Cr:MGAPS(SW)	F	0.0016	0.0091	0.0222	0.0259*	Poiley, 1972
Cr:MGAPS(SW)	M	0.0018	0.0092	0.0246	0.0308*	Poiley, 1972
C3HF/HeCr	F	0.0019	0.0106	0.0181	0.0176*	Poiley, 1972
C3HF/HeCr	M	0.0020	0.0121	0.0205	0.0224*	Poiley, 1972
C3H/HeCr	F	0.0015	0.0079	0.0255	0.0326*	Poiley, 1972
C3H/HeCr	M	0.0015	0.0109	0.0267	0.0350*	Poiley, 1972

TABLE 3-3 (cont.)

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
C57Bl/10ScCr	F	0.0014	0.0119	0.0233	0.0281*	Poiley, 1972
C57Bl/10ScCr	M	0.0014	0.0122	0.0269	0.0354*	Poiley, 1972
C57Bl/6Cr	F	0.0014	0.0082	0.0198	0.0210*	Poiley, 1972
C57Bl/6Cr	M	0.0015	0.0094	0.0220	0.0255*	Poiley, 1972
C57L/Cr	F	0.0017	0.0095	0.0190	0.0194*	Poiley, 1972
C57L/Cr	M	0.0018	0.0103	0.0207	0.0229*	Poiley, 1972
DBA/2Cr	F	0.0014	0.0095	0.0214	0.0243*	Poiley, 1972
DBA/2Cr	M	0.0015	0.0097	0.0225	0.0265*	Poiley, 1972
D2AKF1	F	0.0017	0.0075	0.0209	0.0233*	Poiley, 1972
D2AKF1	M	0.0016	0.0080	0.0240	0.0295*	Poiley, 1972
NZB/Cr	F	0.0015	0.0103	0.0255	0.0326*	Poiley, 1972
NZB/Cr	M	0.0015	0.0113	0.0286	0.0389*	Poiley, 1972
NZW/Cr	F	0.0020	0.0109	0.0255	0.0326*	Poiley, 1972
NZW/Cr	M	0.0021	0.0115	0.0285	0.0387*	Poiley, 1972
PRI/PlCr	F	0.0015	0.0148	0.0284	0.0385*	Poiley, 1972

TABLE 3-3 (cont.)

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
PRI/PlCr	M	0.0015	0.0158	0.0302	0.0421*	Poiley, 1972
SJL/JCr	F	0.0018	0.0116	0.0206	0.0227*	Poiley, 1972
SJL/JCr	M	0.0017	0.0120	0.0243	0.0302*	Poiley, 1972
SM/JCr	F	0.0017	0.0088	0.0165	0.0143*	Poiley, 1972
SM/JCr	M	0.0016	0.0100	0.0182	0.0178*	Poiley, 1972
Various Inbred	F		0.0102	0.0220	0.0255*	NAS, 1978
Various Inbred	M		0.0110	0.0240	0.0295*	NAS, 1978
ZWZBF1	F	0.0027	0.0067	0.0235	0.0285*	Poiley, 1972
ZWZBF1	M	0.0027	0.0078	0.0333	0.0484*	Poiley, 1972

*Recommended chronic body weights based on the equation, $BW_{ch} = -0.019+2.03\ BW_{sub}$, where BWch is the recommended chronic body and BWsub is the recommended subchronic body weight.

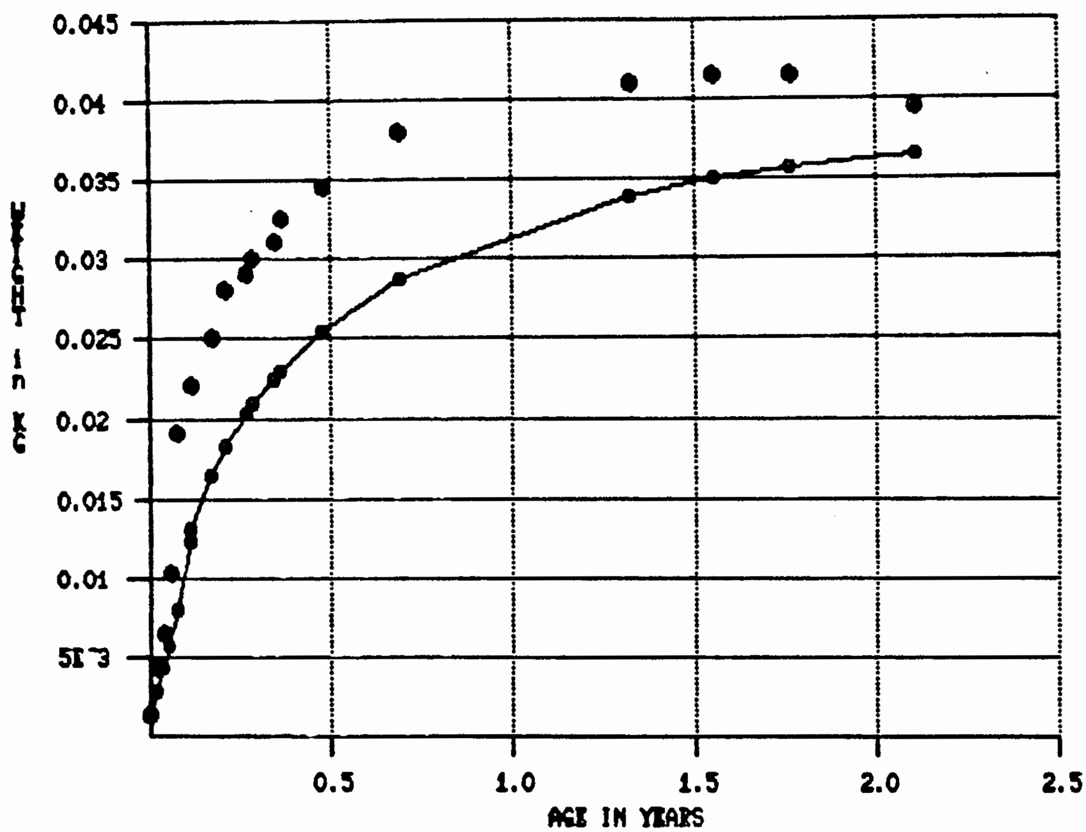


FIGURE 3-17

Recommended Growth Curve for Male B6C3F1 Mice

[Data from Poiley (1972) and Cameron et al. (1985)]

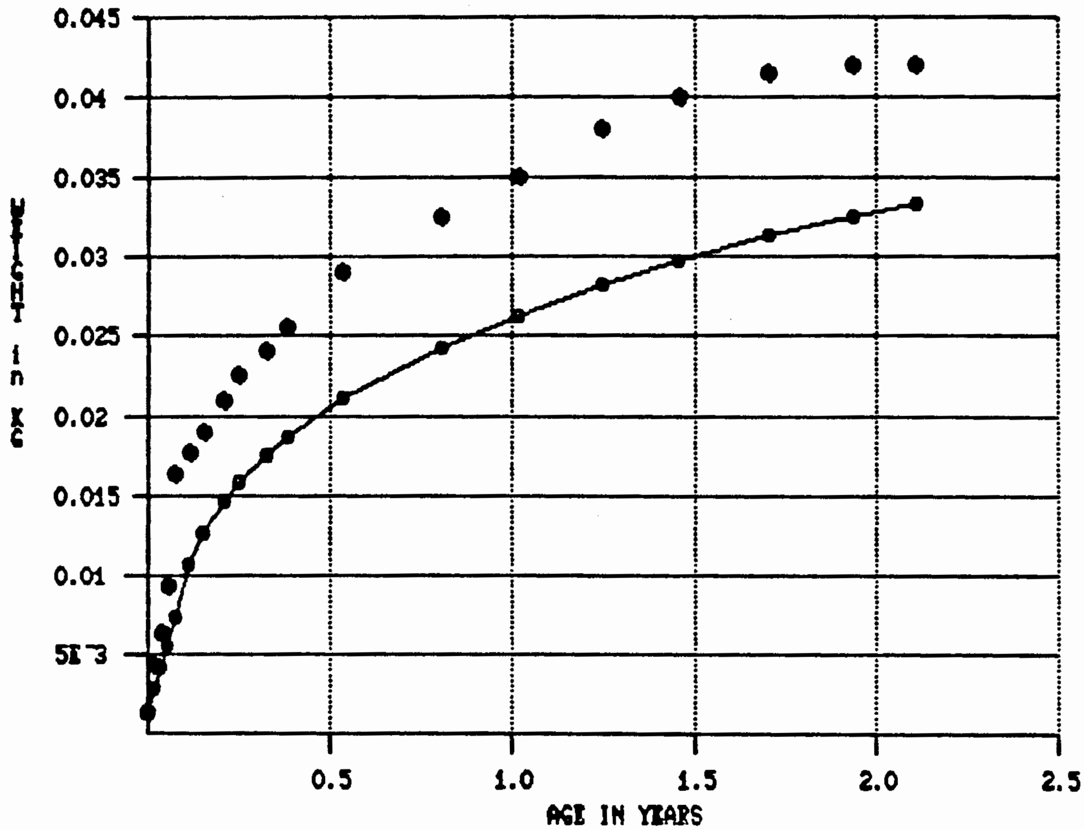


FIGURE 3-18

Recommended Growth Curve for Female B6C3F1 Mice

[Data from Poiley (1972) and Cameron et al. (1985)]

In both of these figures and in the calculation of recommended body weights, the Poiley (1972) data for B6C3F1 mice at day 42 and following are omitted. These data are omitted because body weights at day 42 in Poiley (1972) are substantially higher for both sexes than body weights at day 42 in the publication by Cameron et al. (1985). And the latter study is given preference because of the far greater numbers of animals used to estimate the body weight.

Recommended subchronic body weights also are provided in Table 3-3 and are calculated directly from the Poiley (1972) data and from composite growth data on various strains of inbred mice reported by NAS (1978). Data are not available to directly calculate recommended chronic body weights for any of these other strains of mice.

Chronic body weights could be estimated by assuming that the ratio of chronic to subchronic body weights is the same as that observed in male and female B6C3F1 mice. In the growth data on rats, summarized in Section 3.2.2., substantial variation is apparent in the ratios of recommended chronic to subchronic body weights among male and female Sprague-Dawley and Fischer rats, as well as male Wistar rats. In addition, this variation seems likely to occur among strains of mice.

As an alternative to that approach, recommended chronic body weights for mice and rats were estimated from the observed relationship between subchronic and chronic body weights for B6C3F1 mice and the strains of rats specified above. This relationship and associated summary statistics are given in Figure 3-19. From this relationship, the recommended chronic body weights are based on the equation:

$$BWch = -0.019 + 2.03BWsub \qquad (3\text{-}2)$$

where BWch is the recommended chronic body weight and BWsub is the recommended subchronic body weight.

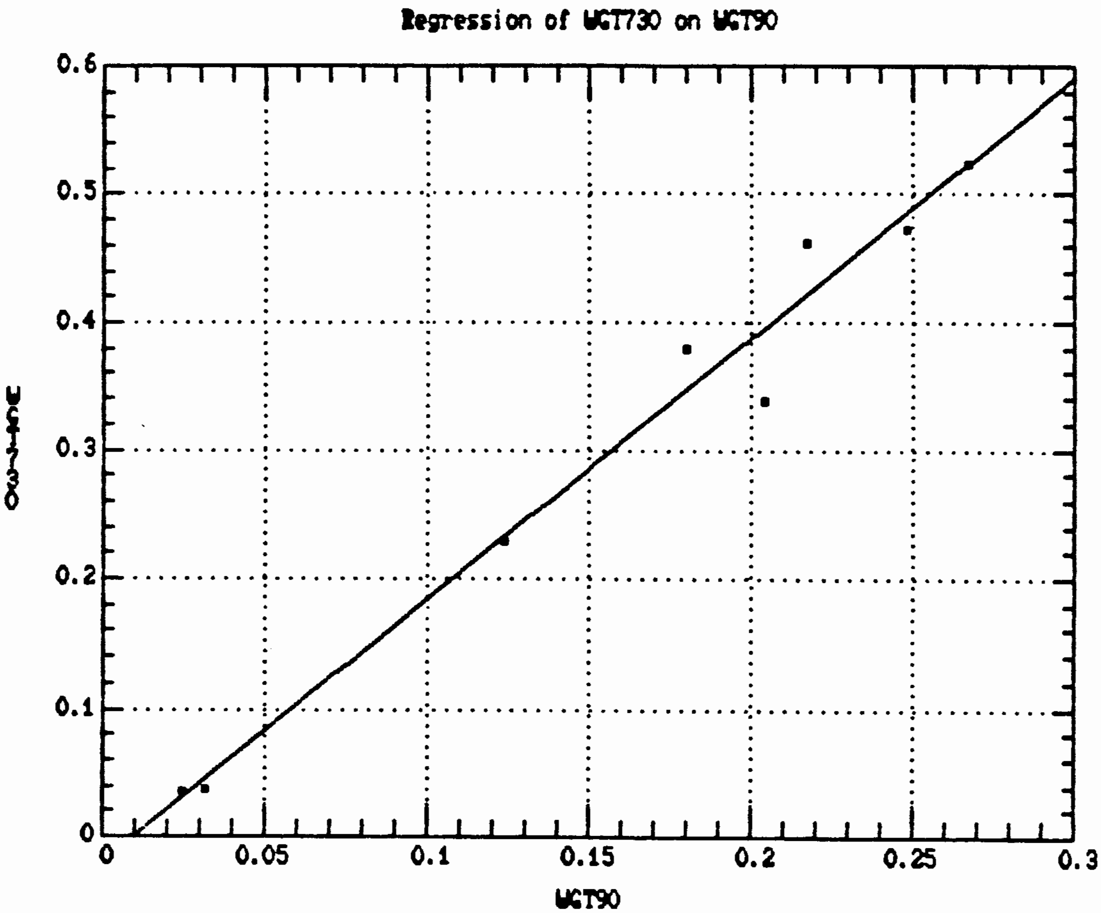


FIGURE 3-19

Relationship of "Subchronic" to "Chronic"
Time-Weighted Average Body Weights for Mice and Rats

(See text for definition and discussion of terms)

This approach assumes that the ratio of subchronic to chronic body weights will generally be the same for males and females. Male B6C3F1 mice, however, exhibit a marked plateau in growth (see Figure 3-17) not seen in female mice (see Figure 3-18). A similar pattern is seen in human males (see Figure 3-5) and females (see Figure 3-6) as well as in other species, as discussed in subsequent sections. This fact suggests that sex-specific body weight estimates may be more appropriate than the general approach given above. Given the small number of available sex-specific strain comparisons, however, a clear pattern is not apparent.

Since toxicity studies commonly give initial or weanling weights without giving final or average body weights, the relationship of weanling weight to recommended subchronic weight was examined. This relationship is illustrated in Figure 3-20 for rats and mice combined. The high correlation coefficient is due to the clustering of the rat and mouse data. Within either species, the correlation is poor. Consequently, the use of weanling weight to estimate recommended body weights is not proposed.

Recommended body weights for mice, when the strain is not specified or when recommended weights are not available on the specified strain, should be based on the recommended weights for male and female B6C3F1 mice. These weights are the best documented and are near the average for all mice strains combined.

3.2.2. Rats. The U.S. EPA (1980) has recommended a reference body weight of 0.35 kg for adult rats. Other reported reference values are 0.45 (ARS Spraguė-Dawley, 1974), 0.25 (Boxenbaum, 1983) and 0.40 kg (Lehman, 1959).

As with mice, a substantial amount of information is available on the growth of rats. These data are summarized in Table 3-4 and plotted in Figure 3-21. Body weights of rats seem to vary more than those of mice.

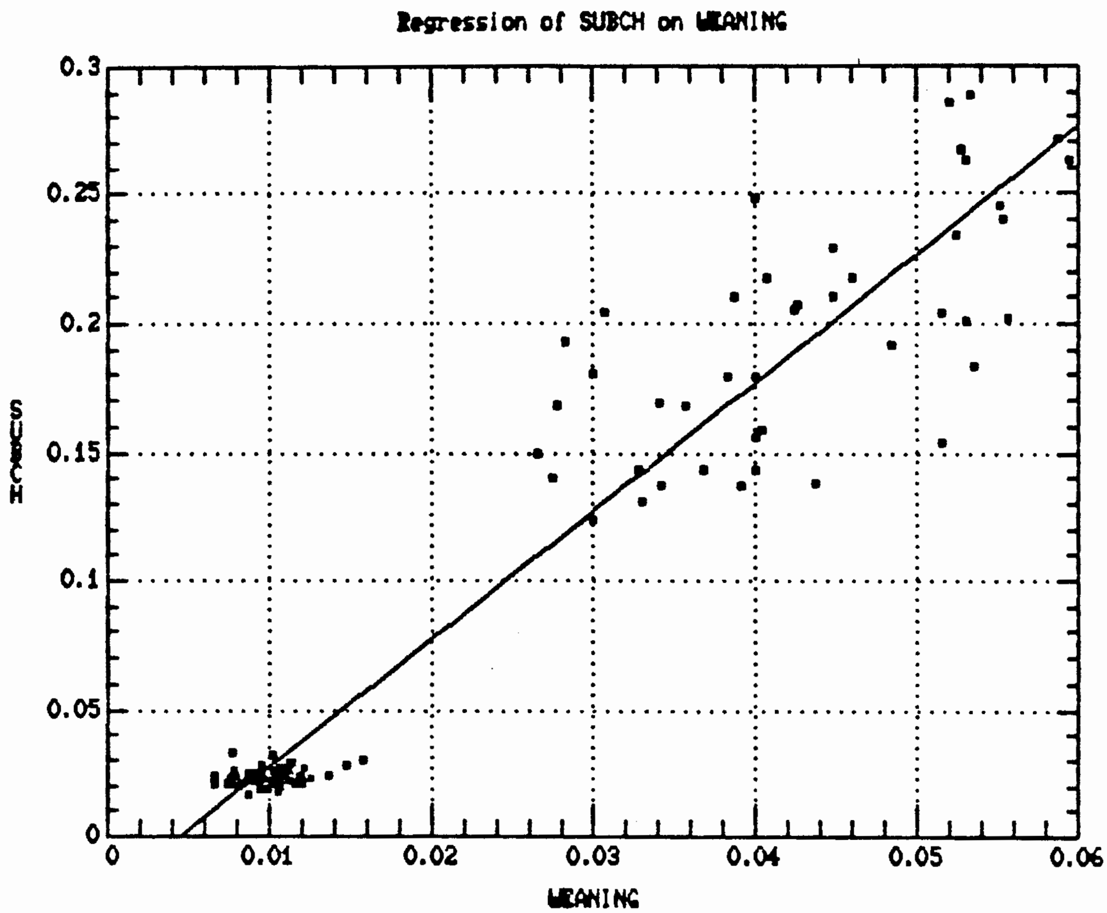


FIGURE 3-20

Relationship of Body Weight at Weaning to Recommended Subchronic Body Weight for Various Strains of Mice and Rats

TABLE 3-4

Growth and Body Weight Data on Rats

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
ACP 9935/Cr	female	20	1	0.00510	2.25E-008	Polley, 1972
ACP 9935/Cr	female	21	7	0.01030	8.56E-007	Polley, 1972
ACP 9935/Cr	female	23	14	0.01990	3.61E-006	Polley, 1972
ACP 9935/Cr	female	31	21	0.03300	3.90E-006	Polley, 1972
ACP 9935/Cr	female	31	28	0.04460	1.62E-005	Polley, 1972
ACP 9935/Cr	female	24	42	0.08770	1.40E-004	Polley, 1972
ACP 9935/Cr	female	25	56	0.12490	2.22E-004	Polley, 1972
ACP 9935/Cr	female	21	70	0.13780	1.24E-004	Polley, 1972
ACP 9935/Cr	female	27	84	0.16380	1.37E-004	Polley, 1972
ACP 9935/Cr	female	21	112	0.18120	1.76E-004	Polley, 1972
ACP 9935/Cr	female	24	140	0.21330	2.69E-004	Polley, 1972
ACP 9935/Cr	female	21	168	0.25310	2.12E-004	Polley, 1972
ACP 9935/Cr	male	20	1	0.00520	1.56E-008	Polley, 1972
ACP 9935/Cr	male	24	7	0.01190	1.10E-006	Polley, 1972
ACP 9935/Cr	male	26	14	0.02120	4.62E-006	Polley, 1972
ACP 9935/Cr	male	20	21	0.03410	3.61E-006	Polley, 1972
ACP 9935/Cr	male	32	28	0.04640	2.92E-005	Polley, 1972
ACP 9935/Cr	male	24	42	0.09100	7.92E-005	Polley, 1972
ACP 9935/Cr	male	25	56	0.12790	1.81E-004	Polley, 1972
ACP 9935/Cr	male	23	70	0.18800	3.11E-004	Polley, 1972
ACP 9935/Cr	male	21	84	0.23070	4.00E-004	Polley, 1972
ACP 9935/Cr	male	26	112	0.25870	1.40E-004	Polley, 1972
ACP 9935/Cr	male	27	140	0.28810	1.70E-004	Polley, 1972
ACP 9935/Cr	male	25	168	0.30970	2.34E-004	Polley, 1972
ACl 9935/Cr	female	28	1	0.00530	2.50E-009	Polley, 1972
ACl 9935/Cr	female	28	7	0.00930	3.03E-007	Polley, 1972
ACl 9935/Cr	female	28	14	0.02180	8.10E-007	Polley, 1972
ACl 9935/Cr	female	28	21	0.03420	1.63E-006	Polley, 1972
ACl 9935/Cr	female	28	28	0.04830	2.26E-007	Polley, 1972
ACl 9935/Cr	female	28	42	0.09180	1.85E-005	Polley, 1972
ACl 9935/Cr	female	28	56	0.12730	1.11E-004	Polley, 1972
ACl 9935/Cr	female	28	70	0.14390	7.92E-005	Polley, 1972
ACl 9935/Cr	female	28	84	0.16530	7.98E-006	Polley, 1972
ACl 9935/Cr	female	27	112	0.19110	5.44E-005	Polley, 1972
ACl 9935/Cr	female	27	140	0.20900	5.85E-005	Polley, 1972
ACl 9935/Cr	female	27	168	0.24830	9.03E-005	Polley, 1972
ACl 9935/Cr	male	32	1	0.00540	6.25E-010	Polley, 1972
ACl 9935/Cr	male	32	7	0.01070	5.26E-007	Polley, 1972
ACl 9935/Cr	male	32	14	0.02350	1.41E-007	Polley, 1972
ACl 9935/Cr	male	32	21	0.03570	1.10E-006	Polley, 1972
ACl 9935/Cr	male	32	28	0.04930	6.01E-007	Polley, 1972
ACl 9935/Cr	male	32	42	0.09510	5.04E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
ACI 9935/Cr	male	32	56	0.13070	1.13E-004	Polley, 1972
ACI 9935/Cr	male	31	70	0.19590	4.61E-004	Polley, 1972
ACI 9935/Cr	male	31	84	0.23380	4.68E-004	Polley, 1972
ACI 9935/Cr	male	29	112	0.26710	3.75E-005	Polley, 1972
ACI 9935/Cr	male	29	140	0.28920	2.30E-005	Polley, 1972
ACI 9935/Cr	male	29	168	0.30880	8.06E-005	Polley, 1972
ALBANY/Cr	female	35	1	0.00710	1.60E-007	Polley, 1972
ALBANY/Cr	female	35	7	0.01800	2.26E-007	Polley, 1972
ALBANY/Cr	female	35	14	0.03030	1.96E-006	Polley, 1972
ALBANY/Cr	female	35	21	0.05350	2.53E-005	Polley, 1972
ALBANY/Cr	female	25	28	0.07980	4.36E-005	Polley, 1972
ALBANY/Cr	female	31	42	0.12140	7.29E-006	Polley, 1972
ALBANY/Cr	female	45	56	0.17260	2.06E-004	Polley, 1972
ALBANY/Cr	female	36	70	0.20930	2.73E-004	Polley, 1972
ALBANY/Cr	female	29	84	0.24130	1.93E-004	Polley, 1972
ALBANY/Cr	female	36	112	0.24680	1.33E-004	Polley, 1972
ALBANY/Cr	female	31	140	0.25740	7.27E-005	Polley, 1972
ALBANY/Cr	female	28	168	0.26420	6.32E-005	Polley, 1972
ALBANY/Cr	male	35	1	0.00720	9.00E-008	Polley, 1972
ALBANY/Cr	male	35	7	0.01910	1.41E-007	Polley, 1972
ALBANY/Cr	male	35	14	0.03270	2.25E-006	Polley, 1972
ALBANY/Cr	male	35	21	0.05530	2.05E-005	Polley, 1972
ALBANY/Cr	male	35	28	0.08160	5.04E-005	Polley, 1972
ALBANY/Cr	male	28	42	0.15800	8.88E-005	Polley, 1972
ALBANY/Cr	male	25	56	0.19680	1.43E-004	Polley, 1972
ALBANY/Cr	male	35	70	0.26950	3.14E-004	Polley, 1972
ALBANY/Cr	male	37	84	0.33200	1.89E-004	Polley, 1972
ALBANY/Cr	male	43	112	0.35980	1.29E-004	Polley, 1972
ALBANY/Cr	male	29	140	0.38570	1.08E-004	Polley, 1972
ALBANY/Cr	male	32	168	0.39690	7.61E-005	Polley, 1972
August 28807/Cr	female	34	1	0.00590	5.26E-007	Polley, 1972
August 28807/Cr	female	37	7	0.01250	6.38E-006	Polley, 1972
August 28807/Cr	female	43	14	0.02700	1.04E-005	Polley, 1972
August 28807/Cr	female	32	21	0.04040	2.86E-005	Polley, 1972
August 28807/Cr	female	31	28	0.06390	7.92E-005	Polley, 1972
August 28807/Cr	female	28	42	0.11200	9.65E-005	Polley, 1972
August 28807/Cr	female	28	56	0.12890	2.68E-005	Polley, 1972
August 28807/Cr	female	24	70	0.15120	1.07E-004	Polley, 1972
August 28807/Cr	female	26	84	0.16280	6.40E-005	Polley, 1972
August 28807/Cr	female	28	112	0.18800	5.85E-005	Polley, 1972
August 28807/Cr	female	24	140	0.19860	3.60E-005	Polley, 1972
August 28807/Cr	female	28	168	0.20680	6.05E-005	Polley, 1972
August 28807/Cr	female	25	196	0.22820	5.11E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
August 28807/Cr	male	35	1	0.00610	4.90E-007	Polley, 1972
August 28807/Cr	male	33	7	0.01380	4.52E-006	Polley, 1972
August 28807/Cr	male	32	14	0.02860	1.50E-005	Polley, 1972
August 28807/Cr	male	32	21	0.04260	2.92E-005	Polley, 1972
August 28807/Cr	male	25	28	0.06770	4.69E-005	Polley, 1972
August 28807/Cr	male	27	42	0.13260	1.19E-004	Polley, 1972
August 28807/Cr	male	28	56	0.19150	1.30E-004	Polley, 1972
August 28807/Cr	male	25	70	0.23650	2.89E-004	Polley, 1972
August 28807/Cr	male	24	84	0.26540	4.31E-004	Polley, 1972
August 28807/Cr	male	22	112	0.30040	2.66E-004	Polley, 1972
August 28807/Cr	male	27	140	0.32620	1.58E-004	Polley, 1972
August 28807/Cr	male	23	168	0.34010	2.19E-004	Polley, 1972
August 28807/Cr	male	25	196	0.36440	2.73E-005	Polley, 1972
Bald	female	8	30	0.05000	NS	Inazu et al., 1984
Bald	female	8	91	0.22000	NS	Inazu et al., 1984
Bald	female	8	183	0.26000	NS	Inazu et al., 1984
Bald	female	8	365	0.28000	NS	Inazu et al., 1984
Bald	male	8	30	0.06000	NS	Inazu et al., 1984
Bald	male	8	91	0.29000	NS	Inazu et al., 1984
Bald	male	8	183	0.31000	NS	Inazu et al., 1984
Bald	male	8	365	0.39000	NS	Inazu et al., 1984
BHE	female	27	50	0.16900	3.60E-005	NAS, 1971
BHE	female	38	100	0.24000	2.50E-005	NAS, 1971
BHE	female	45	300	0.31900	2.50E-005	NAS, 1971
BHE	male	29	50	0.23200	3.60E-005	NAS, 1971
BHE	male	37	100	0.36400	2.50E-005	NAS, 1971
BHE	male	45	300	0.49900	2.50E-005	NAS, 1971
Black	female	1	1	0.00400	NS	Worden, 1947
Black	female	1	3	0.00600	NS	Worden, 1947
Black	female	1	5	0.00800	NS	Worden, 1947
Black	female	1	7	0.00900	NS	Worden, 1947
Black	female	1	9	0.01100	NS	Worden, 1947
Black	female	1	11	0.01200	NS	Worden, 1947
Black	female	1	13	0.01300	NS	Worden, 1947
Black	female	1	15	0.01500	NS	Worden, 1947
Black	female	1	17	0.01700	NS	Worden, 1947
Black	female	1	19	0.02000	NS	Worden, 1947
Black	female	1	21	0.02300	NS	Worden, 1947
Black	female	1	23	0.02600	NS	Worden, 1947
Black	female	1	25	0.02800	NS	Worden, 1947
Black	female	1	27	0.03000	NS	Worden, 1947
Black	female	1	29	0.03100	NS	Worden, 1947

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Black	female	1	31	0.03300	NS	Worden, 1947
Black	female	1	33	0.03600	NS	Worden, 1947
Black	female	1	35	0.03700	NS	Worden, 1947
Black	female	1	65	0.10800	NS	Worden, 1947
Black	female	1	96	0.17000	NS	Worden, 1947
Black	female	1	126	0.19000	NS	Worden, 1947
Black	female	1	157	0.19600	NS	Worden, 1947
Black	female	1	188	0.19300	NS	Worden, 1947
Black	female	1	247	0.19300	NS	Worden, 1947
Black	female	1	308	0.19700	NS	Worden, 1947
Black	female	1	338	0.19700	NS	Worden, 1947
Black	female	1	369	0.19700	NS	Worden, 1947
Black	male	1	1	0.00500	NS	Worden, 1947
Black	male	1	3	0.00700	NS	Worden, 1947
Black	male	1	5	0.00900	NS	Worden, 1947
Black	male	1	7	0.01100	NS	Worden, 1947
Black	male	1	9	0.01400	NS	Worden, 1947
Black	male	1	11	0.01800	NS	Worden, 1947
Black	male	1	13	0.02000	NS	Worden, 1947
Black	male	1	15	0.02200	NS	Worden, 1947
Black	male	1	17	0.02300	NS	Worden, 1947
Black	male	1	19	0.02500	NS	Worden, 1947
Black	male	1	21	0.02600	NS	Worden, 1947
Black	male	1	23	0.02800	NS	Worden, 1947
Black	male	1	25	0.02900	NS	Worden, 1947
Black	male	1	27	0.03100	NS	Worden, 1947
Black	male	1	29	0.03300	NS	Worden, 1947
Black	male	1	31	0.03600	NS	Worden, 1947
Black	male	1	33	0.04000	NS	Worden, 1947
Black	male	1	65	0.12000	NS	Worden, 1947
Black	male	1	96	0.19000	NS	Worden, 1947
Black	male	1	126	0.20100	NS	Worden, 1947
Black	male	1	157	0.20800	NS	Worden, 1947
Black	male	1	188	0.20200	NS	Worden, 1947
Black	male	1	216	0.20000	NS	Worden, 1947
Black	male	1	247	0.20400	NS	Worden, 1947
Black	male	1	369	0.21100	NS	Worden, 1947
BN/Cr	female	29	1	0.00610	5.63E-007	Polley, 1972
BN/Cr	female	27	7	0.01280	6.25E-006	Polley, 1972
BN/Cr	female	26	14	0.02800	1.81E-005	Polley, 1972
BN/Cr	female	27	21	0.04370	3.16E-005	Polley, 1972
BN/Cr	female	45	28	0.06200	5.26E-005	Polley, 1972
BN/Cr	female	29	42	0.09680	5.81E-005	Polley, 1972
BN/Cr	female	34	56	0.12860	9.02E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
BN/Cr	female	29	70	0.15210	1.32E-004	Polley, 1972
BN/Cr	female	35	84	0.16730	6.81E-005	Polley, 1972
BN/Cr	female	25	112	0.17910	9.03E-005	Polley, 1972
BN/Cr	female	24	140	0.18760	1.38E-004	Polley, 1972
BN/Cr	female	24	168	0.20680	1.16E-004	Polley, 1972
BN/Cr	male	30	1	0.00620	5.63E-007	Polley, 1972
BN/Cr	male	29	7	0.01390	6.89E-006	Polley, 1972
BN/Cr	male	27	14	0.02900	2.14E-005	Polley, 1972
BN/Cr	male	25	21	0.04480	3.02E-005	Polley, 1972
BN/Cr	male	43	28	0.06730	1.16E-004	Polley, 1972
BN/Cr	male	29	42	0.12420	1.63E-004	Polley, 1972
BN/Cr	male	38	56	0.19340	1.35E-004	Polley, 1972
BN/Cr	male	34	70	0.24740	6.89E-004	Polley, 1972
BN/Cr	male	33	84	0.26440	5.18E-004	Polley, 1972
BN/Cr	male	26	112	0.30400	5.29E-004	Polley, 1972
BN/Cr	male	25	140	0.32170	2.10E-004	Polley, 1972
BN/Cr	male	25	168	0.34110	4.10E-004	Polley, 1972
BUFFALO/Cr	female	35	1	0.00550	1.56E-008	Polley, 1972
BUFFALO/Cr	female	35	7	0.01210	1.06E-007	Polley, 1972
BUFFALO/Cr	female	35	14	0.02240	5.88E-006	Polley, 1972
BUFFALO/Cr	female	35	21	0.02780	8.41E-006	Polley, 1972
BUFFALO/Cr	female	35	28	0.05940	6.12E-005	Polley, 1972
BUFFALO/Cr	female	29	42	0.11970	8.51E-005	Polley, 1972
BUFFALO/Cr	female	28	56	0.15200	1.51E-004	Polley, 1972
BUFFALO/Cr	female	36	70	0.17860	2.12E-004	Polley, 1972
BUFFALO/Cr	female	39	84	0.22690	1.54E-004	Polley, 1972
BUFFALO/Cr	female	38	112	0.23770	1.40E-004	Polley, 1972
BUFFALO/Cr	female	32	140	0.24640	1.61E-004	Polley, 1972
BUFFALO/Cr	female	35	168	0.25210	1.36E-004	Polley, 1972
BUFFALO/Cr	male	35	1	0.00640	1.56E-008	Polley, 1972
BUFFALO/Cr	male	35	7	0.01330	9.00E-008	Polley, 1972
BUFFALO/Cr	male	35	14	0.02620	3.61E-006	Polley, 1972
BUFFALO/Cr	male	35	21	0.04480	3.57E-005	Polley, 1972
BUFFALO/Cr	male	35	28	0.07430	6.89E-005	Polley, 1972
BUFFALO/Cr	male	24	42	0.13940	5.08E-005	Polley, 1972
BUFFALO/Cr	male	22	56	0.19170	1.54E-004	Polley, 1972
BUFFALO/Cr	male	30	70	0.25310	1.63E-004	Polley, 1972
BUFFALO/Cr	male	26	84	0.32890	4.30E-004	Polley, 1972
BUFFALO/Cr	male	31	112	0.33380	2.21E-004	Polley, 1972
BUFFALO/Cr	male	30	140	0.37440	3.62E-004	Polley, 1972
BUFFALO/Cr	male	30	168	0.38860	2.72E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Copenhagen/Cr	female	25	1	0.00570	5.62E-009	Polley, 1972
Copenhagen/Cr	female	25	7	0.01290	8.56E-007	Polley, 1972
Copenhagen/Cr	female	25	14	0.02440	6.81E-007	Polley, 1972
Copenhagen/Cr	female	25	21	0.02660	4.52E-006	Polley, 1972
Copenhagen/Cr	female	25	28	0.04850	2.48E-005	Polley, 1972
Copenhagen/Cr	female	25	42	0.09450	1.06E-004	Polley, 1972
Copenhagen/Cr	female	26	56	0.15940	8.60E-005	Polley, 1972
Copenhagen/Cr	female	27	70	0.17890	5.08E-005	Polley, 1972
Copenhagen/Cr	female	28	84	0.18570	4.94E-005	Polley, 1972
Copenhagen/Cr	female	25	112	0.19980	7.48E-005	Polley, 1972
Copenhagen/Cr	female	24	140	0.22660	1.62E-004	Polley, 1972
Copenhagen/Cr	female	26	168	0.23330	9.26E-005	Polley, 1972
Copenhagen/Cr	male	25	1	0.00580	5.62E-009	Polley, 1972
Copenhagen/Cr	male	25	7	0.01410	1.05E-006	Polley, 1972
Copenhagen/Cr	male	25	14	0.02720	1.38E-006	Polley, 1972
Copenhagen/Cr	male	25	21	0.03070	3.52E-006	Polley, 1972
Copenhagen/Cr	male	25	28	0.05500	1.14E-005	Polley, 1972
Copenhagen/Cr	male	25	42	0.10470	8.10E-005	Polley, 1972
Copenhagen/Cr	male	24	56	0.20380	1.70E-004	Polley, 1972
Copenhagen/Cr	male	25	70	0.24000	1.40E-004	Polley, 1972
Copenhagen/Cr	male	26	84	0.26960	2.14E-005	Polley, 1972
Copenhagen/Cr	male	27	112	0.28300	1.18E-004	Polley, 1972
Copenhagen/Cr	male	31	140	0.31000	1.36E-004	Polley, 1972
Copenhagen/Cr	male	26	168	0.33460	7.01E-005	Polley, 1972
Cpb:WU	male	1	365	0.62800	NS	Haas et al., 1985
Cpb:WU	male	1	456	0.65600	NS	Haas et al., 1985
Cpb:WU	male	1	456	0.65600	NS	Haas et al., 1985
Cr:MGAPS(OM)	female	21	1	0.00580	2.76E-007	Polley, 1972
Cr:MGAPS(OM)	female	21	7	0.01090	1.56E-006	Polley, 1972
Cr:MGAPS(OM)	female	21	14	0.03320	1.23E-005	Polley, 1972
Cr:MGAPS(OM)	female	21	21	0.04840	3.75E-005	Polley, 1972
Cr:MGAPS(OM)	female	21	28	0.06390	4.26E-005	Polley, 1972
Cr:MGAPS(OM)	female	20	42	0.11370	2.63E-005	Polley, 1972
Cr:MGAPS(OM)	female	20	56	0.17520	2.72E-004	Polley, 1972
Cr:MGAPS(OM)	female	20	70	0.21550	5.12E-004	Polley, 1972
Cr:MGAPS(OM)	female	20	84	0.25800	4.36E-004	Polley, 1972
Cr:MGAPS(OM)	female	20	112	0.28380	3.95E-004	Polley, 1972
Cr:MGAPS(OM)	female	20	140	0.29910	3.85E-004	Polley, 1972
Cr:MGAPS(OM)	male	21	1	0.00610	4.22E-007	Polley, 1972
Cr:MGAPS(OM)	male	21	7	0.01160	1.56E-006	Polley, 1972
Cr:MGAPS(OM)	male	21	14	0.03540	1.41E-005	Polley, 1972
Cr:MGAPS(OM)	male	21	21	0.05510	9.00E-006	Polley, 1972
Cr:MGAPS(OM)	male	21	28	0.07910	7.23E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Cr:MGAPS(OM)	male	20	42	0.14350	5.44E-005	Polley, 1972
Cr:MGAPS(OM)	male	20	56	0.23670	5.01E-004	Polley, 1972
Cr:MGAPS(OM)	male	20	70	0.28120	4.10E-004	Polley, 1972
Cr:MGAPS(OM)	male	20	84	0.32740	4.36E-004	Polley, 1972
Cr:MGAPS(OM)	male	20	112	0.39280	7.16E-004	Polley, 1972
Cr:MGAPS(OM)	male	20	140	0.46190	1.14E-003	Polley, 1972
Cr:RAR(SD)	female	49	1	0.00650	2.26E-007	Polley, 1972
Cr:RAR(SD)	female	51	7	0.01600	1.09E-005	Polley, 1972
Cr:RAR(SD)	female	46	14	0.04080	2.03E-005	Polley, 1972
Cr:RAR(SD)	female	43	21	0.05560	2.03E-005	Polley, 1972
Cr:RAR(SD)	female	44	28	0.09490	2.18E-004	Polley, 1972
Cr:RAR(SD)	female	49	42	0.15340	3.42E-005	Polley, 1972
Cr:RAR(SD)	female	54	56	0.20200	1.94E-005	Polley, 1972
Cr:RAR(SD)	female	47	70	0.23910	1.46E-004	Polley, 1972
Cr:RAR(SD)	female	57	84	0.24660	1.68E-004	Polley, 1972
Cr:RAR(SD)	female	38	112	0.25990	1.28E-004	Polley, 1972
Cr:RAR(SD)	female	42	140	0.28120	1.03E-004	Polley, 1972
Cr:RAR(SD)	female	40	168	0.28840	4.36E-005	Polley, 1972
Cr:RAR(SD)	female	33	196	0.29180	4.16E-005	Polley, 1972
Cr:RAR(SD)	male	54	1	0.00670	2.50E-007	Polley, 1972
Cr:RAR(SD)	male	46	7	0.01820	2.81E-006	Polley, 1972
Cr:RAR(SD)	male	56	14	0.04300	5.81E-005	Polley, 1972
Cr:RAR(SD)	male	47	21	0.05940	7.98E-006	Polley, 1972
Cr:RAR(SD)	male	47	28	0.09890	1.13E-004	Polley, 1972
Cr:RAR(SD)	male	55	42	0.16230	3.00E-004	Polley, 1972
Cr:RAR(SD)	male	48	56	0.23570	1.78E-004	Polley, 1972
Cr:RAR(SD)	male	41	70	0.29270	2.32E-004	Polley, 1972
Cr:RAR(SD)	male	53	84	0.35870	2.88E-004	Polley, 1972
Cr:RAR(SD)	male	49	112	0.38800	3.48E-004	Polley, 1972
Cr:RAR(SD)	male	37	140	0.43940	1.91E-004	Polley, 1972
Cr:RAR(SD)	male	45	168	0.45200	1.31E-004	Polley, 1972
Cr:RAR(SD)	male	31	196	0.49120	2.07E-004	Polley, 1972
Fischer F344	female	3167	42	0.07500	NS	Cameron et al., 1985
Fischer F344	female	3167	56	0.10000	NS	Cameron et al., 1985
Fischer F344	female	3167	70	0.12000	NS	Cameron et al., 1985
Fischer F344	female	3167	77	0.14500	NS	Cameron et al., 1985
Fischer F344	female	3167	91	0.16500	NS	Cameron et al., 1985
Fischer F344	female	3167	119	0.18500	NS	Cameron et al., 1985
Fischer F344	female	3167	147	0.19000	NS	Cameron et al., 1985
Fischer F344	female	3167	217	0.21500	NS	Cameron et al., 1985
Fischer F344	female	3167	315	0.22500	NS	Cameron et al., 1985
Fischer F344	female	3167	567	0.28000	NS	Cameron et al., 1985
Fischer F344	female	3167	770	0.30500	NS	Cameron et al., 1985

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Fischer F344	female	3167	770	0.30500	NS	Cameron et al., 1985
Fischer F344	female	3167	770	0.30500	NS	Cameron et al., 1985
Fischer F344	female	20	77	0.14610	NS	Dorato et al., 1983
Fischer F344	female	19	91	0.15790	2.02E-004	Dorato et al., 1983
Fischer F344	female	19	112	0.16670	NS	Dorato et al., 1983
Fischer F344	female	19	161	0.18000	NS	Dorato et al., 1983
Fischer F344	female	19	196	0.19080	NS	Dorato et al., 1983
Fischer F344	female	19	238	0.19400	NS	Dorato et al., 1983
Fischer F344	female	19	280	0.20140	NS	Dorato et al., 1983
Fischer F344	female	19	322	0.20690	NS	Dorato et al., 1983
Fischer F344	female	120	102	0.16695	2.33E-006	Morrissey and Norred, 1984
Fischer F344	female	NS	28	0.04400	NS	NAS, 1978
Fischer F344	female	NS	35	0.06500	NS	NAS, 1978
Fischer F344	female	NS	56	0.12300	NS	NAS, 1978
Fischer F344	female	NS	70	0.14500	NS	NAS, 1978
Fischer F344	female	NS	84	0.16200	NS	NAS, 1978
Fischer F344	female	529	49	0.12000	NS	Solleveld et al., 1984
Fischer F344	female	529	119	0.18000	NS	Solleveld et al., 1984
Fischer F344	female	529	189	0.20500	NS	Solleveld et al., 1984
Fischer F344	female	529	259	0.21000	NS	Solleveld et al., 1984
Fischer F344	female	529	329	0.23500	NS	Solleveld et al., 1984
Fischer F344	female	529	399	0.26500	NS	Solleveld et al., 1984
Fischer F344	female	529	469	0.28000	NS	Solleveld et al., 1984
Fischer F344	female	529	539	0.31000	NS	Solleveld et al., 1984
Fischer F344	female	529	609	0.32500	NS	Solleveld et al., 1984
Fischer F344	female	529	679	0.33000	NS	Solleveld et al., 1984
Fischer F344	female	529	749	0.33000	NS	Solleveld et al., 1984
Fischer F344	female	529	819	0.32500	NS	Solleveld et al., 1984
Fischer F344	female	529	889	0.32000	NS	Solleveld et al., 1984
Fischer F344	female	529	959	0.31000	NS	Solleveld et al., 1984
Fischer F344	female	529	1029	0.28500	NS	Solleveld et al., 1984
Fischer F344	male	3225	42	0.07500	NS	Cameron et al., 1985
Fischer F344	male	3225	56	0.12500	NS	Cameron et al., 1985
Fischer F344	male	3225	77	0.18000	NS	Cameron et al., 1985
Fischer F344	male	3225	91	0.23000	NS	Cameron et al., 1985
Fischer F344	male	3225	112	0.26000	NS	Cameron et al., 1985
Fischer F344	male	3225	133	0.29000	NS	Cameron et al., 1985
Fischer F344	male	3225	140	0.31000	NS	Cameron et al., 1985
Fischer F344	male	3225	147	0.32500	NS	Cameron et al., 1985
Fischer F344	male	3225	217	0.35500	NS	Cameron et al., 1985
Fischer F344	male	3225	259	0.38000	NS	Cameron et al., 1985
Fischer F344	male	3225	343	0.41000	NS	Cameron et al., 1985
Fischer F344	male	3225	427	0.41500	NS	Cameron et al., 1985
Fischer F344	male	3225	525	0.42000	NS	Cameron et al., 1985
Fischer F344	male	3225	602	0.42000	NS	Cameron et al., 1985

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Fischer F344	male	3225	693	0.42500	NS	Cameron et al., 1985
Fischer F344	male	3225	770	0.41000	NS	Cameron et al., 1985
Fischer F344	male	20	77	0.21840	NS	Dorato et al., 1983
Fischer F344	male	20	91	0.24850	NS	Dorato et al., 1983
Fischer F344	male	20	112	0.27980	NS	Dorato et al., 1983
Fischer F344	male	20	161	0.31780	NS	Dorato et al., 1983
Fischer F344	male	20	196	0.34280	NS	Dorato et al., 1983
Fischer F344	male	20	238	0.36630	NS	Dorato et al., 1983
Fischer F344	male	20	280	0.38880	NS	Dorato et al., 1983
Fischer F344	male	20	322	0.40950	NS	Dorato et al., 1983
Fischer F344	male	NS	28	0.05300	NS	NAS, 1978
Fischer F344	male	NS	35	0.08000	NS	NAS, 1978
Fischer F344	male	NS	56	0.16000	NS	NAS, 1978
Fischer F344	male	NS	70	0.21300	NS	NAS, 1978
Fischer F344	male	NS	84	0.25600	NS	NAS, 1978
Fischer F344	male	529	49	0.13000	NS	Solleveld et al., 1984
Fischer F344	male	529	119	0.31000	NS	Solleveld et al., 1984
Fischer F344	male	529	189	0.35500	NS	Solleveld et al., 1984
Fischer F344	male	529	259	0.38500	NS	Solleveld et al., 1984
Fischer F344	male	529	329	0.42000	NS	Solleveld et al., 1984
Fischer F344	male	529	399	0.42500	NS	Solleveld et al., 1984
Fischer F344	male	529	469	0.46000	NS	Solleveld et al., 1984
Fischer F344	male	529	539	0.47000	NS	Solleveld et al., 1984
Fischer F344	male	529	609	0.46000	NS	Solleveld et al., 1984
Fischer F344	male	529	679	0.46800	NS	Solleveld et al., 1984
Fischer F344	male	529	749	0.43500	NS	Solleveld et al., 1984
Fischer F344	male	529	819	0.42500	NS	Solleveld et al., 1984
Fischer F344	male	529	889	0.39000	NS	Solleveld et al., 1984
Fischer F344	male	529	959	0.34500	NS	Solleveld et al., 1984
Fischer F344	male	10	32	0.07200	1.94E-005	Tillerey and Lehnert, 1986
Fischer F344	male	10	37	0.09570	1.23E-005	Tillerey and Lehnert, 1986
Fischer F344	male	10	55	0.16760	3.48E-005	Tillerey and Lehnert, 1986
Fischer F344	male	10	59	0.16810	1.68E-005	Tillerey and Lehnert, 1986
Fischer F344	male	10	74	0.20160	2.30E-005	Tillerey and Lehnert, 1986
Fischer F344	male	20	98	0.27170	2.13E-004	Tillerey and Lehnert, 1986
Fischer F344	male	10	126	0.30450	2.10E-004	Tillerey and Lehnert, 1986
Fischer F344	male	20	135	0.30310	1.37E-004	Tillerey and Lehnert, 1986
Fischer 334/Cr	female	68	1	0.00550	3.31E-007	Polley, 1972
Fischer 334/Cr	female	45	7	0.01130	1.10E-006	Polley, 1972
Fischer 334/Cr	female	45	14	0.02010	4.52E-006	Polley, 1972
Fischer 334/Cr	female	61	21	0.02990	1.70E-005	Polley, 1972
Fischer 334/Cr	female	58	28	0.04770	1.64E-005	Polley, 1972
Fischer 334/Cr	female	60	42	0.08630	1.47E-004	Polley, 1972
Fischer 334/Cr	female	58	56	0.12550	1.63E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Fischer 334/Cr	female	46	70	0.14830	2.05E-004	Polley, 1972
Fischer 334/Cr	female	42	84	0.15310	2.48E-004	Polley, 1972
Fischer 334/Cr	female	66	112	0.18050	8.10E-005	Polley, 1972
Fischer 334/Cr	female	54	140	0.21500	3.60E-005	Polley, 1972
Fischer 334/Cr	female	54	168	0.21890	7.66E-005	Polley, 1972
Fischer 334/Cr	male	75	1	0.00590	1.27E-006	Polley, 1972
Fischer 334/Cr	male	48	7	0.01200	1.00E-006	Polley, 1972
Fischer 334/Cr	male	38	14	0.02630	1.23E-005	Polley, 1972
Fischer 334/Cr	male	52	21	0.03070	1.41E-005	Polley, 1972
Fischer 334/Cr	male	49	28	0.05420	4.90E-005	Polley, 1972
Fischer 334/Cr	male	48	42	0.10510	1.17E-004	Polley, 1972
Fischer 334/Cr	male	66	56	0.18110	1.82E-004	Polley, 1972
Fischer 334/Cr	male	56	70	0.24450	5.64E-004	Polley, 1972
Fischer 334/Cr	male	46	84	0.20590	1.91E-004	Polley, 1972
Fischer 334/Cr	male	66	112	0.30420	4.90E-005	Polley, 1972
Fischer 334/Cr	male	53	140	0.31300	9.03E-005	Polley, 1972
Fischer 334/Cr	male	56	168	0.33540	2.89E-004	Polley, 1972
F334/Crl Lov	female	10	91	0.14500	7.29E-004	Mauderly, 1986
F334/Crl Lov	female	10	183	0.19900	2.56E-004	Mauderly, 1986
F334/Crl Lov	female	10	365	0.21900	3.24E-004	Mauderly, 1986
F334/Crl Lov	female	10	730	0.25500	6.25E-004	Mauderly, 1986
F334/Crl Lov	male	10	91	0.29100	3.61E-004	Mauderly, 1986
F334/Crl Lov	male	10	183	0.33600	1.23E-003	Mauderly, 1986
F334/Crl Lov	male	10	365	0.36800	4.84E-004	Mauderly, 1986
F334/Crl Lov	male	10	730	0.40700	7.84E-004	Mauderly, 1986
F334/Crl Lov	both	20	91	0.18200	2.12E-003	Mauderly, 1986
F334/Crl Lov	both	20	183	0.26700	5.18E-003	Mauderly, 1986
F334/Crl Lov	both	20	365	0.29300	5.93E-003	Mauderly, 1986
F334/Crl Lov	both	20	730	0.33100	6.56E-003	Mauderly, 1986
Holtzman	female	11	200	0.22400	1.76E-005	Harriman, 1969b
Holtzman	female	11	200	0.22400	1.76E-005	Harriman, 1969b
Long-Evans	female	24	1	0.00610	5.26E-007	Polley, 1972
Long-Evans	female	24	7	0.01370	6.89E-006	Polley, 1972
Long-Evans	female	24	14	0.02860	7.29E-006	Polley, 1972
Long-Evans	female	24	21	0.03830	4.62E-005	Polley, 1972
Long-Evans	female	24	28	0.06140	6.05E-005	Polley, 1972
Long-Evans	female	24	42	0.12690	8.56E-006	Polley, 1972
Long-Evans	female	24	56	0.16870	1.76E-004	Polley, 1972
Long-Evans	female	24	70	0.20050	5.43E-004	Polley, 1972
Long-Evans	female	24	84	0.23820	1.80E-004	Polley, 1972
Long-Evans	female	24	112	0.25280	3.54E-004	Polley, 1972
Long-Evans	female	24	140	0.26260	3.19E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Long-Evans	male	54	182	0.41000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	304	0.45000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	335	0.47500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	365	0.50000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	395	0.51000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	426	0.51500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	456	0.53000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	487	0.54000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	517	0.55000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	548	0.54500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	578	0.56000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	608	0.57500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	639	0.57500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	669	0.58000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	700	0.58500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	730	0.59000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	760	0.59000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	791	0.59500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	821	0.60000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	852	0.59000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	882	0.57500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	913	0.55000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	943	0.53500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	973	0.53500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1004	0.49500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1034	0.52000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1065	0.51000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1095	0.48500	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1125	0.50000	NS	Holloszy and Smith, 1986
Long-Evans	male	54	1156	0.48000	NS	Holloszy and Smith, 1986
Long-Evans	male	24	1	0.00660	6.01E-007	Polley, 1972
Long-Evans	male	24	7	0.01470	4.84E-006	Polley, 1972
Long-Evans	male	24	14	0.03140	1.62E-005	Polley, 1972
Long-Evans	male	24	21	0.04000	5.15E-005	Polley, 1972
Long-Evans	male	24	28	0.07240	5.04E-005	Polley, 1972
Long-Evans	male	24	42	0.15190	8.02E-003	Polley, 1972
Long-Evans	male	24	56	0.23040	4.19E-004	Polley, 1972
Long-Evans	male	24	70	0.29670	4.85E-004	Polley, 1972
Long-Evans	male	24	84	0.33660	2.58E-004	Polley, 1972
Long-Evans	male	24	112	0.36210	3.07E-004	Polley, 1972
Long-Evans	male	24	140	0.38430	3.53E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Marshall 520/Cr	female	30	1	0.00590	6.81E-007	Polley, 1972
Marshall 520/Cr	female	26	7	0.01430	3.42E-006	Polley, 1972
Marshall 520/Cr	female	28	14	0.02370	1.24E-005	Polley, 1972
Marshall 520/Cr	female	27	21	0.03280	1.21E-005	Polley, 1972
Marshall 520/Cr	female	34	28	0.05470	9.00E-006	Polley, 1972
Marshall 520/Cr	female	26	42	0.11510	2.35E-005	Polley, 1972
Marshall 520/Cr	female	26	56	0.12460	5.48E-005	Polley, 1972
Marshall 520/Cr	female	24	70	0.15480	7.88E-005	Polley, 1972
Marshall 520/Cr	female	27	84	0.16680	1.02E-004	Polley, 1972
Marshall 520/Cr	female	25	112	0.20980	1.43E-004	Polley, 1972
Marshall 520/Cr	female	24	140	0.23150	2.05E-004	Polley, 1972
Marshall 520/Cr	female	26	168	0.25460	1.11E-004	Polley, 1972
Marshall 520/Cr	male	28	1	0.00600	5.63E-007	Polley, 1972
Marshall 520/Cr	male	26	7	0.01630	4.20E-006	Polley, 1972
Marshall 520/Cr	male	28	14	0.02600	1.14E-005	Polley, 1972
Marshall 520/Cr	male	31	21	0.04070	2.50E-005	Polley, 1972
Marshall 520/Cr	male	21	28	0.06190	5.06E-006	Polley, 1972
Marshall 520/Cr	male	26	42	0.13350	4.62E-005	Polley, 1972
Marshall 520/Cr	male	26	56	0.19230	3.12E-004	Polley, 1972
Marshall 520/Cr	male	25	70	0.24600	2.10E-004	Polley, 1972
Marshall 520/Cr	male	24	84	0.29560	2.88E-004	Polley, 1972
Marshall 520/Cr	male	25	112	0.33030	4.32E-004	Polley, 1972
Marshall 520/Cr	male	27	140	0.36990	5.03E-004	Polley, 1972
Marshall 520/Cr	male	23	168	0.37880	3.76E-004	Polley, 1972
NBR/P1Cr	female	25	1	0.00580	1.00E-008	Polley, 1972
NBR/P1Cr	female	25	7	0.01240	1.00E-008	Polley, 1972
NBR/P1Cr	female	25	14	0.02360	1.23E-007	Polley, 1972
NBR/P1Cr	female	25	21	0.02750	2.26E-007	Polley, 1972
NBR/P1Cr	female	25	28	0.04490	1.28E-005	Polley, 1972
NBR/P1Cr	female	25	42	0.09360	8.98E-005	Polley, 1972
NBR/P1Cr	female	25	56	0.14960	7.70E-006	Polley, 1972
NBR/P1Cr	female	25	70	0.16090	5.40E-005	Polley, 1972
NBR/P1Cr	female	25	84	0.17230	3.14E-005	Polley, 1972
NBR/P1Cr	female	25	112	0.19410	2.21E-005	Polley, 1972
NBR/P1Cr	female	25	140	0.20280	2.48E-005	Polley, 1972
NBR/P1Cr	female	25	168	0.22660	2.97E-005	Polley, 1972
NBR/P1Cr	male	25	1	0.00580	2.50E-009	Polley, 1972
NBR/P1Cr	male	25	7	0.01310	7.56E-008	Polley, 1972
NBR/P1Cr	male	25	14	0.02520	3.91E-007	Polley, 1972
NBR/P1Cr	male	25	21	0.02830	1.76E-006	Polley, 1972
NBR/P1Cr	male	25	28	0.04620	1.54E-005	Polley, 1972
NBR/P1Cr	male	25	42	0.10180	5.08E-005	Polley, 1972
NBR/P1Cr	male	25	56	0.19520	6.68E-005	Polley, 1972
NBR/P1Cr	male	25	70	0.22060	1.58E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
NBR/PlCr	male	25	84	0.24890	4.03E-005	Polley, 1972
NBR/PlCr	male	25	112	0.27910	4.52E-005	Polley, 1972
NBR/PlCr	male	25	140	0.29130	6.89E-005	Polley, 1972
NBR/PlCr	male	25	168	0.31550	4.52E-005	Polley, 1972
NS	male	NS	21	0.03138	NS	Rios et al., 1986a
NS	male	NS	42	0.10157	NS	Rios et al., 1986a
NS	male	NS	63	0.18182	NS	Rios et al., 1986a
NS	male	35	91	0.23770	8.76E-004	Rios et al., 1986b
NS	male	31	91	0.24980	8.70E-004	Rios et al., 1986b
NS	NS	8	11	0.02400	2.12E-003	Fisher and Mortola, 1981
NS	NS	6	4	0.01400	4.00E-006	Mortola, 1983
NS	NS	4	2	0.00720	1.00E-008	Mortola, 1984
Osborne-Mendel	female	24	1	0.00640	3.03E-007	Polley, 1972
Osborne-Mendel	female	24	7	0.01590	4.95E-006	Polley, 1972
Osborne-Mendel	female	24	14	0.04960	4.95E-006	Polley, 1972
Osborne-Mendel	female	24	21	0.05200	5.64E-006	Polley, 1972
Osborne-Mendel	female	24	28	0.08790	6.12E-005	Polley, 1972
Osborne-Mendel	female	26	42	0.13950	1.81E-005	Polley, 1972
Osborne-Mendel	female	31	56	0.18920	2.18E-004	Polley, 1972
Osborne-Mendel	female	26	70	0.23560	2.21E-004	Polley, 1972
Osborne-Mendel	female	32	84	0.25910	9.22E-005	Polley, 1972
Osborne-Mendel	female	27	112	0.27440	2.14E-004	Polley, 1972
Osborne-Mendel	female	26	140	0.29450	8.79E-005	Polley, 1972
Osborne-Mendel	female	25	168	0.30170	4.22E-005	Polley, 1972
Osborne-Mendel	female	31	196	0.30540	6.44E-005	Polley, 1972
Osborne-Mendel	male	24	1	0.00640	2.50E-007	Polley, 1972
Osborne-Mendel	male	24	7	0.01730	2.56E-006	Polley, 1972
Osborne-Mendel	male	24	14	0.05170	2.72E-006	Polley, 1972
Osborne-Mendel	male	24	21	0.05300	6.13E-006	Polley, 1972
Osborne-Mendel	male	24	28	0.09430	5.81E-005	Polley, 1972
Osborne-Mendel	male	27	42	0.15360	1.41E-004	Polley, 1972
Osborne-Mendel	male	24	56	0.22970	5.05E-004	Polley, 1972
Osborne-Mendel	male	25	70	0.29550	4.55E-004	Polley, 1972
Osborne-Mendel	male	26	84	0.37290	2.62E-004	Polley, 1972
Osborne-Mendel	male	28	112	0.39930	5.76E-004	Polley, 1972
Osborne-Mendel	male	26	140	0.45130	2.18E-004	Polley, 1972
Osborne-Mendel	male	31	168	0.47680	1.29E-004	Polley, 1972
Osborne-Mendel	male	24	196	0.50350	1.16E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
SH/Cr	female	41	1	0.00550	4.90E-007	Polley, 1972
SH/Cr	female	41	7	0.01130	4.00E-006	Polley, 1972
SH/Cr	female	48	14	0.01730	8.85E-006	Polley, 1972
SH/Cr	female	41	21	0.04000	3.00E-005	Polley, 1972
SH/Cr	female	46	28	0.07200	3.08E-005	Polley, 1972
SH/Cr	female	44	42	0.11000	1.48E-004	Polley, 1972
SH/Cr	female	45	56	0.13800	9.41E-005	Polley, 1972
SH/Cr	female	51	70	0.15740	1.16E-004	Polley, 1972
SH/Cr	female	57	84	0.17360	1.39E-004	Polley, 1972
SH/Cr	female	48	112	0.18220	1.95E-004	Polley, 1972
SH/Cr	male	42	1	0.00620	3.31E-007	Polley, 1972
SH/Cr	male	45	7	0.01390	6.76E-006	Polley, 1972
SH/Cr	male	46	14	0.02170	1.63E-006	Polley, 1972
SH/Cr	male	47	21	0.04240	2.89E-005	Polley, 1972
SH/Cr	male	38	28	0.07710	5.08E-005	Polley, 1972
SH/Cr	male	47	42	0.12550	1.80E-004	Polley, 1972
SH/Cr	male	47	56	0.18550	1.23E-004	Polley, 1972
SH/Cr	male	46	70	0.23980	2.12E-004	Polley, 1972
SH/Cr	male	55	84	0.26250	3.07E-004	Polley, 1972
SH/Cr	male	50	112	0.29340	3.23E-004	Polley, 1972
Sprague-Dawley	female	NS	21	0.04400	NS	NAS, 1978
Sprague-Dawley	female	NS	28	0.06400	NS	NAS, 1978
Sprague-Dawley	female	NS	35	0.10000	NS	NAS, 1978
Sprague-Dawley	female	NS	56	0.18500	NS	NAS, 1978
Sprague-Dawley	female	NS	70	0.21000	NS	NAS, 1978
Sprague-Dawley	female	NS	84	0.23000	NS	NAS, 1978
Sprague-Dawley	female	21	21	0.05500	NS	Pond et al., 1985
Sprague-Dawley	female	21	49	0.17500	NS	Pond et al., 1985
Sprague-Dawley	female	21	77	0.22500	NS	Pond et al., 1985
Sprague-Dawley	female	21	105	0.25000	NS	Pond et al., 1985
Sprague-Dawley	female	21	126	0.27500	NS	Pond et al., 1985
Sprague-Dawley	female	21	147	0.29000	NS	Pond et al., 1985
Sprague-Dawley	male	NS	21	0.04600	NS	NAS, 1978
Sprague-Dawley	male	NS	28	0.07500	NS	NAS, 1978
Sprague-Dawley	male	NS	35	0.12000	NS	NAS, 1978
Sprague-Dawley	male	NS	56	0.23600	NS	NAS, 1978
Sprague-Dawley	male	NS	70	0.30200	NS	NAS, 1978
Sprague-Dawley	male	NS	84	0.36500	NS	NAS, 1978
Sprague-Dawley	male	21	21	0.05500	NS	Pond et al., 1985
Sprague-Dawley	male	21	49	0.21600	NS	Pond et al., 1985
Sprague-Dawley	male	21	77	0.31000	NS	Pond et al., 1985
Sprague-Dawley	male	21	105	0.40000	NS	Pond et al., 1985
Sprague-Dawley	male	21	126	0.42500	NS	Pond et al., 1985
Sprague-Dawley	male	21	147	0.46000	NS	Pond et al., 1985

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Sprague-Dawley/MCr	female	26	1	0.00630	3.03E-007	Polley, 1972
Sprague-Dawley/MCr	female	27	7	0.01640	7.56E-006	Polley, 1972
Sprague-Dawley/MCr	female	22	14	0.05200	4.73E-006	Polley, 1972
Sprague-Dawley/MCr	female	25	21	0.05560	1.56E-006	Polley, 1972
Sprague-Dawley/MCr	female	20	28	0.09530	6.81E-005	Polley, 1972
Sprague-Dawley/MCr	female	24	42	0.15530	2.26E-005	Polley, 1972
Sprague-Dawley/MCr	female	28	56	0.19010	8.28E-005	Polley, 1972
Sprague-Dawley/MCr	female	28	70	0.23670	2.57E-004	Polley, 1972
Sprague-Dawley/MCr	female	20	84	0.24460	7.06E-005	Polley, 1972
Sprague-Dawley/MCr	female	20	112	0.25900	5.29E-005	Polley, 1972
Sprague-Dawley/MCr	female	20	140	0.28030	9.70E-005	Polley, 1972
Sprague-Dawley/MCr	female	20	168	0.28680	7.70E-005	Polley, 1972
Sprague-Dawley/MCr	female	20	196	0.28950	3.66E-005	Polley, 1972
Sprague-Dawley/MCr	male	20	1	0.00670	2.50E-007	Polley, 1972
Sprague-Dawley/MCr	male	21	7	0.01800	3.52E-006	Polley, 1972
Sprague-Dawley/MCr	male	28	14	0.05300	1.00E-006	Polley, 1972
Sprague-Dawley/MCr	male	26	21	0.05700	1.89E-006	Polley, 1972
Sprague-Dawley/MCr	male	23	28	0.09850	7.92E-005	Polley, 1972
Sprague-Dawley/MCr	male	26	42	0.16680	3.20E-004	Polley, 1972
Sprague-Dawley/MCr	male	22	56	0.23260	2.64E-004	Polley, 1972
Sprague-Dawley/MCr	male	24	70	0.29650	2.44E-004	Polley, 1972
Sprague-Dawley/MCr	male	22	84	0.36860	3.60E-004	Polley, 1972
Sprague-Dawley/MCr	male	20	112	0.38490	4.70E-004	Polley, 1972
Sprague-Dawley/MCr	male	20	140	0.44030	3.19E-004	Polley, 1972
Sprague-Dawley/MCr	male	20	168	0.45110	1.11E-004	Polley, 1972
Sprague-Dawley/MCr	male	20	196	0.51570	1.25E-004	Polley, 1972
Sprague-Dawley Spartan	female	80	46	0.20000	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	76	0.26500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	106	0.28500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	136	0.31000	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	226	0.32500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	316	0.35000	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	406	0.35000	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	586	0.38500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	766	0.44500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	766	0.44500	NS	Pond et al., 1985
Sprague-Dawley Spartan	female	80	766	0.44500	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	106	0.45000	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	136	0.47500	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	226	0.53500	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	316	0.58000	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	406	0.60000	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	586	0.61500	NS	Pond et al., 1985
Sprague-Dawley Spartan	male	80	766	0.56500	NS	Pond et al., 1985

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Sprague-Dawley Spartan	male	80	46	0.25000	NS	Quast et al., 1983
Sprague-Dawley Spartan	male	80	46	0.25000	NS	Quast et al., 1983
Sprague-Dawley Spartan	male	80	76	0.40000	NS	Quast et al., 1983
Sprague-Dawley 1951	female	103	1	0.00550	4.56E-007	Polley, 1972
Sprague-Dawley 1951	female	100	7	0.01260	1.44E-006	Polley, 1972
Sprague-Dawley 1951	female	91	14	0.02250	1.46E-005	Polley, 1972
Sprague-Dawley 1951	female	79	21	0.03510	2.03E-005	Polley, 1972
Sprague-Dawley 1951	female	100	28	0.04810	4.56E-005	Polley, 1972
Sprague-Dawley 1951	female	100	42	0.09250	6.01E-005	Polley, 1972
Sprague-Dawley 1951	female	91	56	0.11520	1.72E-004	Polley, 1972
Sprague-Dawley 1951	female	45	70	0.16220	1.76E-004	Polley, 1972
Sprague-Dawley 1951	female	69	84	0.17640	3.06E-004	Polley, 1972
Sprague-Dawley 1951	female	40	112	0.19850	3.91E-005	Polley, 1972
Sprague-Dawley 1951	female	35	140	0.21610	3.02E-005	Polley, 1972
Sprague-Dawley 1951	female	53	168	0.23000	9.03E-005	Polley, 1972
Sprague-Dawley 1951	male	100	1	0.00600	8.56E-007	Polley, 1972
Sprague-Dawley 1951	male	95	7	0.01300	1.89E-006	Polley, 1972
Sprague-Dawley 1951	male	83	14	0.02460	1.70E-005	Polley, 1972
Sprague-Dawley 1951	male	95	21	0.03740	7.56E-006	Polley, 1972
Sprague-Dawley 1951	male	100	28	0.04980	4.06E-005	Polley, 1972
Sprague-Dawley 1951	male	100	42	0.09760	6.68E-005	Polley, 1972
Sprague-Dawley 1951	male	87	56	0.15280	2.03E-004	Polley, 1972
Sprague-Dawley 1951	male	66	70	0.20540	5.52E-004	Polley, 1972
Sprague-Dawley 1951	male	58	84	0.23990	4.33E-004	Polley, 1972
Sprague-Dawley 1951	male	40	112	0.28750	9.75E-005	Polley, 1972
Sprague-Dawley 1951	male	33	140	0.31820	7.88E-005	Polley, 1972
Sprague-Dawley 1951	male	41	168	0.32360	3.13E-004	Polley, 1972
S5B/PlCr	female	29	1	0.00590	7.66E-007	Polley, 1972
S5B/PlCr	female	21	7	0.01390	5.06E-006	Polley, 1972
S5B/PlCr	female	36	14	0.02470	1.50E-005	Polley, 1972
S5B/PlCr	female	46	21	0.03680	2.02E-005	Polley, 1972
S5B/PlCr	female	54	28	0.05520	2.63E-005	Polley, 1972
S5B/PlCr	female	49	42	0.09540	1.24E-004	Polley, 1972
S5B/PlCr	female	64	56	0.12500	5.44E-005	Polley, 1972
S5B/PlCr	female	27	70	0.14490	4.90E-005	Polley, 1972
S5B/PlCr	female	27	84	0.16730	1.08E-004	Polley, 1972
S5B/PlCr	female	28	112	0.20570	2.29E-004	Polley, 1972
S5B/PlCr	female	32	140	0.22980	2.25E-004	Polley, 1972
S5B/PlCr	female	30	168	0.24400	3.66E-004	Polley, 1972
S5B/PlCr	male	24	1	0.00610	5.63E-007	Polley, 1972
S5B/PlCr	male	16	7	0.01610	3.06E-006	Polley, 1972
S5B/PlCr	male	26	14	0.02500	1.50E-005	Polley, 1972
S5B/PlCr	male	27	21	0.03870	2.50E-005	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
S5B/PlCr	male	47	28	0.06010	7.23E-005	Polley, 1972
S5B/PlCr	male	44	42	0.12240	2.85E-004	Polley, 1972
S5B/PlCr	male	58	56	0.18970	2.98E-004	Polley, 1972
S5B/PlCr	male	21	70	0.24130	2.56E-004	Polley, 1972
S5B/PlCr	male	23	84	0.28560	3.02E-004	Polley, 1972
S5B/PlCr	male	29	112	0.31940	4.05E-004	Polley, 1972
S5B/PlCr	male	27	140	0.35830	6.19E-004	Polley, 1972
S5B/PlCr	male	25	168	0.36620	5.94E-004	Polley, 1972
Wcrypt/Ztm	female	12	100	0.11500	1.44E-004	Alt et al., 1985
Wcrypt/Ztm	male	36	100	0.28600	6.25E-004	Alt et al., 1985
Wistar/Furth Cr	female	29	1	0.00710	1.60E-007	Polley, 1972
Wistar/Furth Cr	female	28	7	0.01640	3.80E-006	Polley, 1972
Wistar/Furth Cr	female	20	14	0.02260	7.56E-006	Polley, 1972
Wistar/Furth Cr	female	22	21	0.03910	3.06E-006	Polley, 1972
Wistar/Furth Cr	female	25	28	0.06150	1.50E-005	Polley, 1972
Wistar/Furth Cr	female	19	42	0.07590	5.33E-005	Polley, 1972
Wistar/Furth Cr	female	24	56	0.13660	6.38E-006	Polley, 1972
Wistar/Furth Cr	female	27	70	0.14310	1.23E-005	Polley, 1972
Wistar/Furth Cr	female	23	84	0.17550	7.97E-005	Polley, 1972
Wistar/Furth Cr	female	19	112	0.20190	2.46E-001	Polley, 1972
Wistar/Furth Cr	female	19	140	0.22490	1.03E-004	Polley, 1972
Wistar/Furth Cr	female	24	168	0.26270	3.73E-004	Polley, 1972
Wistar/Furth Cr	male	21	1	0.00720	1.81E-007	Polley, 1972
Wistar/Furth Cr	male	27	7	0.01740	2.48E-006	Polley, 1972
Wistar/Furth Cr	male	25	14	0.02420	5.18E-006	Polley, 1972
Wistar/Furth Cr	male	21	21	0.04000	1.21E-006	Polley, 1972
Wistar/Furth Cr	male	28	28	0.06510	9.77E-006	Polley, 1972
Wistar/Furth Cr	male	20	42	0.09120	5.13E-004	Polley, 1972
Wistar/Furth Cr	male	22	56	0.15660	6.16E-005	Polley, 1972
Wistar/Furth Cr	male	26	70	0.18510	1.21E-005	Polley, 1972
Wistar/Furth Cr	male	10	84	0.24030	3.43E-004	Polley, 1972
Wistar/Furth Cr	male	22	112	0.27770	7.55E-004	Polley, 1972
Wistar/Furth Cr	male	17	140	0.31940	8.31E-004	Polley, 1972
Wistar/Furth Cr	male	21	168	0.35960	5.39E-004	Polley, 1972
Wistar/Lewis Cr	female	27	1	0.00510	7.66E-007	Polley, 1972
Wistar/Lewis Cr	female	33	7	0.01810	1.89E-006	Polley, 1972
Wistar/Lewis Cr	female	24	14	0.02560	4.00E-006	Polley, 1972
Wistar/Lewis Cr	female	36	21	0.05240	2.50E-005	Polley, 1972
Wistar/Lewis Cr	female	57	28	0.08490	2.29E-004	Polley, 1972
Wistar/Lewis Cr	female	38	42	0.14180	6.44E-004	Polley, 1972
Wistar/Lewis Cr	female	35	56	0.24250	1.16E-004	Polley, 1972
Wistar/Lewis Cr	female	42	70	0.26120	3.15E-004	Polley, 1972

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Wistar/Lewis Cr	female	39	84	0.30240	3.06E-004	Polley, 1972
Wistar/Lewis Cr	female	41	112	0.32700	2.85E-004	Polley, 1972
Wistar/Lewis Cr	female	45	140	0.33570	2.64E-004	Polley, 1972
Wistar/Lewis Cr	female	42	168	0.34990	1.93E-004	Polley, 1972
Wistar/Lewis Cr	male	27	1	0.00520	7.66E-007	Polley, 1972
Wistar/Lewis Cr	male	32	7	0.01970	7.56E-006	Polley, 1972
Wistar/Lewis Cr	male	29	14	0.02720	4.52E-006	Polley, 1972
Wistar/Lewis Cr	male	32	21	0.05330	3.45E-005	Polley, 1972
Wistar/Lewis Cr	male	59	28	0.09610	1.03E-004	Polley, 1972
Wistar/Lewis Cr	male	38	42	0.18140	7.84E-004	Polley, 1972
Wistar/Lewis Cr	male	44	56	0.26970	5.18E-004	Polley, 1972
Wistar/Lewis Cr	male	33	70	0.31650	5.64E-004	Polley, 1972
Wistar/Lewis Cr	male	30	84	0.38170	4.00E-004	Polley, 1972
Wistar/Lewis Cr	male	28	112	0.41820	4.46E-004	Polley, 1972
Wistar/Lewis Cr	male	29	140	0.45910	7.84E-004	Polley, 1972
Wistar/Lewis Cr	male	34	168	0.52640	4.52E-004	Polley, 1972
Wistar	female	33	50	0.16800	2.50E-005	NAS, 1971
Wistar	female	42	100	0.22900	2.50E-005	NAS, 1971
Wistar	female	52	300	0.29900	1.60E-005	NAS, 1971
Wistar	female	100	28	0.09750	1.41E-005	Wiberg et al., 1966
Wistar	female	100	56	0.14750	1.41E-005	Wiberg et al., 1966
Wistar	female	100	84	0.17000	2.50E-005	Wiberg et al., 1966
Wistar	female	100	112	0.18000	5.62E-005	Wiberg et al., 1966
Wistar	female	100	112	0.18000	5.62E-005	Wiberg et al., 1966
Wistar	male	25	60	0.15000	NS	Deyl et al., 1975
Wistar	male	25	90	0.29500	NS	Deyl et al., 1975
Wistar	male	25	120	0.35000	NS	Deyl et al., 1975
Wistar	male	25	150	0.39500	NS	Deyl et al., 1975
Wistar	male	25	210	0.41500	NS	Deyl et al., 1975
Wistar	male	25	270	0.45000	NS	Deyl et al., 1975
Wistar	male	25	330	0.48000	NS	Deyl et al., 1975
Wistar	male	25	390	0.49000	NS	Deyl et al., 1975
Wistar	male	25	450	0.50000	NS	Deyl et al., 1975
Wistar	male	25	510	0.52000	NS	Deyl et al., 1975
Wistar	male	25	570	0.55000	NS	Deyl et al., 1975
Wistar	male	25	630	0.58500	NS	Deyl et al., 1975
Wistar	male	25	690	0.59500	NS	Deyl et al., 1975
Wistar	male	25	720	0.60000	NS	Deyl et al., 1975
Wistar	male	25	750	0.48000	NS	Deyl et al., 1975
Wistar	male	25	780	0.53000	NS	Deyl et al., 1975
Wistar	male	25	840	0.47000	NS	Deyl et al., 1975
Wistar	male	25	900	0.57000	NS	Deyl et al., 1975
Wistar	male	25	930	0.55000	NS	Deyl et al., 1975
Wistar	male	10	35	0.05230	1.69E-006	Leong et al., 1964

TABLE 3-4 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Wistar	male	10	49	0.10980	2.60E-005	Leong et al., 1964
Wistar	male	10	70	0.21130	4.49E-005	Leong et al., 1964
Wistar	male	10	126	0.29850	5.78E-005	Leong et al., 1964
Wistar	male	34	50	0.21800	2.50E-005	NAS, 1971
Wistar	male	38	100	0.36700	2.50E-005	NAS, 1971
Wistar	male	NS	300	0.48500	1.60E-005	NAS, 1971
Wistar	male	100	84	0.27000	6.25E-006	Wiberg et al., 1966
Wistar	male	100	112	0.29500	5.62E-005	Wiberg et al., 1966
Wistar	male	100	28	0.12500	6.25E-006	Wiberg et al., 1966
Wistar	male	100	56	0.22500	5.62E-005	Wiberg et al., 1966
Yoshida/Cr	female	35	1	0.00600	4.23E-007	Polley, 1972
Yoshida/Cr	female	35	7	0.01130	1.56E-006	Polley, 1972
Yoshida/Cr	female	31	14	0.03400	1.37E-005	Polley, 1972
Yoshida/Cr	female	24	21	0.05150	3.19E-005	Polley, 1972
Yoshida/Cr	female	21	28	0.06400	2.65E-005	Polley, 1972
Yoshida/Cr	female	28	42	0.13480	5.55E-005	Polley, 1972
Yoshida/Cr	female	26	56	0.18980	1.48E-004	Polley, 1972
Yoshida/Cr	female	24	70	0.25850	1.51E-004	Polley, 1972
Yoshida/Cr	female	25	84	0.27200	2.57E-004	Polley, 1972
Yoshida/Cr	female	21	112	0.30320	4.17E-004	Polley, 1972
Yoshida/Cr	female	23	140	0.31060	4.14E-004	Polley, 1972
Yoshida/Cr	male	20	1	0.00610	3.91E-007	Polley, 1972
Yoshida/Cr	male	21	7	0.01240	1.50E-006	Polley, 1972
Yoshida/Cr	male	22	14	0.03740	1.21E-005	Polley, 1972
Yoshida/Cr	male	24	21	0.05870	2.02E-005	Polley, 1972
Yoshida/Cr	male	21	28	0.07990	6.16E-005	Polley, 1972
Yoshida/Cr	male	22	42	0.15920	9.95E-005	Polley, 1972
Yoshida/Cr	male	23	56	0.25570	3.42E-004	Polley, 1972
Yoshida/Cr	male	24	70	0.32070	4.09E-004	Polley, 1972
Yoshida/Cr	male	25	84	0.34130	5.51E-004	Polley, 1972
Yoshida/Cr	male	26	112	0.40190	4.82E-004	Polley, 1972
Yoshida/Cr	male	22	140	0.47260	1.23E-003	Polley, 1972

NS = Not specified

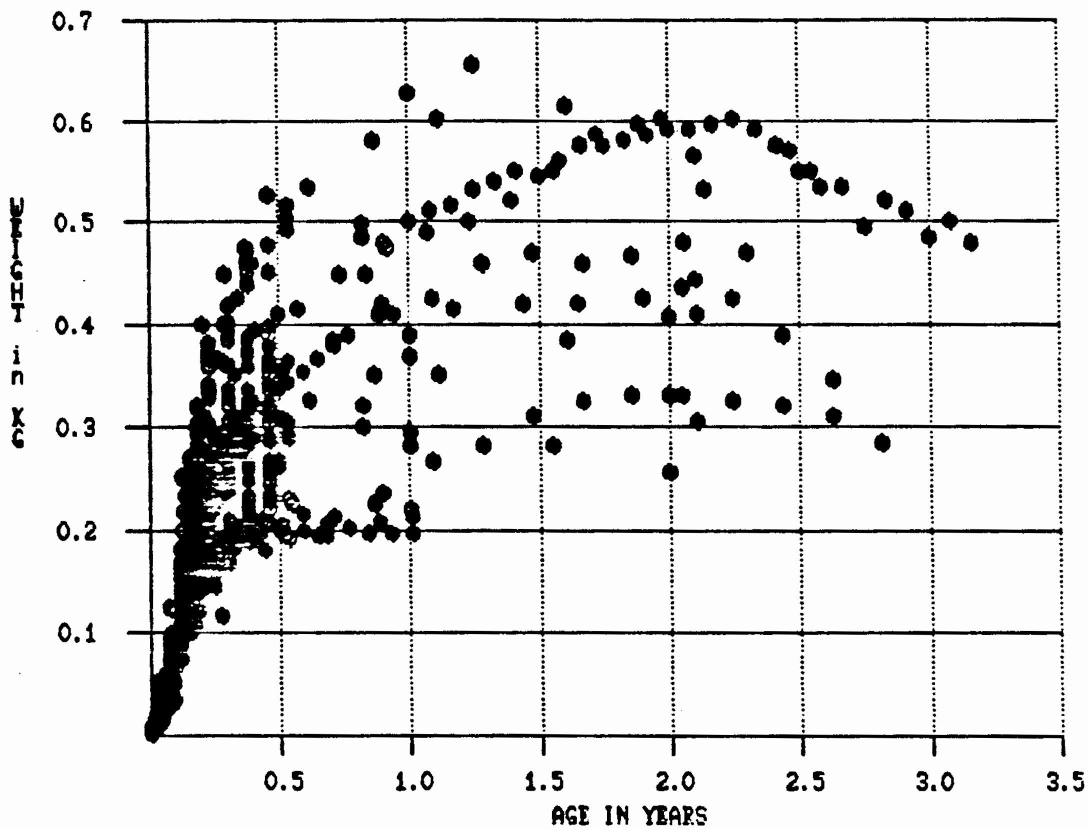


FIGURE 3-21

Body Weight Data on Male and Female Rats

(See Table 3-4 for data points and references)

This variation may be somewhat exaggerated in Figure 3-21 because most of the points between 0.5 and 1.0 year that plateau at ~0.2 kg are from Worden (1947) and represent the growth of a single female and single male black rat. Most body weights for mature rats range from ~0.3-0.6 kg.

Lifespan growth data are adequate to propose recommended values for four strains of rats which, in descending order of size, are Sprague-Dawley, Long-Evans, Wistar and Fischer.

Growth data on male and female Sprague-Dawley rats are presented in Figures 3-22 and 3-23, respectively. These figures include all of the data on Sprague-Dawley rats summarized in Table 3-4, except for the Sprague-Dawley 1951 rats, which are smaller than other Sprague-Dawley rats. As with B6C3F1 mice, male Sprague-Dawley rats evidence a definite plateau in growth at maturity and a slight decrease in body weight after 2 years of age. Females, conversely, continue to gain weight at a substantial rate throughout the observation period of ~2.1 years.

A somewhat different pattern is seen with male and female Fischer rats, as illustrated in Figures 3-24 and 3-25, respectively. These figures include all of the data on Fischer rats presented in Table 3-4. The data reported by Mauderly (1986), on relatively small numbers of animals, vary from the other sets of data, particularly for male rats at 1 year and female rats at 2 years of age. These differences, however, do not have a substantial effect on the estimates of TWA body weights.

In Fischer rats, clear peaks and subsequent decreases in body weight are apparent for both male and female rats. The peak in male rats occurs somewhat sooner (~1.5 years) than in female rats (~2 years,) and the decrease in body weight in male rats is more pronounced than in females. Given the large numbers of animals and the number of observations, it is unlikely that

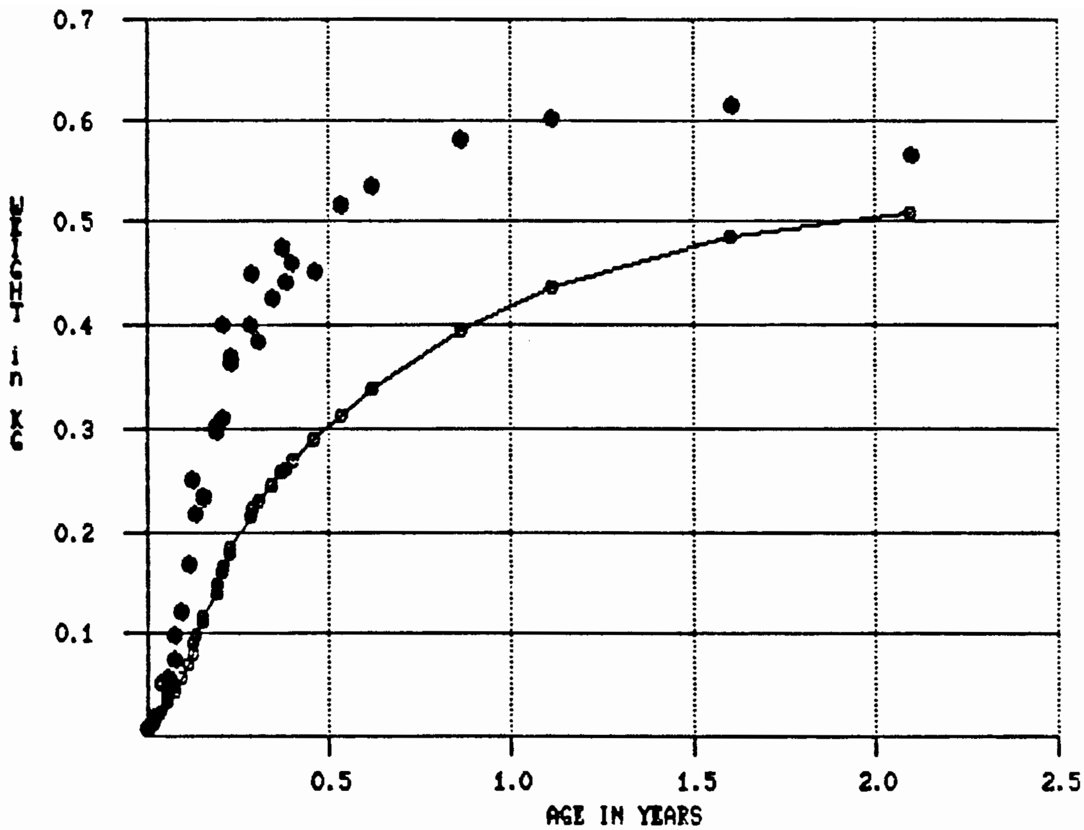


FIGURE 3-22

Recommended Growth Curve for Male Sprague-Dawley Rats

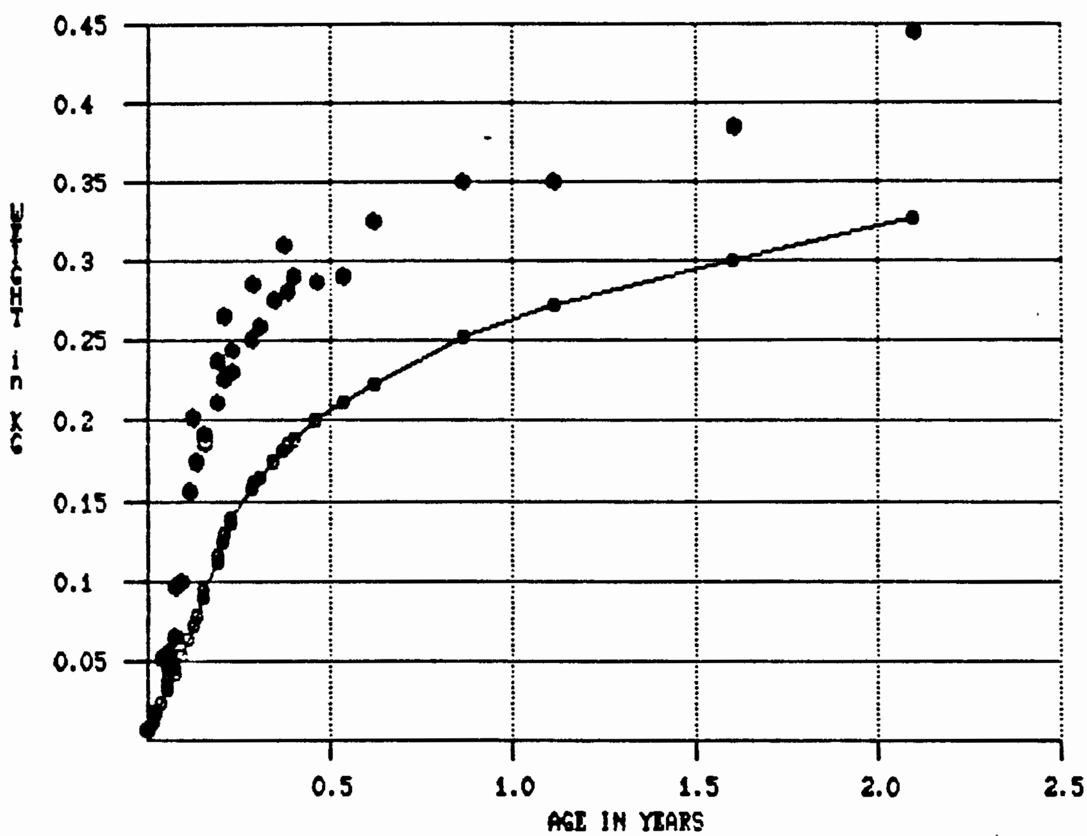


FIGURE 3-23

Recommended Growth Curve for Female Sprague-Dawley Rats

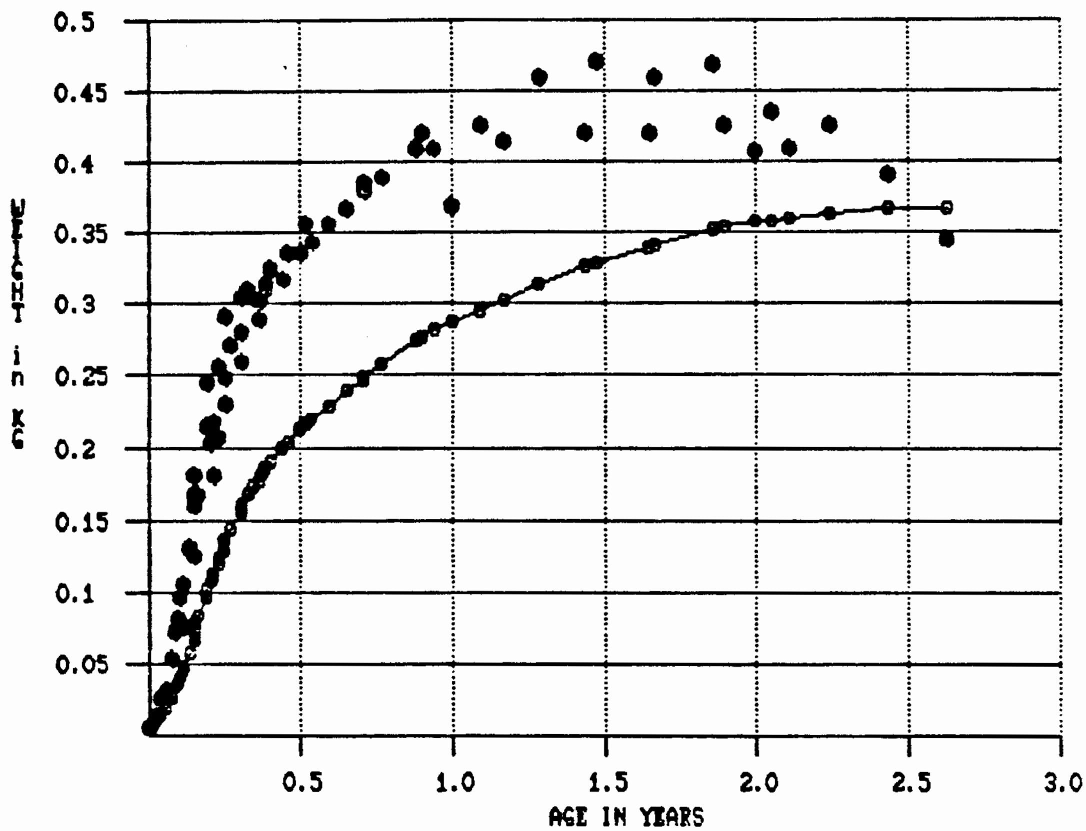


FIGURE 3-24

Recommended Growth Curve for Male Fischer Rats

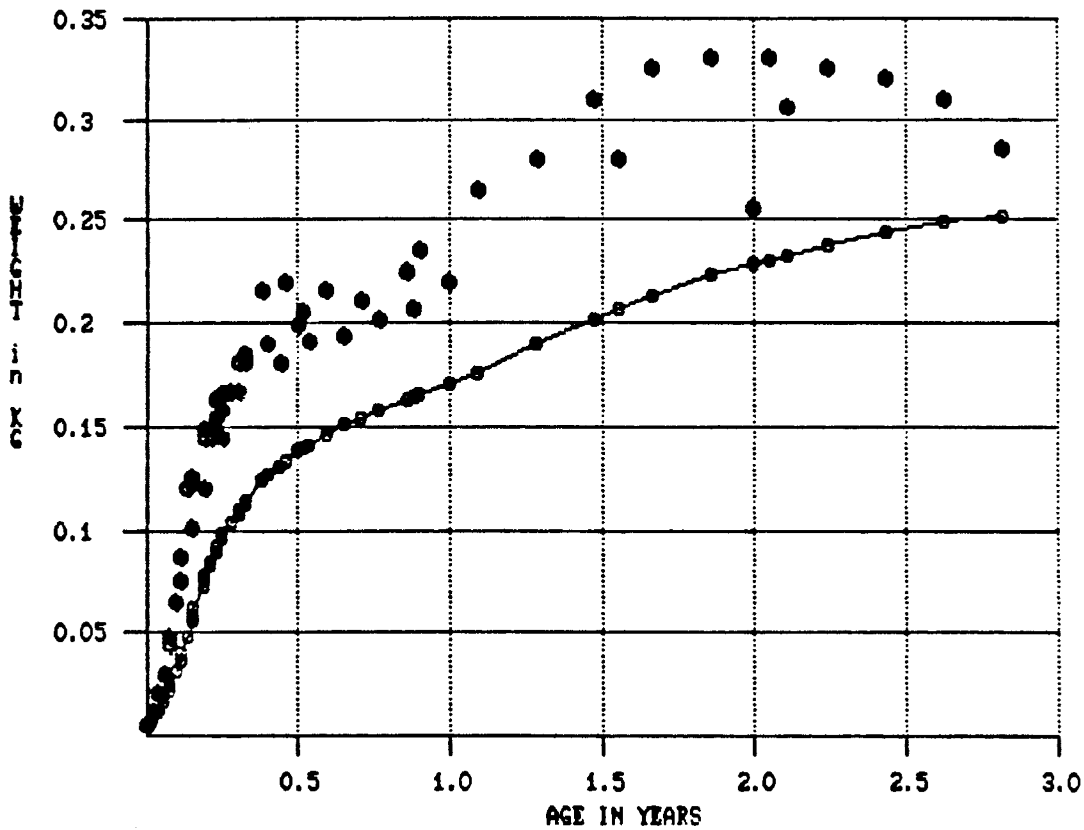


FIGURE 3-25

Recommended Growth Curve for Female Fischer Rats these patterns are artifacts of small sample sizes. Since these points represent the mean weights of groups of animals, and individual body weight data have not been reported, it cannot be determined if these patterns and other similar patterns are associated with weight loss in older animals or increased longevity in lighter animals.

The significance of the inflection in body weight in female Fischer rats that appears to occur between 6 and 9 months is not apparent. This is similar to the inflection in human females, between the ages of 20 and 30 years (Stoudt et al., 1960).

Lifespan growth data on Long-Evans male rats are illustrated in Figure 3-26. The growth data on young (1-140 days) rats reported by Poiley (1972) and the growth data on older (182-1156 days) rats reported by Holloszy and Smith (1986) are combined in this figure and yield a smooth growth curve. Reported weights for male Long-Evans and male Sprague-Dawley rats both reach a maximum of ~0.6 kg, but Sprague-Dawley rats reach this weight more rapidly. Thus, Sprague-Dawley rats have a slightly higher TWA body weight than Long-Evans rats. Like male Fischer rats, male Long-Evans rats show a marked decline in body weight near the end of the lifespan. This decline appears later (2.1 years) in the Long-Evans rats than in the Fischer rats (1.5 years).

Growth data over the lifespan of male Wistar rats are plotted in Figure 3-27. As specified in Table 3-4, this figure combines data on different varieties of Wistar rats and unspecified varieties of Wistar rats reported in different studies. This may partially account for the greater amount of scatter than that seen in the previous figures. Nonetheless, in the growth data on young Wistar rats (days 1-168) reported by Poiley (1972), male and female Wistar/Lewis rats appear to have greater growth rates than Wistar/Furth rats. No clear peak in growth is evident in this strain. All of the

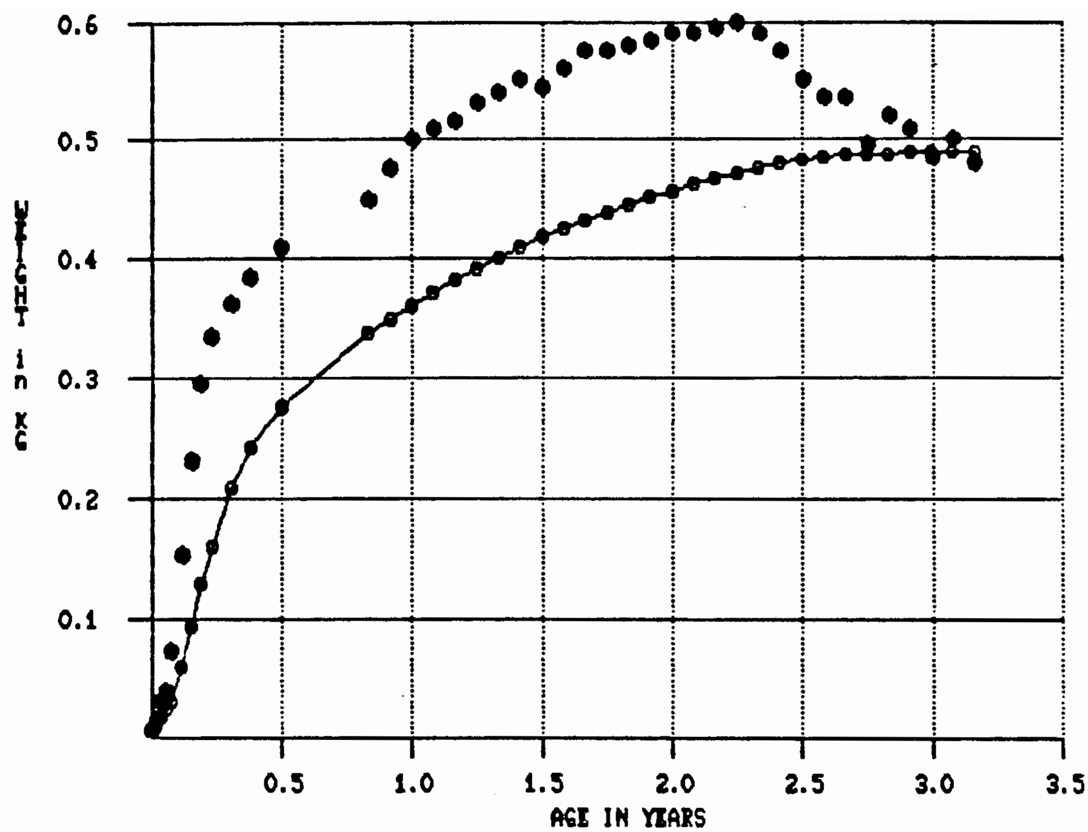


FIGURE 3-26

Recommended Growth Curve for Male Long-Evans Rats

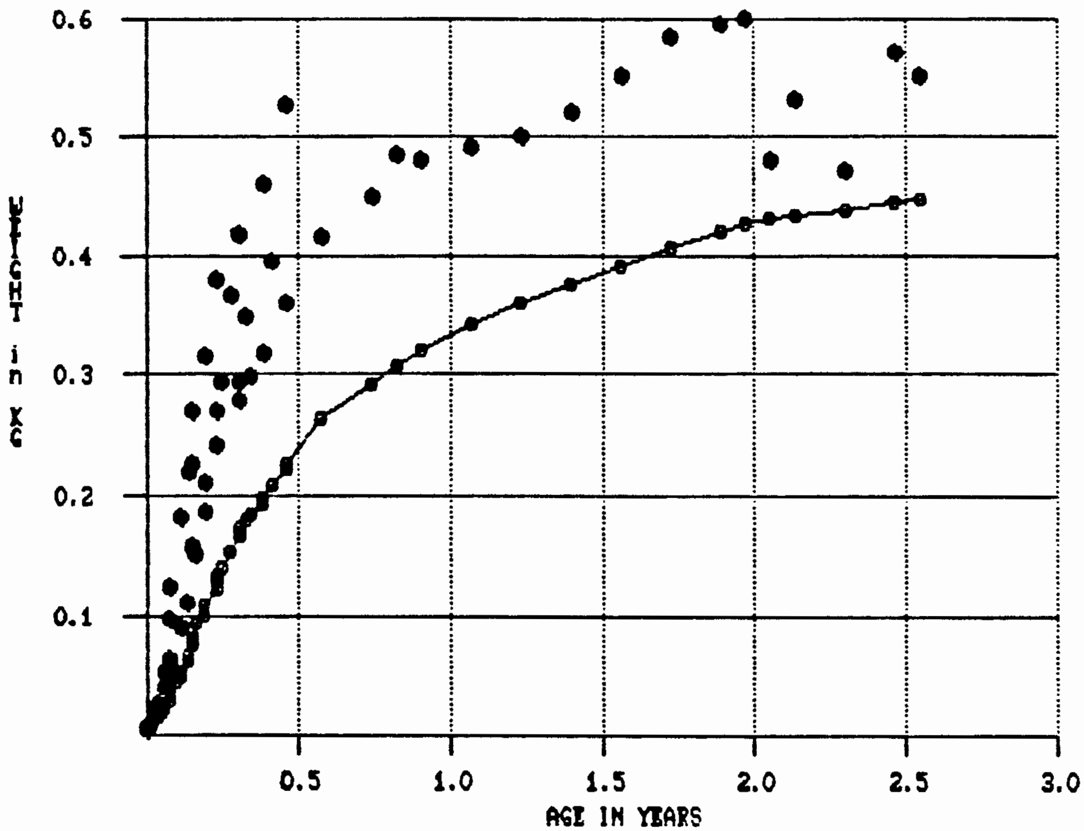


FIGURE 3-27

Recommended Growth Curve for Male Wistar Rats growth data for animals >1 year are reported from a single study (Deyl et al., 1975) which is based on a small number of animals. Haas et al. (1985) reported the spontaneous occurrence of a "giant" Wistar (Cpb:WU) rat that weighed 0.656 kg at age 15 months. While somewhat large, this weight is not exceptional given the growth data in Figure 3-27.

Lifespan growth data are not available on female Long-Evans, Wistar rats or other strains of rats.

Proposed recommended values for various strains of rats are given in Table 3-5. As with mice, both subchronic and chronic recommended body weights are given that parallel the standard subchronic and chronic exposure periods for toxicity studies using rats. For the sexes and strains on which lifespan growth data are available, chronic body weights are estimated directly from the appropriate figure (see Figures 3-22 to 3-27). For strains on which a subchronic, but not a chronic, body weight can be calculated directly, the chronic body weight is estimated using Equation 3-2. [The limitations of this approach are discussed in Section 3.2.1.]

When recommended body weights are not available from Table 3-5, any available body weight data should be used to select the strain of rat most similar to the strain used in the study being considered for risk assessment. If the strain of rat is not specified or if no body weight data are provided, using the recommended values for the Fischer rat will generally yield the lowest estimate of mg/kg/day dose, based on the use of the recommended body weight and the relationship of body weight to inhalation rates, food consumption, or water consumption.

TABLE 3-5

Reference Values for Body Weights of Various Strains of Rats

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
ACP 9935/Cr	F	0.0051	0.033	0.131	0.2466*	Poiley, 1972
ACP 9935/Cr	M	0.0052	0.0341	0.169	0.3237*	Poiley, 1972
ACl 9935/Cr	F	0.0053	0.0342	0.137	0.2588*	Poiley, 1972
ACl 9935/Cr	M	0.0054	0.0357	0.168	0.3217*	Poiley, 1972
ALBANY/Cr	F	0.0071	0.0535	0.184	0.3542*	Poiley, 1972
ALBANY 9935/Cr	M	0.0072	0.0553	0.240	0.4678*	Poiley, 1972
August 28807/Cr	F	0.0059	0.0404	0.159	0.3034*	Poiley, 1972
August 28807/Cr	M	0.0061	0.0426	0.207	0.4008*	Poiley, 1972
BN/Cr	F	0.0061	0.0437	0.138	0.2608*	Poiley, 1972
BN/Cr	M	0.0062	0.0448	0.210	0.4069*	Poiley, 1972
BUFFALO/Cr	F	0.0055	0.0278	0.168	0.3217*	Poiley, 1972
BUFFALO/Cr	M	0.0064	0.0448	0.229	0.4455*	Poiley, 1972
Copenhagen/Cr	F	0.0057	0.0266	0.149	0.2832*	Poiley, 1972
Copenhagen/Cr	M	0.0058	0.0307	0.204	0.3947*	Poiley, 1972
Cr:MGAPS(OM)	F	0.0058	0.0484	0.192	0.3704*	Poiley, 1972
Cr:MGAPS(OM)	M	0.0061	0.0551	0.245	0.4779*	Poiley, 1972
Cr:RAR(SD)	F	0.0065	0.0556	0.202	0.3907*	Poiley, 1972
Cr:RAR(SD)	M	0.0067	0.0594	0.263	0.5144*	Poiley, 1972

TABLE 3-5 (cont.)

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
Fischer	F	0.0055	0.03	0.124	0.229	Composite, see text
Fischer	M	0.0059	0.03	0.180	0.380	Composite, see text
Long-Evans	F	0.0061	0.0383	0.179	0.3440*	Poiley, 1972
Long-Evans	M	0.0066	0.0400	0.248	0.472	Composite, see text
Marshall 520/Cr	F	0.0059	0.0328	0.143	0.2710*	Poiley, 1972
Marshall 520/Cr	M	0.0060	0.0407	0.217	0.4211*	Poiley, 1972
NBR/PlCr	F	0.0058	0.0275	0.140	0.2649*	Poiley, 1972
NBR/PlCr	M	0.0058	0.0283	0.193	0.3724*	Poiley, 1972
Osborne-Mendel	F	0.0064	0.0520	0.286	0.5611*	Poiley, 1972
Osborne-Mendel	F	0.0064	0.0530	0.201	0.3886*	Poiley, 1972
Osborne-Mendel	M	0.0064	0.0530	0.263	0.5144*	Poiley, 1972
SH/Cr	F	0.0055	0.0400	0.143	0.2710*	Poiley, 1972
SH/Cr	M	0.0062	0.0424	0.205	0.3968*	Poiley, 1972
Sprague-Dawley	F	0.0063	0.0515	0.204	0.338	Composite, see text
Sprague-Dawley	M	0.0067	0.0527	0.267	0.523	Composite, see text
S5B/PlCr	F	0.0059	0.0368	0.143	0.2710*	Poiley, 1972
S5B/PlCr	M	0.0061	0.0387	0.210	0.4069*	Poiley, 1972
Wistar/Furth Cr	F	0.0071	0.0391	0.137	0.2588*	Poiley, 1972
Wistar/Furth Cr	M	0.0072	0.0400	0.179	0.3440*	Poiley, 1972
Wistar/Lewis Cr	F	0.0051	0.0524	0.234	0.4556*	Poiley, 1972
Wistar/Lewis Cr	M	0.0052	0.0533	0.289	0.5672*	Poiley, 1972

TABLE 3-5 (cont.)

Strain	Sex	Weight at Birth	Weight at Weaning	Subchronic TWA Body Weight	Chronic TWA Body Weight	Reference
Wistar	F	0.006	0.040	0.156	0.2974*	Composite, see text
Wistar	M	0.006	0.046	0.217	0.462	Composite, see text
Yoshida/Cr	F	0.0060	0.0515	0.154	0.2933*	Poiley, 1972
Yoshida/Cr	M	0.0061	0.0587	0.271	0.5307*	Poiley, 1972

*Recommended chronic body weights based on the equation, BWch = -0.019+2.03 BWsub, where BWch is the recommended chronic body and BWsub is the recommended subchronic body weight.

3.2.3. Guinea Pigs. The U.S. EPA has not recommended a reference body weight for guinea pigs. Values for guinea pig body weight reported in the literature include 0.27 kg (Boxenbaum, 1983), 0.43 kg (ARS/Sprague-Dawley, 1974) and 0.75 (Lehman, 1959). Growth data for guinea pigs and some additional body weights for guinea pigs of unspecified age are summarized in Table 3-6. All weight data from Table 3-6, for which corresponding ages are specified, are plotted in Figure 3-28

The data base for guinea pigs is much less complete than that for mice or rats. Donhoffer (1986) presents data over a period close to the 6-year recommended lifespan for the guinea pig. While these reported values are consistent with the data given by Mortola (1983, 1984), neither sex nor strain are specified. In addition, the body weight data reported by Donhoffer (1986) are markedly less than sex- and strain-specific data reported by Poiley (1972), Hirsch (1973) and Navia and Lopez (1973). These data for male guinea pigs are illustrated in Figure 3-29. The lower series of smooth body weight points are those reported by Poiley (1972) for the American short-hair guinea pig. The upper series of smooth body weight points are those for the Albino short-hair (Hirsch, 1973) and Hartley (Navia and Lopez, 1973) strains. The only sex-specific data reported for female guinea pigs are that of Poiley (1972) for the American short-hair (Figure 3-30).

For proposing recommended values, it does not seem reasonable to rely on the data of Donhoffer (1986) both because the sex and strain are not specified and because the data, while plausible given the scatter previously noted with rats and mice, are not consistent with the sex- and strain-specific data plotted in Figures 3-29 and 3-30. As an alternative, subchronic body weights are derived from the available sex and strain data.

TABLE 3-6

Growth and Body Weight Data on Guinea Pigs

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Albino short-hair	male	5	10	0.20000	NS	Hirsch, 1973
Albino short-hair	male	5	20	0.27000	NS	Hirsch, 1973
Albino short-hair	male	5	30	0.36000	NS	Hirsch, 1973
Albino short-hair	male	5	40	0.41500	NS	Hirsch, 1973
Albino short-hair	male	5	50	0.48000	NS	Hirsch, 1973
Albino short-hair	male	5	60	0.52000	NS	Hirsch, 1973
Albino short-hair	male	5	70	0.58000	NS	Hirsch, 1973
Amer. short-hair	female	50	1	0.07900	1.50E-004	Poiley, 1972
Amer. short-hair	female	50	7	0.11060	1.50E-004	Poiley, 1972
Amer. short-hair	female	50	14	0.14560	2.33E-004	Poiley, 1972
Amer. short-hair	female	50	21	0.18010	4.52E-004	Poiley, 1972
Amer. short-hair	female	50	28	0.21890	7.02E-004	Poiley, 1972
Amer. short-hair	female	50	42	0.29730	2.23E-003	Poiley, 1972
Amer. short-hair	female	48	56	0.37420	1.98E-003	Poiley, 1972
Amer. short-hair	female	48	70	0.44950	2.53E-003	Poiley, 1972
Amer. short-hair	female	48	84	0.51890	3.48E-003	Poiley, 1972
Amer. short-hair	female	48	112	0.62560	5.26E-003	Poiley, 1972
Amer. short-hair	female	48	140	0.72010	9.65E-003	Poiley, 1972
Amer. short-hair	female	47	168	0.79620	1.35E-003	Poiley, 1972
Amer. short-hair	female	47	196	0.83750	2.65E-003	Poiley, 1972
Amer. short-hair	male	50	1	0.08030	2.56E-004	Poiley, 1972
Amer. short-hair	male	50	7	0.11570	1.76E-004	Poiley, 1972
Amer. short-hair	male	50	14	0.15560	2.40E-004	Poiley, 1972
Amer. short-hair	male	50	21	0.20040	6.63E-004	Poiley, 1972
Amer. short-hair	male	50	28	0.24060	1.09E-003	Poiley, 1972
Amer. short-hair	male	49	42	0.32240	6.76E-004	Poiley, 1972
Amer. short-hair	male	49	56	0.40530	1.35E-003	Poiley, 1972

TABLE 3-6 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Amer. short-hair	male	49	70	0.48250	7.84E-004	Poiley, 1972
Amer. short-hair	male	49	84	0.54680	1.28E-003	Poiley, 1972
Amer. short-hair	male	49	112	0.65690	2.40E-003	Poiley, 1972
Amer. short-hair	male	49	140	0.76010	4.10E-003	Poiley, 1972
Amer. short-hair	male	45	168	0.84010	2.12E-003	Poiley, 1972
Amer. short-hair	male	45	196	0.89930	2.63E-003	Poiley, 1972
Duncan-Hartley	female	45	NS	020350	2.26E-005	Shelton, 1971
Duncan-harltey	female	45	NS	0.44250	9.51E-005	Shelton, 1971
Duncan-Hartley	male	15	NS	0.20400	1.60E-005	Shelton, 1971
Duncan-Hartley	male	15	NS	0.46350	1.81E-005	Shelton, 1971
Hartley	male	NS	21	0.28000	NS	Navia and Lopez, 1973
Hartley	male	NS	42	0.45000	NS	Navia and Lopez, 1973
Hartley	male	NS	70	0.61000	NS	Navia and Lopez, 1973
Hartley	male	NS	98	0.72000	NS	Navia and Lopez, 1973
Hartley	both	10	98	0.51200	9.80E-003	Mauderly et al., 1979
NS	male	6	NS	0.30900	1.61E-004	Murphy and Ulrich, 1964
NS	male	6	NS	0.34000	1.35E-004	Murphy and Ulrich, 1964
NS	male	6	NS	0.37900	3.39E-004	Murphy and Ulrich, 1964
NS	NS	NS	NS	0.80000	NS	Bruce, 1950
NS	NS	73	2	0.09200	1.16E-004	Donhoffer, 1986
NS	NS	39	5	0.10200	8.64E-004	Donhoffer, 1986
NS	NS	35	8	0.11100	8.28E-004	Donhoffer, 1986
NS	NS	52	15	0.15900	1.33E-003	Donhoffer, 1986
NS	NS	47	45	0.29900	2.40E-003	Donhoffer, 1986
NS	NS	78	195	0.68000	1.94E-003	Donhoffer, 1986
NS	NS	33	810	0.76200	2.88E-003	Donhoffer, 1986
NS	NS	18	1260	0.69900	NS	Donhoffer, 1986

TABLE 3-6 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
NS	NS	19	1440	0.82000	NS	Donhoffer, 1986
NS	NS	18	1800	0.69500	2.10E-003	Donhoffer, 1986
NS	NS	NS	NS	0.80000	NS	Lane-Peter et al., 1967
NS	NS	8	NS	0.19400	1.56E-004	Mead, 1960
NS	NS	5	4	0.11600	1.69E-004	Mortola, 1983
NS	NS	2	3	0.09110	1.80E-004	Mortola, 1984

NS = Not specified

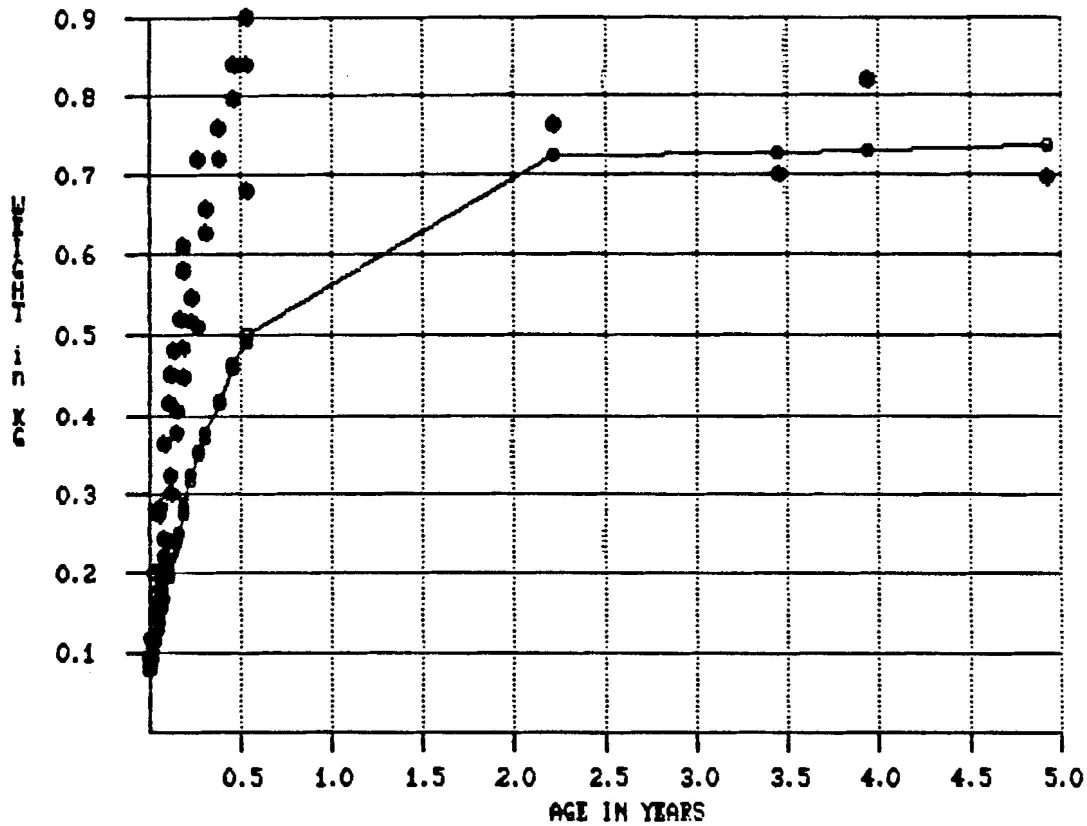


FIGURE 3-28

Body Weight Data on Guinea Pigs

(See Table 3-6 for data points and references)

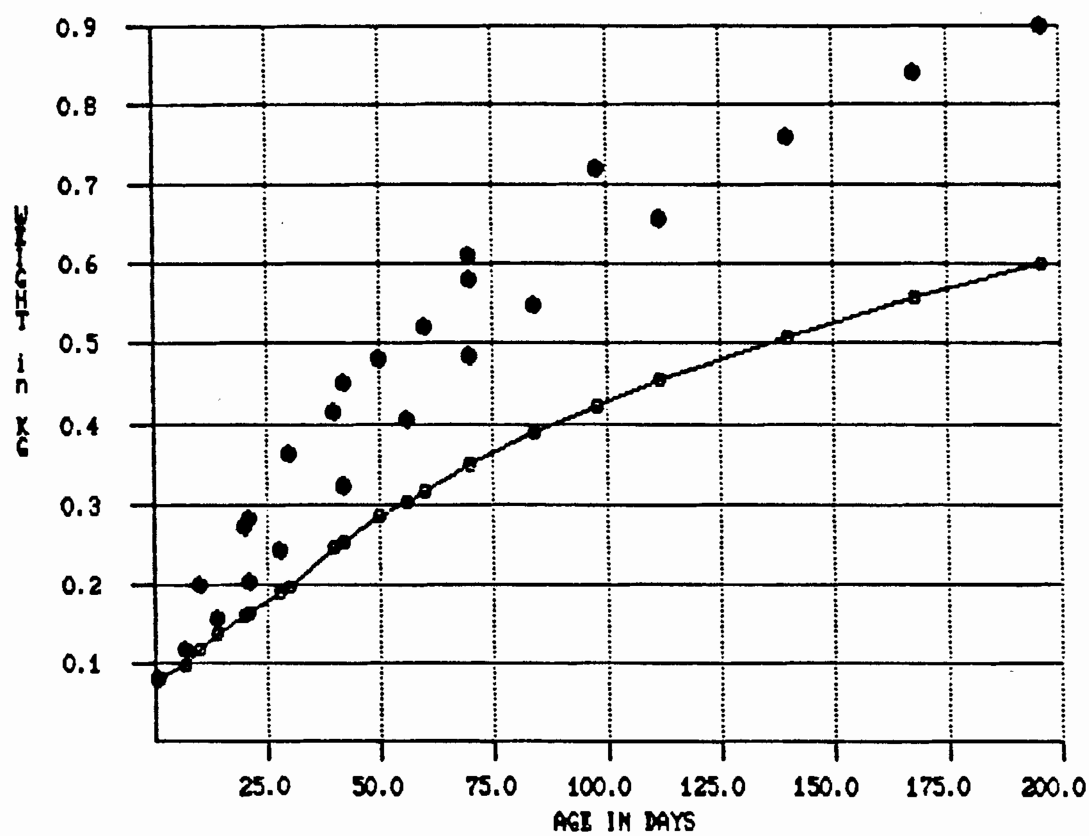


FIGURE 3-29

Growth Data on Male Guinea Pigs

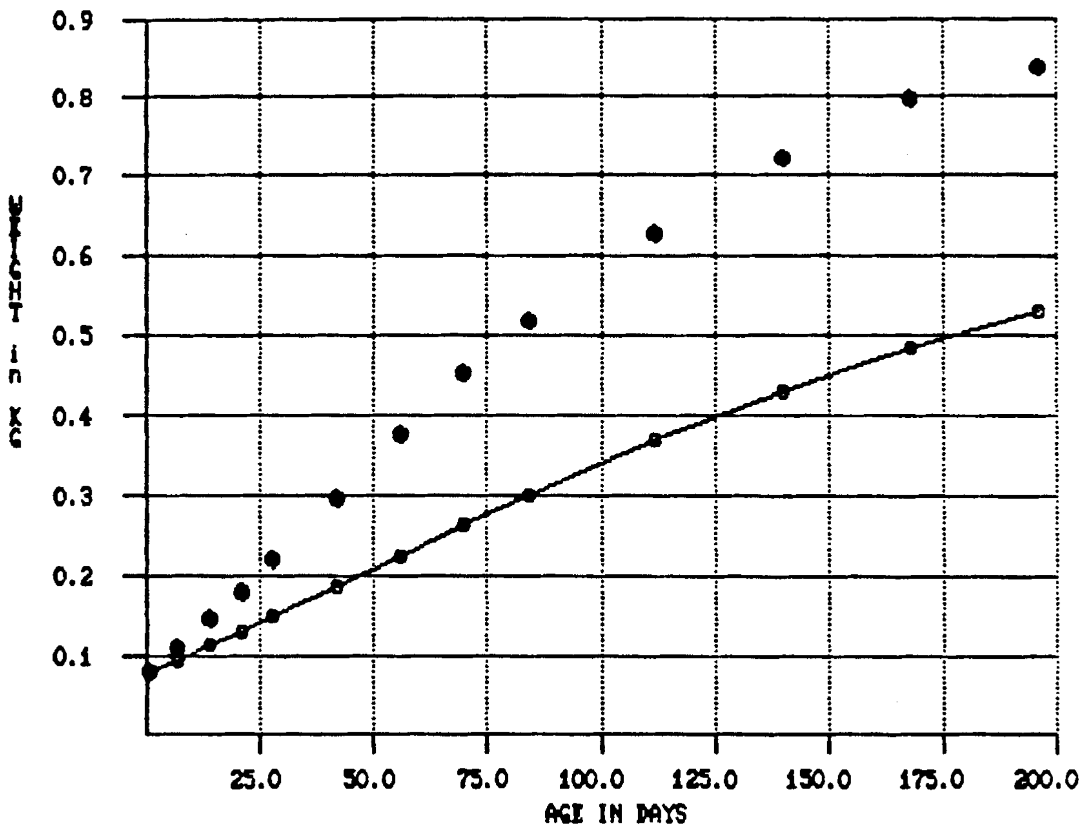


FIGURE 3-30

Growth Data on Female Guinea Pigs

For male guinea pigs (see Figure 3-29), separate subchronic body weights could be derived for the upper and lower body weight patterns discussed above. Given the paucity of the data and the uncertainty in extrapolating such estimates to chronic body weights, only a single value of 0.48 kg is proposed for all male guinea pigs. For female guinea pigs, the proposed recommended subchronic body weight is 0.39 kg. These values are based on the recommended age at weaning of 14 days for guinea pigs and the 90-day duration of a subchronic study.

The TWA body weight curves for male and female guinea pigs given in Figures 3-29 and 3-30 are extended in Figures 3-31 and 3-32, based on the assumption that body weights reach a plateau after 300 days at 1.0 kg for males and 0.9 kg for females. These figures are not extended over the full 6-year lifespan of the guinea pig because lifespan toxicity studies are rarely, if ever, conducted on this species. For providing a recommended chronic body weight, a 2-year exposure period is assumed. The recommended chronic body weights for male and females are estimated at 0.89 and 0.86 kg, respectively.

3.2.4. Hamsters. The U.S. EPA has not recommended a reference body weight for hamsters. ARS/Sprague-Dawley (1974) gives a standard body weight of 0.12 kg. Other reported body weights for adult and weanling hamsters are given in Table 3-7, along with available growth data. All growth data presented in Table 3-7 are plotted in Figure 3-33. The points in Figure 3-33 that show a markedly lower growth rate than most of the other points are for Chinese (Calland et al., 1986) and Djungarian (Heldmaier et al., 1982) hamsters. Because of the substantially lower body weights reported for these strains, separate body weight values will be recommended. Growth data are not available over the 2.5-year recommended lifespan of the hamster.

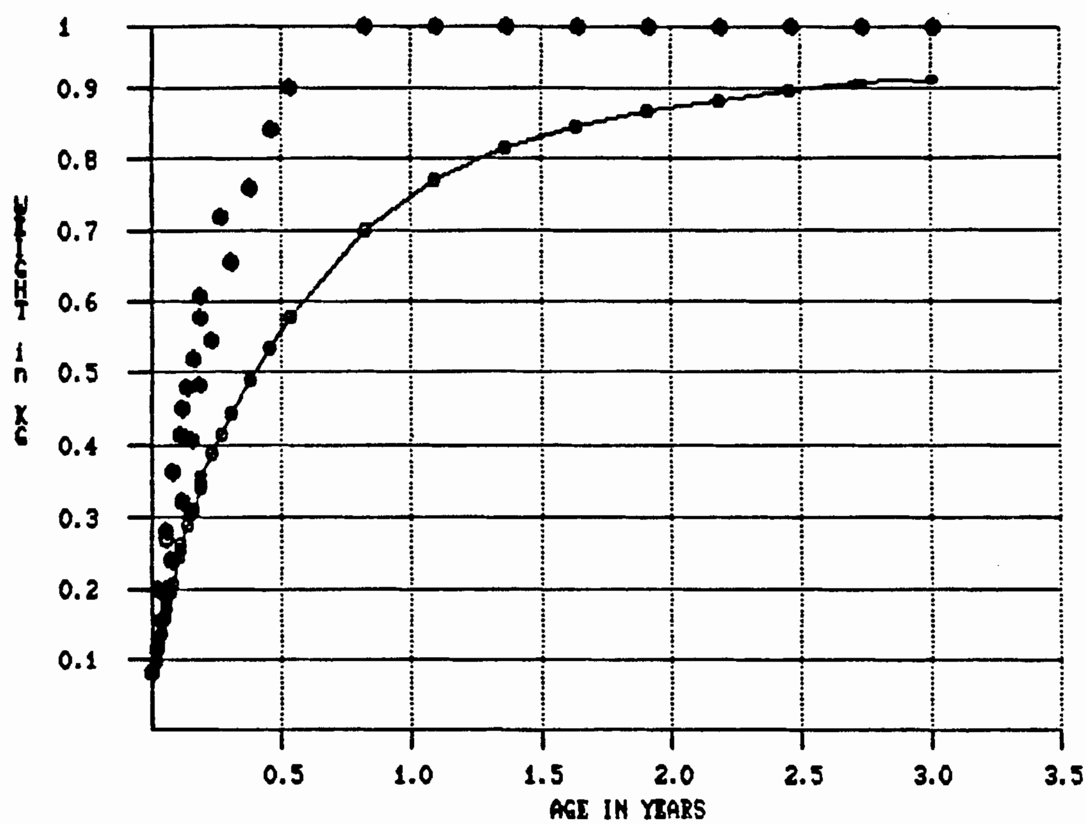


FIGURE 3-31

Recommended Growth Curve for Male Guinea Pigs

9
0.1
7
0.5

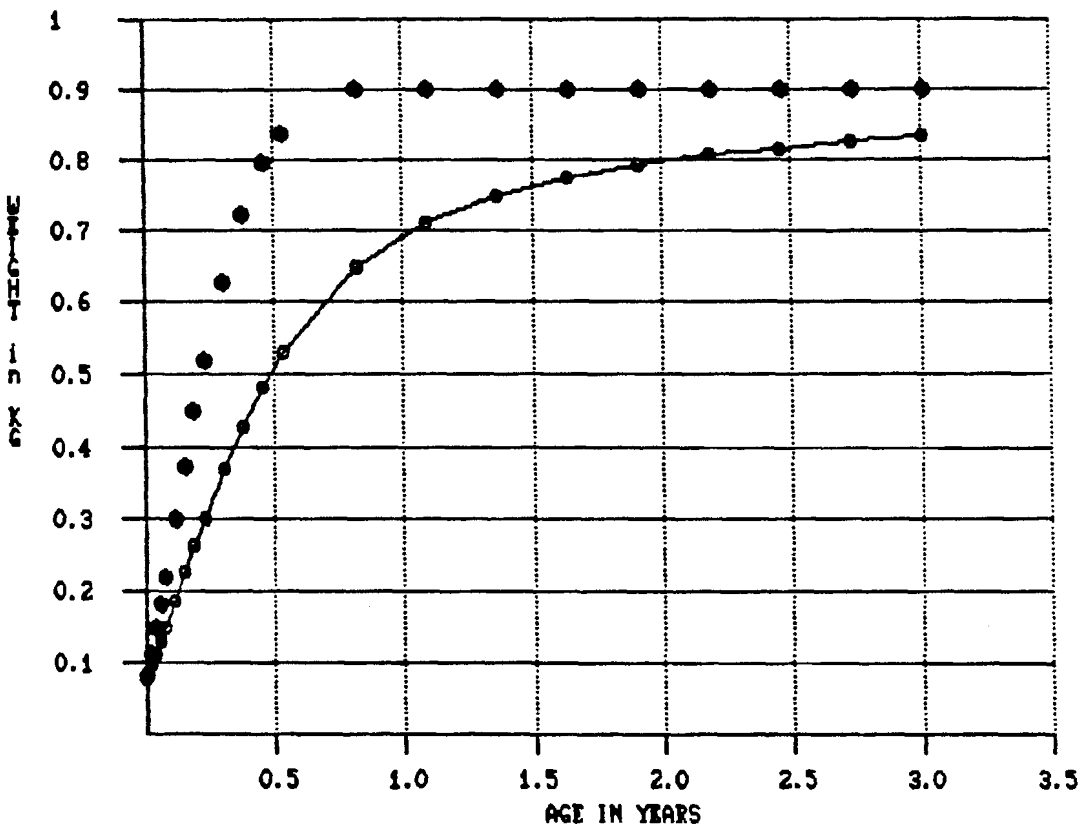


FIGURE 3-32

Recommended Growth Curve for Female Guinea Pigs

TABLE 3-7

Growth and Body Weight Data on Hamsters

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Chinese	female	25	21	0.01500	NS	Calland et al., 1986
Chinese	female	25	28	0.01900	NS	Calland et al., 1986
Chinese	female	25	35	0.02150	NS	Calland et al., 1986
Chinese	female	25	49	0.02400	NS	Calland et al., 1986
Chinese	female	25	63	0.02550	NS	Calland et al., 1986
Chinese	female	25	77	0.02750	NS	Calland et al., 1986
Chinese	female	25	91	0.02900	NS	Calland et al., 1986
Chinese	female	25	112	0.03050	NS	Calland et al., 1986
Chinese	male	25	21	0.01500	NS	Calland et al., 1986
Chinese	male	25	28	0.01900	NS	Calland et al., 1986
Chinese	male	25	35	0.02600	NS	Calland et al., 1986
Chinese	male	25	49	0.02550	NS	Calland et al., 1986
Chinese	male	25	63	0.02950	NS	Calland et al., 1986
Chinese	male	25	77	0.03200	NS	Calland et al., 1986
Chinese	male	25	91	0.03450	NS	Calland et al., 1986
Chinese	male	25	98	0.03550	NS	Calland et al., 1986
Chinese	male	25	112	0.03750	NS	Calland et al., 1986
Cr:RGH(SYR)	female	56	1	0.00300	2.02E-007	Poiley, 1972
Cr:RGH(SYR)	female	60	7	0.00780	4.20E-006	Poiley, 1972
Cr:RGH(SYR)	female	203	14	0.01750	2.65E-005	Poiley, 1972
Cr:RGH(SYR)	female	120	21	0.04030	2.63E-005	Poiley, 1972
Cr:RGH(SYR)	female	120	28	0.04420	8.79E-005	Poiley, 1972
Cr:RGH(SYR)	female	143	42	0.09300	1.54E-005	Poiley, 1972
Cr:RGH(SYR)	female	151	56	0.09450	2.21E-005	Poiley, 1972
Cr:RGH(SYR)	female	163	70	0.10330	3.16E-005	Poiley, 1972
Cr:RGH(SYR)	female	162	84	0.11490	3.36E-005	Poiley, 1972
Cr:RGH(SYR)	female	101	112	0.13590	2.81E-005	Poiley, 1972
Cr:RGH(SYR)	female	94	140	0.14960	1.02E-005	Poiley, 1972
Cr:RGH(SYR)	female	88	168	0.15780	1.79E-005	Poiley, 1972

TABLE 3-7 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Cr:RGH(SYR)	male	54	1	0.00290	2.50E-007	Poiley, 1972
Cr:RGH(SYR)	male	58	7	0.00690	4.95E-006	Poiley, 1972
Cr:RGH(SYR)	male	204	14	0.01830	2.94E-005	Poiley, 1972
Cr:RGH(SYR)	male	160	21	0.04000	2.97E-005	Poiley, 1972
Cr:RGH(SYR)	male	160	28	0.04870	9.41E-005	Poiley, 1972
Cr:RGH(SYR)	male	155	42	0.08610	6.16E-005	Poiley, 1972
Cr:RGH(SYR)	male	163	56	0.09150	8.85E-006	Poiley, 1972
Cr:RGH(SYR)	male	171	70	0.09940	1.46E-005	Poiley, 1972
Cr:RGH(SYR)	male	154	84	0.10390	6.63E-006	Poiley, 1972
Cr:RGH(SYR)	male	98	112	0.12190	2.16E-005	Poiley, 1972
Cr:RGH(SYR)	male	77	140	0.13180	5.26E-005	Poiley, 1972
Cr:RGH(SYR)	male	86	168	0.14050	1.33E-005	Poiley, 1972
Cr:RHG(SYR)	female	NS	21	0.04000	2.50E-005	NAS, 1978
Cr:RHG(SYR)	female	NS	28	0.04400	9.03E-005	NAS, 1978
Cr:RHG(SYR)	female	NS	56	0.09500	2.26E-005	NAS, 1978
Cr:RHG(SYR)	female	NS	84	0.11500	3.60E-005	NAS, 1978
Cr:RHG(SYR)	female	NS	168	0.15800	1.81E-005	NAS, 1978
Cr:RHG(SYR)	male	NS	21	0.04000	3.02E-005	NAS, 1978
Cr:RHG(SYR)	male	NS	28	0.04900	9.51E-005	NAS, 1978
Cr:RHG(SYR)	male	NS	56	0.09200	9.00E-006	NAS, 1978
Cr:RHG(SYR)	male	NS	84	0.10400	6.25E-006	NAS, 1978
Cr:RHG(SYR)	male	NS	168	0.14100	1.22E-005	NAS, 1978
Djungarian	NS	16	91	0.02760	3.60E-007	Heldmaier et al., 1982
Djungarian	NS	14	91	0.04110	8.10E-007	Heldmaier et al., 1982
Ela:ENG(SYR)	female	NS	20	0.03800	NS	NAS, 1978
Ela:ENG(SYR)	female	NS	30	0.06000	NS	NAS, 1978
Ela:ENG(SYR)	female	NS	40	0.08100	NS	NAS, 1978
Ela:ENG(SYR)	female	NS	60	0.10000	NS	NAS, 1978

TABLE 3-7 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Ela:ENG(SYR)	female	NS	70	0.10700	NS	NAS, 1978
Ela:ENG(SYR)	female	NS	90	0.12400	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	20	0.03600	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	30	0.06100	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	40	0.08200	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	60	0.10200	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	70	0.10800	NS	NAS, 1978
Ela:ENG(SYR)	male	NS	90	0.12600	NS	NAS, 1978
Golden Syrian	female	10	35	0.07300	NS	Feron et al., 1979
Golden Syrian	female	10	49	0.08800	NS	Feron et al., 1979
Golden Syrian	female	10	63	0.09300	NS	Feron et al., 1979
Golden Syrian	female	10	77	0.10400	NS	Feron et al., 1979
Golden Syrian	female	10	91	0.10900	NS	Feron et al., 1979
Golden Syrian	female	10	105	0.11900	NS	Feron et al., 1979
Golden Syrian	female	10	119	0.11800	NS	Feron et al., 1979
Golden Syrian	female	10	133	0.12000	NS	Feron et al., 1979
Golden Syrian	male	10	35	0.07400	NS	Feron et al., 1979
Golden Syrian	male	10	49	0.09300	NS	Feron et al., 1979
Golden Syrian	male	10	63	0.09600	NS	Feron et al., 1979
Golden Syrian	male	10	77	0.10300	NS	Feron et al., 1979
Golden Syrian	male	10	91	0.10600	NS	Feron et al., 1979
Golden Syrian	male	10	105	0.10800	NS	Feron et al., 1979
Golden Syrian	male	10	119	0.10700	NS	Feron et al., 1979
Golden Syrian	male	10	133	0.10800	NS	Feron et al., 1979
Golden Syrian	both	192	28	0.05600	1.00E-006	Knapka and Judge, 1974
Golden Syrian	both	192	35	0.06900	1.00E-006	Knapka and Judge, 1974
Golden Syrian	both	192	42	0.07650	1.56E-006	Knapka and Judge, 1974
Golden Syrian	both	192	49	0.08350	1.56E-006	Knapka and Judge, 1974
Golden Syrian	both	192	56	0.08950	5.63E-007	Knapka and Judge, 1974

TABLE 3-7 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Golden	male	10	adult	0.11540	1.21E-004	Holloway and Heath, 1984
Golden	both	22	weaned	0.04170	1.00E-008	Arrington, 1968
Golden	both	22	weaned	0.04170	1.00E-008	Arrington, 1968
Golden	both	12	42	0.07475	3.45E-004	Banta et al., 1975
Golden	both	NS	1	0.00400	NS	Farris, 1950
Golden	both	NS	20	0.02800	NS	Farris, 1950
Golden	both	NS	40	0.07000	NS	Farris, 1950
Golden	both	NS	60	0.09200	NS	Farris, 1950
Golden	both	NS	80	0.10750	7.56E-006	Farris, 1950
Golden	both	NS	100	0.12850	4.56E-005	Farris, 1950
Golden	both	NS	140	0.13350	1.81E-005	Farris, 1950
Golden	both	NS	180	0.14650	1.81E-005	Farris, 1950
Golden	both	NS	220	0.15000	2.50E-005	Farris, 1950
Golden	both	NS	260	0.15150	1.06E-005	Farris, 1950
Golden	both	NS	300	0.15250	2.26E-005	Farris, 1950
Golden	both	NS	360	0.15450	2.76E-005	Farris, 1950
Golden	both	40	21	0.03850	5.63E-007	Granados, 1951
Golden	both	40	56	0.07550	1.41E-005	Granados, 1951
Golden	both	40	91	0.09250	5.06E-006	Granados, 1951
Golden	both	40	126	0.11000	6.25E-006	Granados, 1951
Golden	both	40	161	0.11500	1.60E-005	Granados, 1951
Golden	NS	NS	adult	0.09000	NS	Lane-Peter et al., 1967
NS	NS	NS	adult	0.09000	NS	Bruce, 1950
NS	NS	4	5	0.00643	NS	Mortola and Noworaj, 1985
Standard LVG	female	NS	21	0.03500	NS	NAS, 1978
Standard LVG	female	NS	28	0.05400	NS	NAS, 1978
Standard LVG	female	NS	35	0.06600	NS	NAS, 1978
Standard LVG	female	NS	56	0.09700	NS	NAS, 1978
Standard LVG	female	NS	70	0.10700	NS	NAS, 1978
Standard LVG	female	NS	84	0.11500	NS	NAS, 1978

TABLE 3-7 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Standard LVG	male	NS	21	0.03500	NS	NAS, 1978
Standard LVG	male	NS	28	0.05200	NS	NAS, 1978
Standard LVG	male	NS	35	0.07000	NS	NAS, 1978
Standard LVG	male	NS	56	0.10200	NS	NAS, 1978
Standard LVG	male	NS	70	0.11000	NS	NAS, 1978
Standard LVG	male	NS	84	0.12500	NS	NAS, 1978
Syrian F1B	male	10	40	0.06380	2.50E-005	Schlenker, 1984
Syrian F1B	male	10	70	0.08860	3.14E-005	Schlenker, 1984
Syrian F1B	male	10	100	0.10200	1.14E-004	Schlenker, 1984
Syrian[Sch:Syr]	both	10	98	0.11000	1.21E-004	Mauderly et al., 1979
Syrian	female	10	21	0.03800	1.73E-004	Arrington et al., 1966
Syrian	female	10	35	0.06700	2.21E-005	Arrington et al., 1966
Syrian	female	10	42	0.07900	2.01E-004	Arrington et al., 1966
Syrian	female	10	63	0.09600	2.09E-004	Arrington et al., 1966
Syrian	male	8	21	0.04100	1.59E-004	Arrington et al., 1966
Syrian	male	8	35	0.06700	1.95E-004	Arrington et al., 1966
Syrian	male	8	42	0.07900	2.22E-004	Arrington et al., 1966
Syrian	male	8	63	0.09600	5.51E-005	Arrington et al., 1966
Syrian	male	8	25	0.04600	NS	Rogers et al., 1974
Syrian	male	8	30	0.06100	NS	Rogers et al., 1974
Syrian	male	8	35	0.07600	NS	Rogers et al., 1974
Syrian	male	8	40	0.08800	NS	Rogers et al., 1974
Syrian	male	8	50	0.09900	NS	Rogers et al., 1974
Syrian	male	8	70	0.11000	NS	Rogers et al., 1974
Syrian	male	8	90	0.12300	NS	Rogers et al., 1974
Syrian	male	8	105	0.12700	NS	Rogers et al., 1974
Syrian	male	40	109	0.12900	2.89E-004	Rubin et al., 1978
Syrian	both	10	112	0.11100	1.21E-004	Mauderly and Tesarek, 1975

NS = Not specified

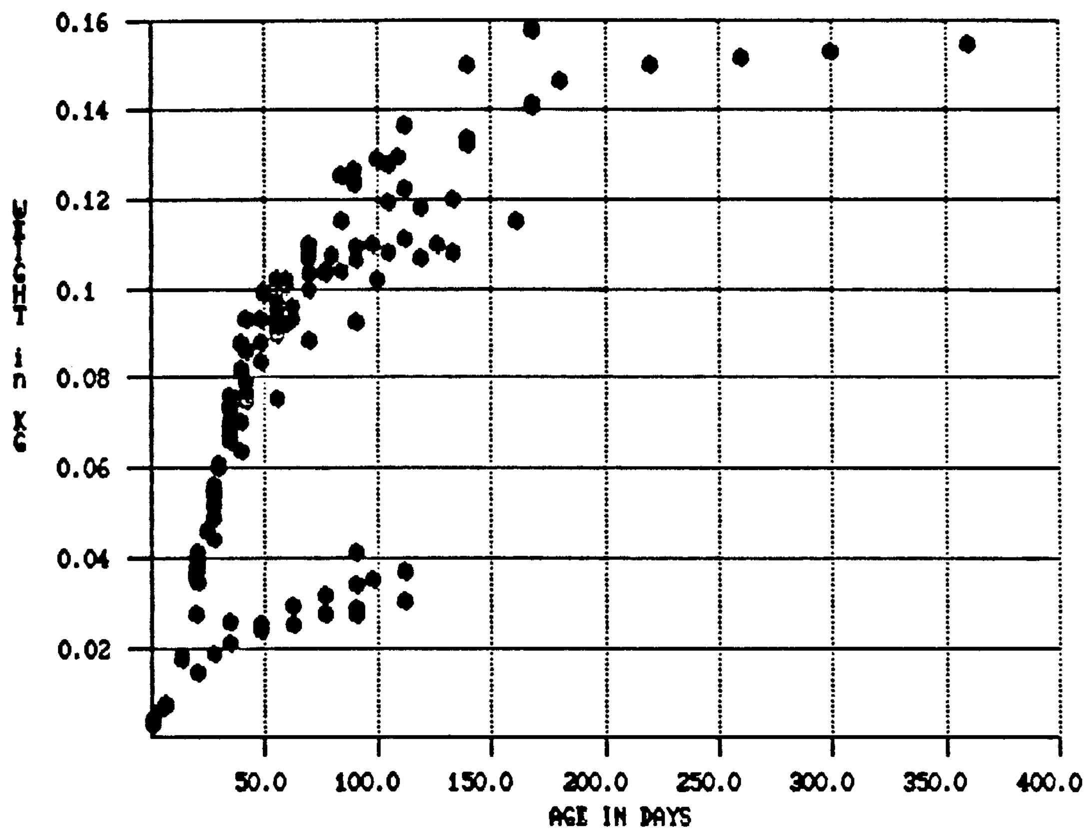


FIGURE 3-33

Body Weight Data on Hamsters

(See Table 3-7 for data points and references)

The only data on growth over an observation period of >6 months are provided in a study on the Golden hamster (Farris, 1950), in which average weights are given for both sexes combined.

Sex differences in body weight do not appear to be as pronounced in hamsters as in other species of laboratory animals. Data on the growth rate of male hamsters, excluding Chinese and Djungarian strains, are plotted in Figure 3-34. Corresponding data for female hamsters are plotted in Figure 3-35. Although some scatter is apparent in both of these figures, the data are reasonably consistent and are not clearly associated with differences in strain. Using the data presented in these figures and a recommended age at weaning of 21 days, the recommended subchronic body weights for these strains of male and female hamsters are 0.097 and 0.095 kg, respectively.

In estimating chronic body weights for these strains of hamsters, data on males and females are extended in Figures 3-36 and 3-37, respectively, using assumed mature body weights of 0.15 kg for males and 0.16 kg for females. These assumed values bracket the combined weight for 1-year-old male and female Golden hamsters of ~0.155 kg (Farris, 1950) and reflect the somewhat higher body weights reported for female hamsters ages 100-200 days, compared with males. Using these assumptions, recommended chronic body weights for these strains of hamsters are 0.134 kg for males and 0.145 kg for females.

Growth data on male and female Chinese hamsters are presented in Figures 3-38 and 3-39, respectively, and the corresponding recommended subchronic body weights are 0.03 kg for males and 0.025 kg for females. The ratio of chronic-to-subchronic body weights for Golden Syrian hamsters (1.38 for males and 1.52 for females) are used to estimate recommended chronic body weights for Chinese hamsters of 0.041 kg for males and 0.038 kg for females.

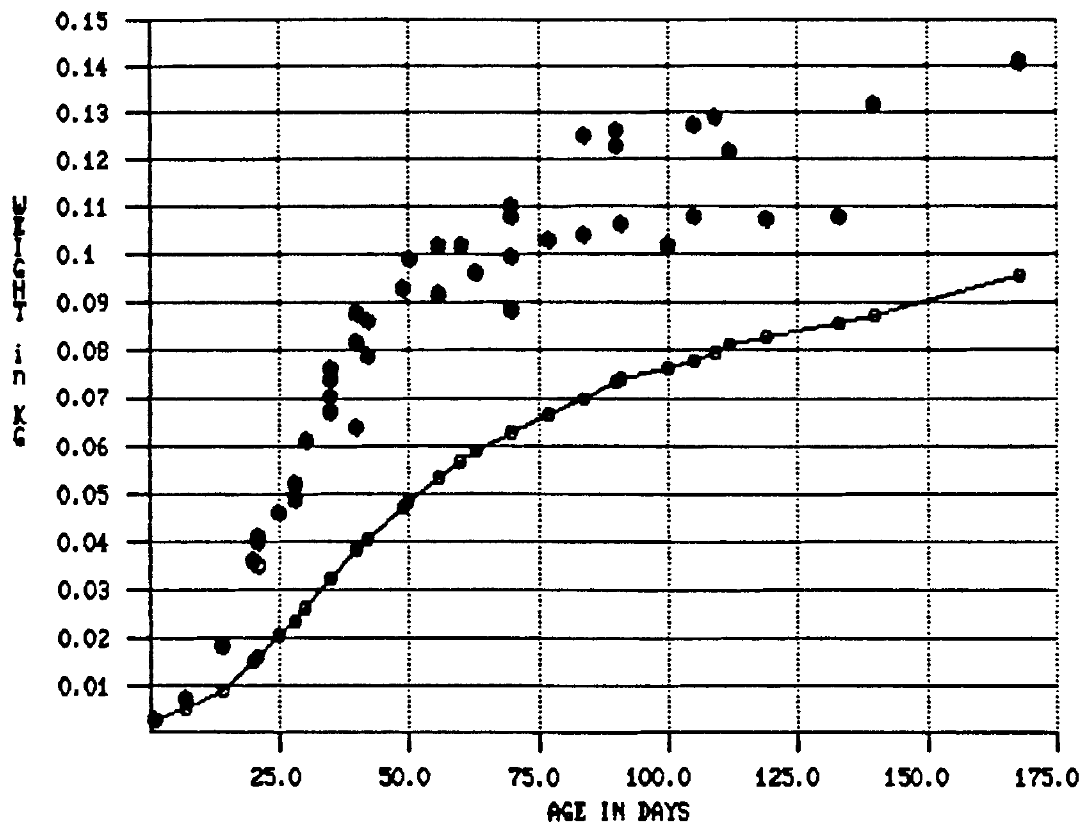


FIGURE 3-34

Growth Data on Male Hamsters
(Excluding Chinese Strain)

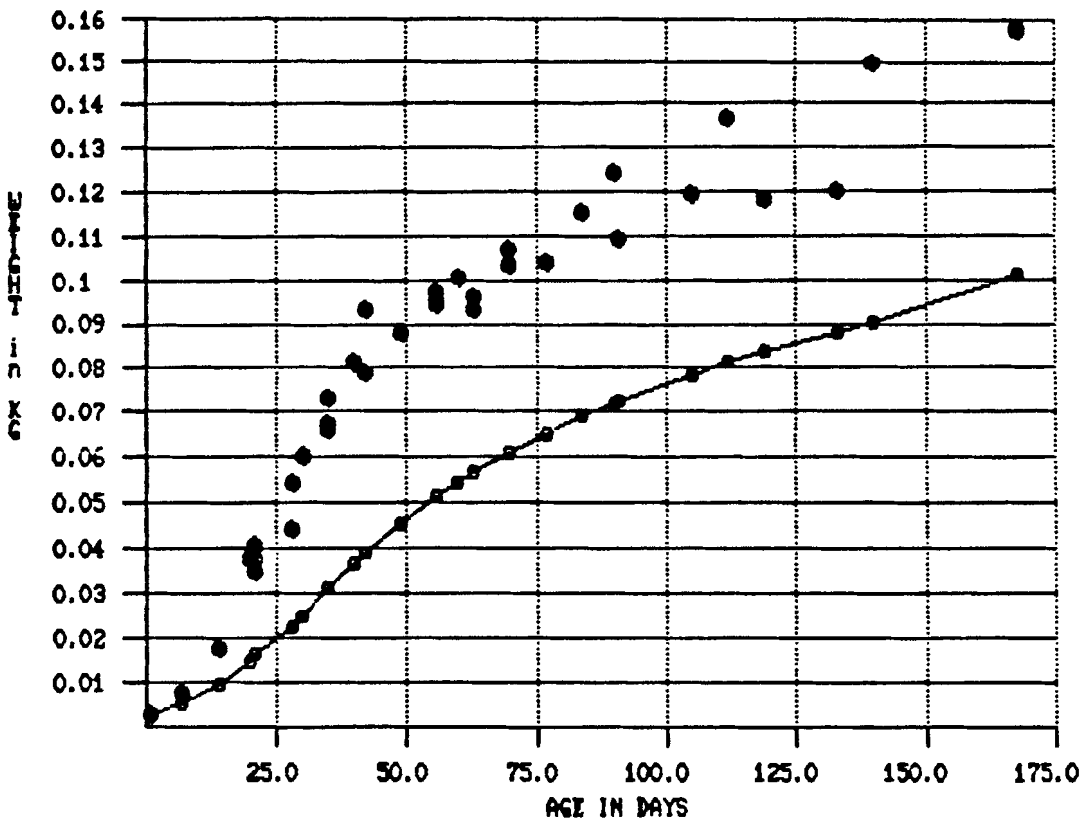


FIGURE 3-35

Growth Data on Female Hamsters
(Excluding Chinese Strain)

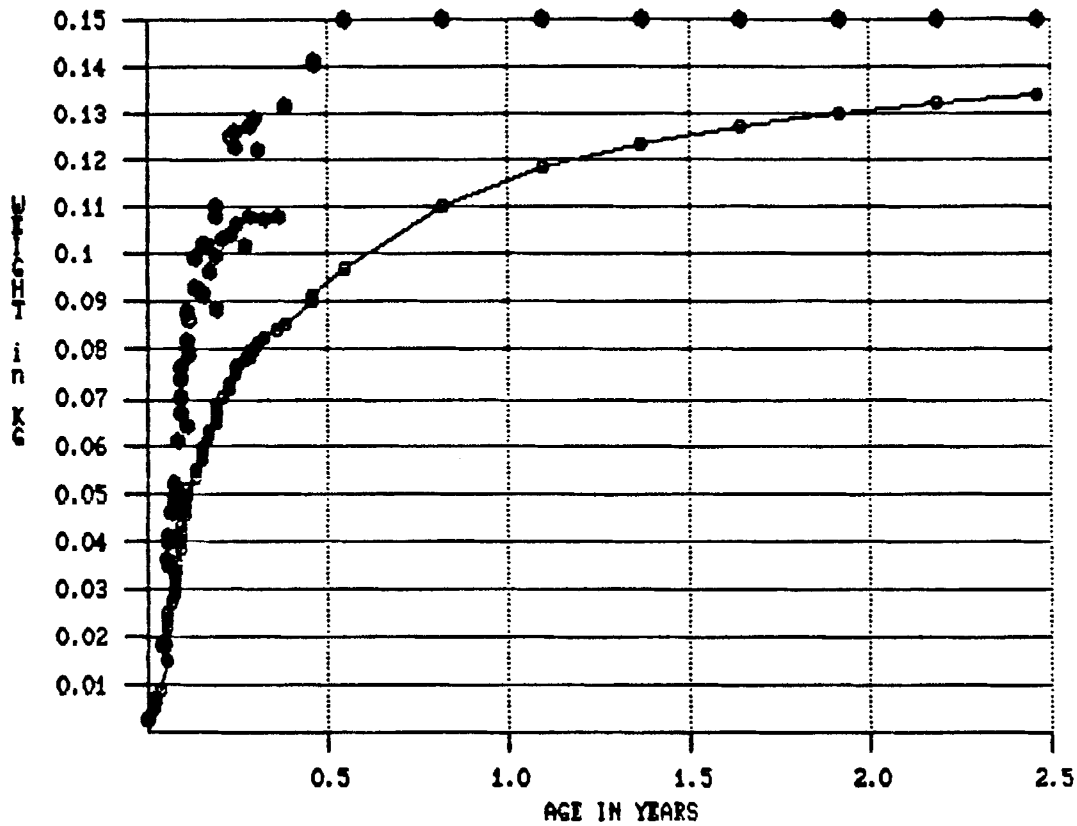


FIGURE 3-36

Recommended Growth Curve for Male Hamsters
(Excluding Chinese Strain)

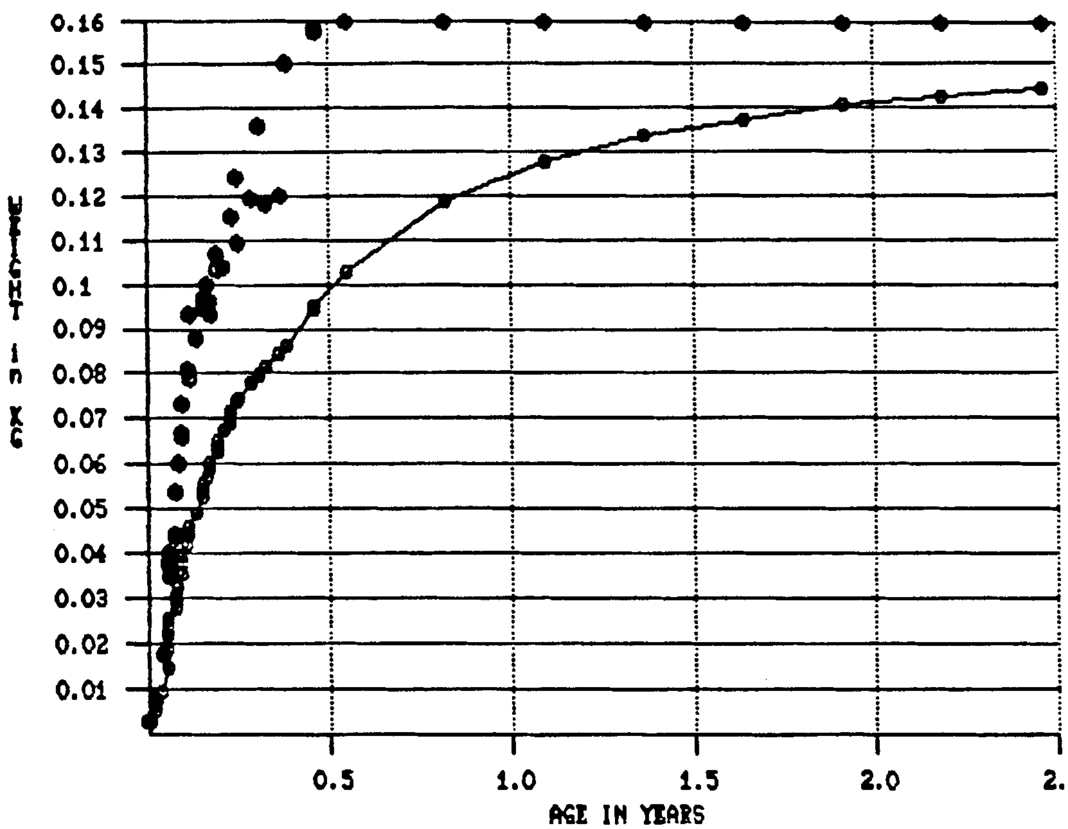


FIGURE 3-37

Recommended Growth Curve for Female Hamsters
(Excluding Chinese Strain)

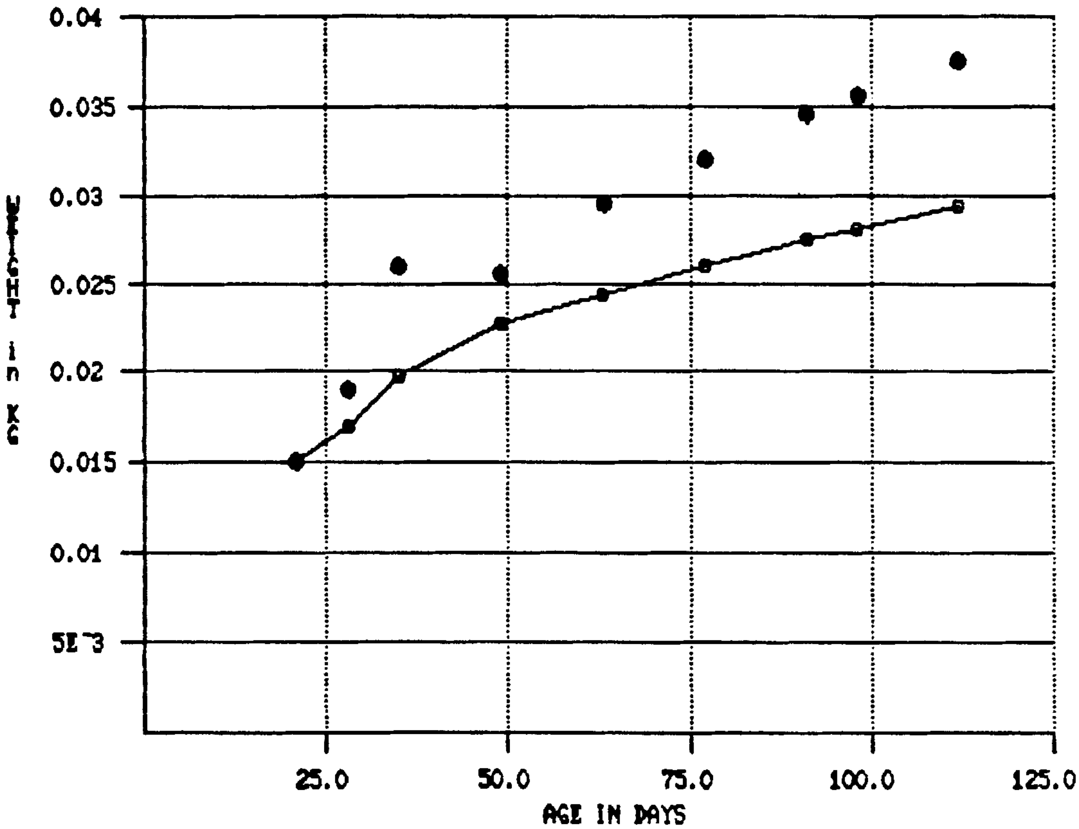


FIGURE 3-38

Recommended Growth Curve for Male Chinese Hamsters

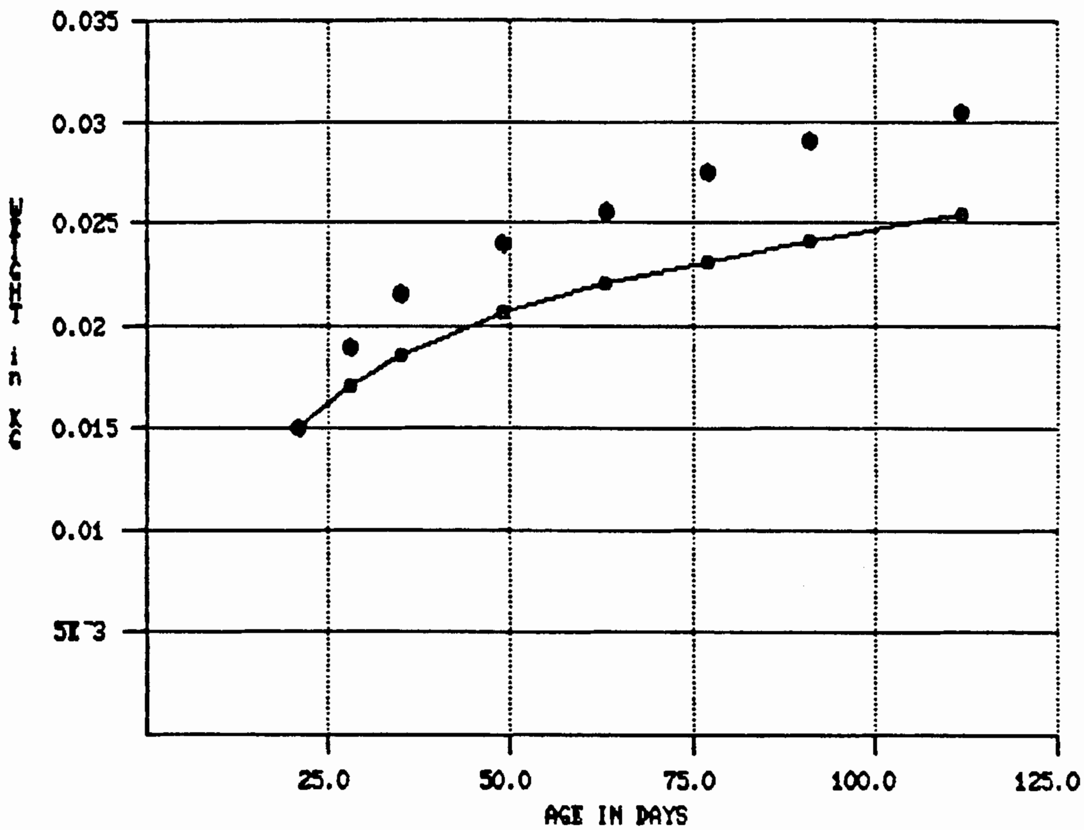


FIGURE 3-39

Recommended Growth Curve for Female Chinese Hamsters

Although growth data are not available for Djungarian hamsters, the body weights reported for 90-day-old hamsters of this strain (Heldmaier et al., 1982) are much closer to those of Chinese than Golden hamsters. Thus, the recommended values for Chinese hamsters should be applied to studies using Djungarian hamsters.

The rather substantial variation in the weights of 91-day-old Djungarian hamsters reported by Heldmaier et al. (1982) reflect seasonal differences, the heavier weight recorded in summer and the lighter weight recorded in winter. Seasonal differences in growth rates and body weights of hamsters are also discussed by Granados (1951). Information for assessing the effects of seasonal differences is not common in the toxicology or growth literature. Thus, seasonal factors are not used in recommending biological values in this report, although such differences are noted when data are available. Such differences, nonetheless, should be recognized as potential and perhaps substantial sources of error in the application of recommended values in risk assessments.

3.2.5. Gerbils. The U.S. EPA has not recommended a reference value for gerbils, and these animals were not included in an earlier report on recommended values for risk assessment (U.S. EPA, 1985). Although not commonly used in toxicological studies, gerbils are usually considered in most recent reference texts on laboratory animals (Arrington, 1978) and are being used more frequently in biomedical research.

As summarized in Table 3-8, most available data are on the Mongolian gerbil; only birth and mature weights were reported by Lane-Peter et al. (1967) for other strains. As illustrated in Figures 3-40 and 3-41 for males and females, respectively, growth data for both sexes are relatively consistent and cover the 3-year recommended lifespan. The body weights reported

TABLE 3-8

Growth and Body Weight Data on Gerbils

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Meriones shawi	NS	NS	1	0.00475	3.91E-007	Lane-Peter et al., 1967
Meriones shawi	NS	NS	adult	0.18500	1.06E-003	Lane-Peter et al., 1967
Mongolian	female	many	1	0.00400	NS	Arrington et al., 1973
Mongolian	female	many	7	0.00700	NS	Arrington et al., 1973
Mongolian	female	many	14	0.01600	NS	Arrington et al., 1973
Mongolian	female	many	21	0.01600	NS	Arrington et al., 1973
Mongolian	female	many	28	0.02100	NS	Arrington et al., 1973
Mongolian	female	many	35	0.03500	NS	Arrington et al., 1973
Mongolian	female	many	42	0.04200	NS	Arrington et al., 1973
Mongolian	female	many	49	0.04700	NS	Arrington et al., 1973
Mongolian	female	many	56	0.04900	NS	Arrington et al., 1973
Mongolian	female	many	180	0.06200	NS	Arrington et al., 1973
Mongolian	female	many	270	0.07400	NS	Arrington et al., 1973
Mongolian	female	many	365	0.07800	NS	Arrington et al., 1973
Mongolian	female	many	730	0.08200	NS	Arrington et al., 1973
Mongolian	female	many	1095	0.08600	NS	Arrington et al., 1973
Mongolian	female	NS	1	0.00300	NS	Marston and Chang, 1965
Mongolian	female	NS	21	0.01300	NS	Marston and Chang, 1965
Mongolian	female	NS	56	0.04000	1.22E-005	Marston and Chang, 1965
Mongolian	female	NS	183	0.07500	2.50E-005	Marston and Chang, 1965
Mongolian	female	NS	365	0.08000	2.50E-005	Marston and Chang, 1965
Mongolian	female	NS	639	0.09750	1.89E-004	Marston and Chang, 1965
Mongolian	female	NS	1	0.00400	NS	McManus and Zurich, 1972
Mongolian	female	NS	14	0.00600	NS	McManus and Zurich, 1972
Mongolian	female	NS	21	0.01200	NS	McManus and Zurich, 1972
Mongolian	female	NS	28	0.01900	NS	McManus and Zurich, 1972
Mongolian	female	NS	35	0.02300	NS	McManus and Zurich, 1972

TABLE 3-8 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mongolian	female	NS	49	0.03300	NS	McManus and Zurich, 1972
Mongolian	female	NS	56	0.04000	NS	McManus and Zurich, 1972
Mongolian	female	NS	70	0.04600	NS	McManus and Zurich, 1972
Mongolian	female	NS	105	0.05500	NS	McManus and Zurich, 1972
Mongolian	female	86	1	0.00280	1.60E-009	Norris and Adams, 1972
Mongolian	female	85	10	0.00740	1.21E-008	Norris and Adams, 1972
Mongolian	female	81	20	0.01210	4.84E-008	Norris and Adams, 1972
Mongolian	female	104	30	0.01950	1.76E-007	Norris and Adams, 1972
Mongolian	female	97	40	0.02430	2.02E-007	Norris and Adams, 1972
Mongolian	female	30	50	0.03160	5.33E-007	Norris and Adams, 1972
Mongolian	female	58	60	0.04010	4.10E-007	Norris and Adams, 1972
Mongolian	female	50	70	0.04300	2.81E-007	Norris and Adams, 1972
Mongolian	female	38	80	0.04660	3.48E-007	Norris and Adams, 1972
Mongolian	female	49	90	0.05010	3.03E-007	Norris and Adams, 1972
Mongolian	female	46	100	0.05190	2.70E-007	Norris and Adams, 1972
Mongolian	female	38	110	0.05180	3.72E-007	Norris and Adams, 1972
Mongolian	female	35	120	0.05400	5.33E-007	Norris and Adams, 1972
Mongolian	female	36	130	0.05620	1.35E-006	Norris and Adams, 1972
Mongolian	female	35	140	0.05720	9.03E-007	Norris and Adams, 1972
Mongolian	female	12	150	0.05540	2.53E-006	Norris and Adams, 1972
Mongolian	male	many	1	0.00400	NS	Arrington et al., 1973
Mongolian	male	many	7	0.00700	NS	Arrington et al., 1973
Mongolian	male	many	14	0.01000	NS	Arrington et al., 1973
Mongolian	male	many	21	0.01700	NS	Arrington et al., 1973
Mongolian	male	many	28	0.02400	NS	Arrington et al., 1973
Mongolian	male	many	35	0.03300	NS	Arrington et al., 1973
Mongolian	male	many	42	0.04500	NS	Arrington et al., 1973
Mongolian	male	many	49	0.05400	NS	Arrington et al., 1973
Mongolian	male	many	56	0.05600	NS	Arrington et al., 1973
Mongolian	male	many	90	0.06800	NS	Arrington et al., 1973

TABLE 3-8 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mongolian	male	many	180	0.08000	NS	Arrington et al., 1973
Mongolian	male	many	270	0.08700	NS	Arrington et al., 1973
Mongolian	male	many	365	0.09000	NS	Arrington et al., 1973
Mongolian	male	many	469	0.09400	NS	Arrington et al., 1973
Mongolian	male	many	550	0.09800	NS	Arrington et al., 1973
Mongolian	male	many	730	0.09800	NS	Arrington et al., 1973
Mongolian	male	many	1095	0.09600	NS	Arrington et al., 1973
Mongolian	male	11	75	0.07050	1.56E-006	Laughlin et al., 1975
Mongolian	male	10	63	0.05550	8.10E-007	Loew, 1968
Mongolian	male	10	98	0.07480	7.56E-006	Loew, 1968
Mongolian	male	10	140	0.08275	1.83E-005	Loew, 1968
Mongolian	male	10	182	0.09085	3.69E-005	Loew, 1968
Mongolian	male	10	224	0.09580	3.03E-005	Loew, 1968
Mongolian	male	NS	1	0.00300	6.25E-008	Marston and Chang, 1965
Mongolian	male	NS	21	0.01450	3.06E-006	Marston and Chang, 1965
Mongolian	male	NS	56	0.04850	3.91E-005	Marston and Chang, 1965
Mongolian	male	NS	183	0.09000	5.62E-005	Marston and Chang, 1965
Mongolian	male	NS	365	0.08500	NS	Marston and Chang, 1965
Mongolian	male	NS	645	0.11750	7.66E-005	Marston and Chang, 1965
Mongolian	male	NS	1	0.00400	NS	McManus and Zurich, 1972
Mongolian	male	NS	14	0.00800	NS	McManus and Zurich, 1972
Mongolian	male	NS	21	0.01200	NS	McManus and Zurich, 1972
Mongolian	male	NS	28	0.02000	NS	McManus and Zurich, 1972
Mongolian	male	NS	35	0.02800	NS	McManus and Zurich, 1972
Mongolian	male	NS	49	0.04000	NS	McManus and Zurich, 1972
Mongolian	male	NS	56	0.04500	NS	McManus and Zurich, 1972
Mongolian	male	NS	70	0.05300	NS	McManus and Zurich, 1972
Mongolian	male	NS	84	0.05700	NS	McManus and Zurich, 1972
Mongolian	male	NS	105	0.06000	NS	McManus and Zurich, 1972
Mongolian	male	80	1	0.00290	1.60E-009	Norris and Adams, 1972

TABLE 3-8 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mongolian	male	76	10	0.00740	1.69E-008	Norris and Adams, 1972
Mongolian	male	72	20	0.01190	5.29E-008	Norris and Adams, 1972
Mongolian	male	87	30	0.01870	9.00E-008	Norris and Adams, 1972
Mongolian	male	73	40	0.02610	2.70E-007	Norris and Adams, 1972
Mongolian	male	29	50	0.03500	3.48E-007	Norris and Adams, 1972
Mongolian	male	41	60	0.04310	5.18E-007	Norris and Adams, 1972
Mongolian	male	26	70	0.04630	8.10E-007	Norris and Adams, 1972
Mongolian	male	12	80	0.05090	3.28E-006	Norris and Adams, 1972
Mongolian	male	25	90	0.05810	8.28E-007	Norris and Adams, 1972
Mongolian	male	25	100	0.05850	1.61E-006	Norris and Adams, 1972
Mongolian	male	25	110	0.05770	2.79E-006	Norris and Adams, 1972
Mongolian	male	15	120	0.06200	2.62E-006	Norris and Adams, 1972
Mongolian	male	12	130	0.06000	3.76E-006	Norris and Adams, 1972
Mongolian	male	27	140	0.06470	1.23E-006	Norris and Adams, 1972
Mongolian	male	15	150	0.06170	2.37E-006	Norris and Adams, 1972
Mongolian	both	20	NS	0.01740	1.00E-008	Arrington, 1968
Mongolian	both	20	215	0.06125	2.64E-006	Harriman, 1969a
Mongolian	both	18	NS	0.06125	6.60E-005	McManus, 1972
Mongolian	NS	NS	1	0.00280	NS	McManus, 1971
Mongolian	NS	NS	7	0.00570	NS	McManus, 1971
Mongolian	NS	NS	14	0.00920	NS	McManus, 1971
Mongolian	NS	NS	21	0.01290	NS	McManus, 1971
Mongolian	NS	NS	28	0.01860	NS	McManus, 1971
Mongolian	NS	NS	105	0.05880	NS	McManus, 1971
M. crassus	NS	NS	1	0.00350	2.50E-007	Lane-Peter et al., 1967
M. crassus	NS	NS	adult	0.10500	5.06E-004	Lane-Peter et al., 1967
M. libycus	NS	NS	1	0.00550	5.63E-007	Lane-Peter et al., 1967
M. libycus	NS	NS	adult	0.10000	4.00E-004	Lane-Peter et al., 1967

TABLE 3-8 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
M. persicus	NS	NS	1	0.00500	NS	Lane-Peter et al., 1967
M. persicus	NS	NS	adult	0.11000	2.25E-004	Lane-Peter et al., 1967
M. sacramenti	NS	NS	adult	0.20000	1.41E-003	Lane-Peter et al., 1967
M. tristrami	NS	NS	1	0.00300	NS	Lane-Peter et al., 1967
M. tristrami	NS	NS	adult	0.10500	5.06E-004	Lane-Peter et al., 1967
M. vinogradovi	NS	NS	1	0.00300	NS	Lane-Peter et al., 1967
M. vinogradovi	NS	NS	adult	0.15000	6.25E-004	Lane-Peter et al., 1967

NS = Not specified

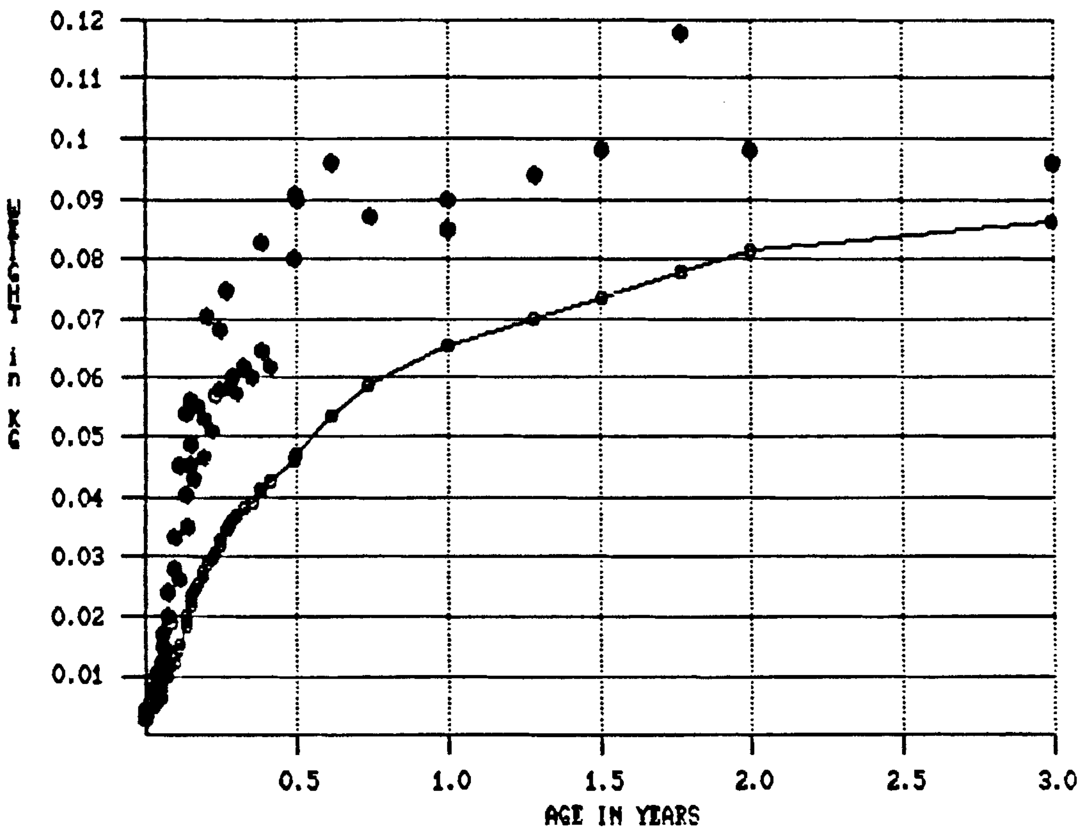


FIGURE 3-40

Recommended Growth Curve for Male Mongolian Gerbils

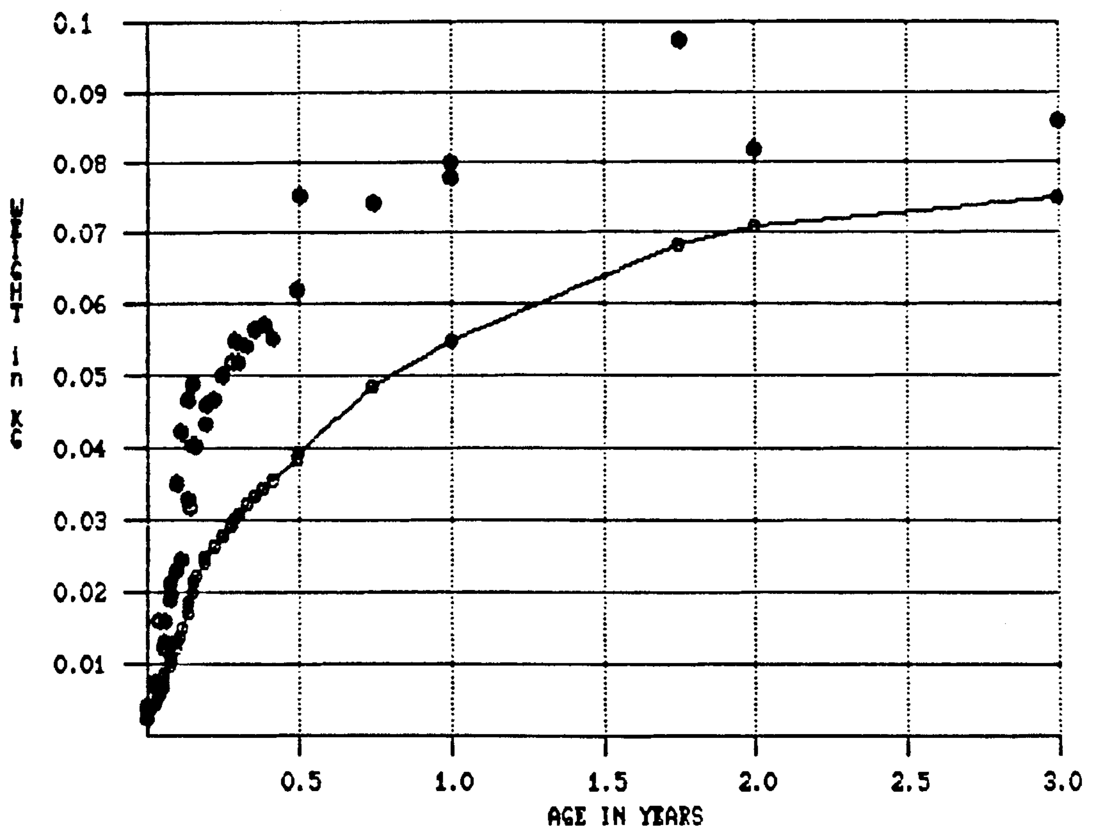


FIGURE 3-41

Recommended Growth Curve for Female Mongolian Gerbils by Marston and Chang (1965) are somewhat higher than those reported by Arrington et al. (1973). Since these records were made at different times and probably under different holding conditions and using different diets, all of the reported weights are used in recommending body weight values.

Using the recommended age at weaning of 21 days, recommended subchronic body weights for males and females are 0.48 and 0.40 kg, respectively; the corresponding recommended chronic body weights are 0.843 and 0.728 kg, respectively.

Recommended values are not proposed for the strains of gerbils for which birth and mature body weights are reported (Lane-Peter et al., 1967), because these strains are not generally used in toxicity studies. Such values could be derived easily, if needed, using the approach taken for hamsters. The data reported by Lane-Peter et al. (1967) suggest that different strains of gerbils, like different strains of many other species, can vary markedly in body weight, and that the body weight values recommended above should be used only for the Mongolian gerbil.

3.3. OTHER LABORATORY MAMMALS

3.3.1. Cats. The U.S. EPA has not recommended a reference body weight for cats. A recommended body weight of 3.3 kg has been given by ARS/Sprague-Dawley (1974). Body weight and growth data on cats are summarized in Table 3-9. This table does not include data by Latimer and Ibsen (1932) as cited by Altman and Dittmer (1972). The more recent data are similar to these earlier data and are for greater numbers of animals. Although cats are widely used in experimental research and are among the most common domestic pets, growth data over the 15-year recommended lifespan of the cat have not been documented. This is not a serious limitation because most toxicity studies on cats are conducted over only a small portion of the lifespan of

TABLE 3-9

Growth and Body Weight Data on Cats

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mixed	male	8	NS	4.10000	1.00E0000	Taton et al., 1984
Mixed	male	9	NS	4.10000	1.21E0000	Taton et al., 1984
Mixed	male	6	NS	4.20000	1.44E0000	Taton et al., 1984
Mixed	male	10	NS	4.20000	8.10E-001	Taton et al., 1984
Mixed	male	6	NS	4.30000	1.21E0000	Taton et al., 1984
Mixed	male	6	NS	4.30000	1.21E0000	Taton et al., 1984
Mixed	male	12	NS	4.30000	8.10E-001	Taton et al., 1984
Mixed	male	12	NS	4.40000	8.10E-001	Taton et al., 1984
Mixed	male	6	NS	4.50000	1.21E0000	Taton et al., 1984
Mixed	male	12	NS	4.50000	8.10E-001	Taton et al., 1984
Mixed	male	5	NS	4.60000	1.21E0000	Taton et al., 1984
Mixed	male	5	NS	4.60000	1.44E0000	Taton et al., 1984
Mixed	male	5	NS	4.60000	1.44E0000	Taton et al., 1984
Mixed	both	NS	105	1.20700	NS	Waterhouse and Carver, 1966
Mixed	both	NS	135	1.57700	NS	Waterhouse and Carver, 1966
Mixed	both	NS	165	1.71800	NS	Waterhouse and Carver, 1966
Mixed	both	NS	195	1.89300	NS	Waterhouse and Carver, 1966
Mixed	both	NS	225	2.17500	NS	Waterhouse and Carver, 1966
Mixed	both	NS	270	2.22800	NS	Waterhouse and Carver, 1966
Mixed	both	NS	365	2.57400	NS	Waterhouse and Carver, 1966
Mixed	both	NS	395	2.78100	NS	Waterhouse and Carver, 1966
NS	female	many	1	0.12500	NS	Olovson, 1986
NS	female	many	70	0.99000	NS	Olovson, 1986
NS	female	many	140	2.30000	NS	Olovson, 1986
NS	female	many	210	3.00000	NS	Olovson, 1986
NS	female	many	280	3.10000	NS	Olovson, 1986
NS	female	many	343	3.10000	NS	Olovson, 1986

TABLE 3-9 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
NS	male	many	1	0.12500	NS	Olovson, 1986
NS	male	many	70	1.12500	NS	Olovson, 1986
NS	male	many	140	2.85000	NS	Olovson, 1986
NS	male	many	210	3.80000	NS	Olovson, 1986
NS	male	many	280	4.20000	NS	Olovson, 1986
NS	male	many	343	4.00000	NS	Olovson, 1986
NS	both	70	1	0.10500	2.64E-004	Lane-Peter et al., 1967
NS	both	70	5	0.16700	1.09E-003	Lane-Peter et al., 1967
NS	both	70	10	0.21700	1.48E-003	Lane-Peter et al., 1967
NS	both	70	15	0.26400	1.60E-003	Lane-Peter et al., 1967
NS	both	70	20	0.31000	2.65E-003	Lane-Peter et al., 1967
NS	both	70	25	0.35500	3.97E-003	Lane-Peter et al., 1967
NS	both	70	30	0.39800	4.13E-003	Lane-Peter et al., 1967
NS	both	70	35	0.44200	6.81E-003	Lane-Peter et al., 1967
NS	both	70	40	0.49000	8.24E-003	Lane-Peter et al., 1967
NS	both	70	45	0.54300	9.36E-003	Lane-Peter et al., 1967
NS	both	70	50	0.60400	1.48E-002	Lane-Peter et al., 1967
NS	NS	6	547	3.62000	3.61E-002	Gautier, 1986
NS	NS	6	4	0.17100	1.94E-003	Mortola, 1983
NS	NS	4	2	0.11880	5.04E-005	Mortola, 1984
NS	NS	6	NS	3.25000	5.06E-002	Siafakas et al., 1983

NS = Not specified

the cat. Thus, as with experimental rodents, subchronic and chronic recommended body weights will be based on 90 and 730 days postweaning, using the recommended age at weaning of 49 days.

Recommended growth data for male and female cats are presented in Figures 3-42 and 3-43, respectively. Both curves are based on a combination of the early (day 1-50) growth data given by Lane-Peter et al. (1967) for both sexes combined and the growth data given by Olovson (1986). Olovson (1986) provides detailed growth curves for male and female cats from birth to 49 weeks of age. Representative points are included in Figures 3-42 and 3-43. Female weight begins to plateau by 26 weeks at ~3.0 kg and increases slowly after this period. Male weight peaks after ~40 weeks at 4.2 kg and declines to ~4.0 kg by 49 weeks. These sex-specific patterns are similar to those discussed in Section 3.2. for laboratory rodents. For recommending reference values, Figure 3-42 extends the male weight, assuming that the weight remains at 4.0 kg, and Figure 3-43 extends the female weight, assuming that the weight remains at 3.1 kg.

Using the growth curves from these figures, recommended subchronic body weights for males and females are 1.72 and 1.49 kg, respectively, and corresponding chronic body weights are 3.66 and 2.96 kg. The chronic weights bracket the recommended value of 3.3 kg from ARS/Sprague-Dawley (1974). Mature body weights of 4.0 and 3.1 kg are recommended for males and females, respectively.

The body weights reported by Taton et al. (1984), which are for mature male cats, are all higher (by 2.5-15%) than the recommended adult male weight used above. As with other species, substantial variations among populations of animals may be expected.

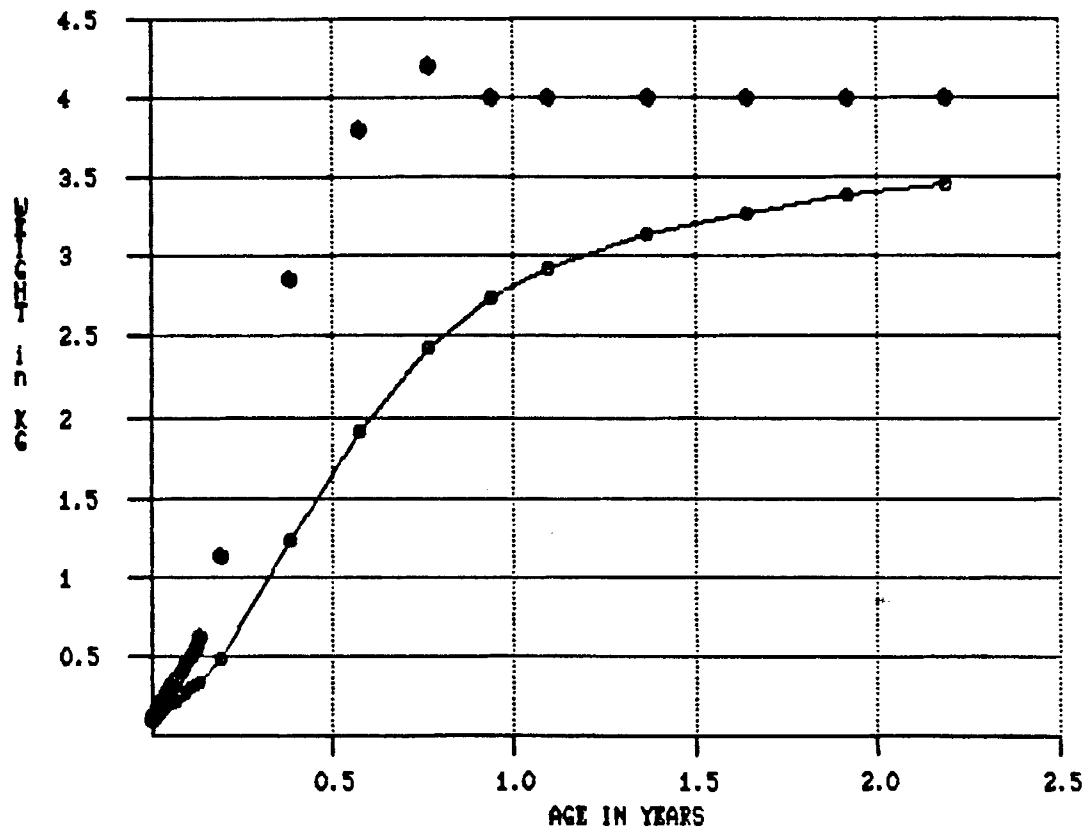


FIGURE 3-42

Recommended Growth Curve for Male Cats

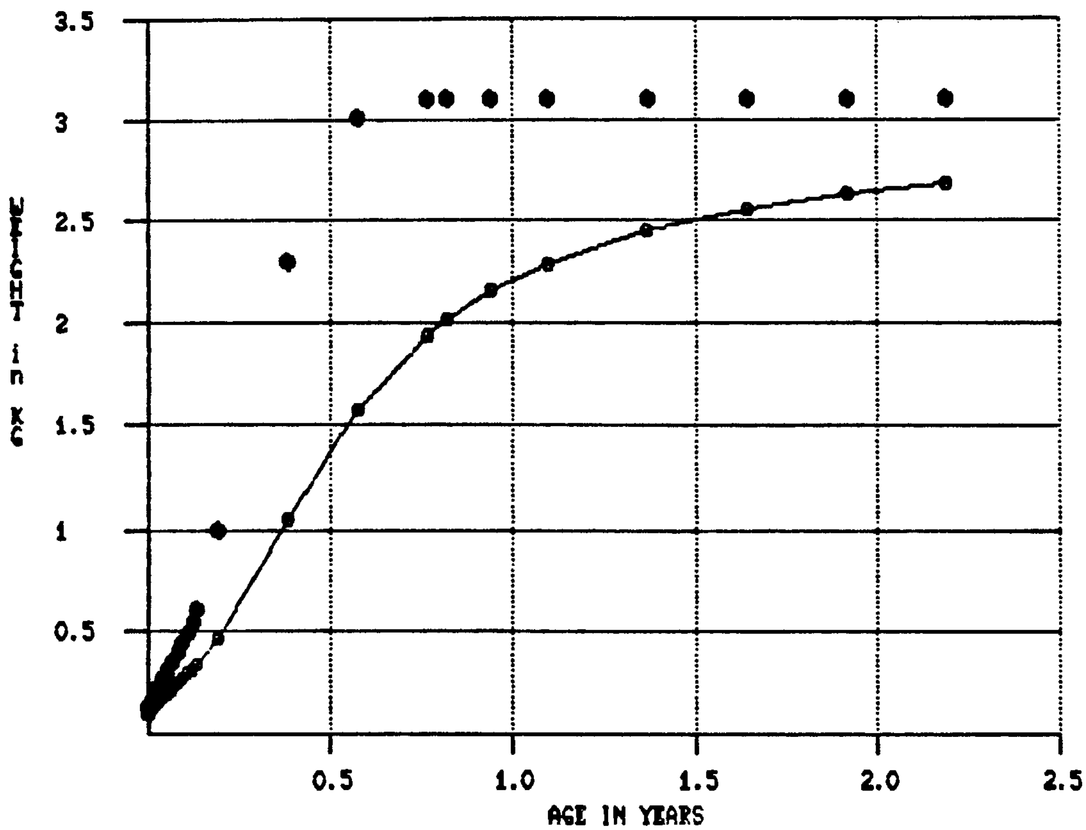


FIGURE 3-43

Recommended Growth Curve for Female Cats

3.3.2. Dogs. The U.S. EPA has not recommended a reference body weight for dogs. Values reported in the literature are 10.0 kg (Lehman, 1959), 12.7 kg (Hertzberg and Dourson, 1983), 14.0 kg (ARS/Sprague-Dawley, 1974) and 14.2 kg (Boxenbaum, 1983).

Body weight and growth data on dogs are summarized in Table 3-10 and plotted in Figure 3-44. To provide better scaling of the graph, Figure 3-44 does not include the 58 kg male mongrel dog reported by Amoroso et al. (1964). The only clear outliers, as illustrated in Figure 3-44, are German Shepards, which are much larger and grow more rapidly than other strains of dogs on which data are available. With this exception, other strains of dogs for which growth data have been reported grow at similar rates and are about the same size as beagles. Since the beagle is by far the most commonly used strain of dog in toxicity studies, this is the only strain for which body weight values will be recommended. Other strain-specific body weights could be derived, based on the data summarized in Table 3-10.

All available growth data on beagle dogs are plotted in Figure 3-45. Much of the apparent scatter, while not atypical for growth data, is eliminated by excluding data where sex is not specified or where data on both sexes are combined. With these exclusions, the only outlying data are that reported by Mauderly (1974), which give lower weights for male and female beagles than would be expected, based on the data given in other reports. Thus, the data reported by Mauderly (1974) are not used in recommending values for risk assessment.

Recommended growth curves for male and female beagle dogs are presented in Figures 3-46 and 3-47, respectively. Both of these curves are based on a combination of the data reported by Altman and Dittmer (1974), NAS (1971) and Worden et al. (1975). Although the first two of these publications are

TABLE 3-10

Growth and Body Weight Data on Dogs

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Airdale	both	4	NS	2.60000	4.00E-002	Arnold and Elvehjem, 1939
Airdale	both	4	NS	6.00000	5.63E-001	Arnold and Elvehjem, 1939
Airdale	both	4	NS	10.50000	5.63E-001	Arnold and Elvehjem, 1939
Airdale	both	4	NS	13.70000	1.82E0000	Arnold and Elvehjem, 1939
Airdale	both	4	NS	15.65000	2.81E0000	Arnold and Elvehjem, 1939
Basenji	male	23	1	0.29000	NR	Altman and Dittmer, 1974
Basenji	male	23	7	0.49000	NR	Altman and Dittmer, 1974
Basenji	male	23	14	0.73000	NR	Altman and Dittmer, 1974
Basenji	male	23	21	0.93000	NR	Altman and Dittmer, 1974
Basenji	male	23	28	1.12000	NR	Altman and Dittmer, 1974
Basenji	male	23	35	1.29000	NR	Altman and Dittmer, 1974
Basenji	male	23	42	1.51000	NR	Altman and Dittmer, 1974
Basenji	male	23	49	1.83000	NR	Altman and Dittmer, 1974
Basenji	male	23	56	2.30000	NR	Altman and Dittmer, 1974
Basenji	male	23	63	2.79000	NR	Altman and Dittmer, 1974
Basenji	male	23	70	3.29000	NR	Altman and Dittmer, 1974
Basenji	male	23	84	4.49000	NR	Altman and Dittmer, 1974
Basenji	male	23	98	5.66000	NR	Altman and Dittmer, 1974
Basenji	male	23	112	6.57000	NR	Altman and Dittmer, 1974
Basenji	female	27	1	0.27000	NR	Altman and Dittmer, 1974
Basenji	female	27	7	0.43000	NR	Altman and Dittmer, 1974
Basenji	female	27	14	0.65000	NR	Altman and Dittmer, 1974
Basenji	female	27	21	0.82000	NR	Altman and Dittmer, 1974
Basenji	female	27	28	0.96000	NR	Altman and Dittmer, 1974
Basenji	female	27	35	1.14000	NR	Altman and Dittmer, 1974
Basenji	female	27	42	1.37000	NR	Altman and Dittmer, 1974
Basenji	female	27	49	1.72000	NR	Altman and Dittmer, 1974
Basenji	female	27	56	2.13000	NR	Altman and Dittmer, 1974
Basenji	female	27	63	2.51000	NR	Altman and Dittmer, 1974
Basenji	female	27	70	2.96000	NR	Altman and Dittmer, 1974
Basenji	female	27	84	3.97000	NR	Altman and Dittmer, 1974
Basenji	female	27	98	4.97000	NR	Altman and Dittmer, 1974
Basenji	female	27	112	5.51000	NR	Altman and Dittmer, 1974
Beagle	female	50	396	8.40000	1.21E0000	Mauderly, 1974
Beagle	female	10	1278	10.00000	1.96E0000	Mauderly, 1974
Beagle	female	35	3375	10.90000	6.25E0000	Mauderly, 1974
Beagle	female	NS	30	1.00000	NS	NAS, 1971
Beagle	female	NS	60	2.70000	NS	NAS, 1971
Beagle	female	NS	90	4.00000	NS	NAS, 1971
Beagle	female	NS	120	5.50000	NS	NAS, 1971

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Beagle	female	NS	180	9.50000	NS	NAS, 1971
Beagle	female	NS	210	9.80000	NS	NAS, 1971
Beagle	female	NS	240	10.00000	NS	NAS, 1971
Beagle	female	7	NS	10.60000	2.03E-001	Romos et al., 1981
Beagle	female	7	NS	10.85000	7.56E-002	Romos et al., 1981
Beagle	female	7	NS	10.90000	1.60E-001	Romos et al., 1981
Beagle	female	7	NS	11.00000	1.22E-001	Romos et al., 1981
Beagle	female	3	NS	11.05000	5.06E-002	Romos et al., 1981
Beagle	female	7	NS	11.40000	9.00E-002	Romos et al., 1981
Beagle	female	7	NS	11.70000	6.25E-002	Romos et al., 1981
Beagle	female	11	NS	11.85000	1.06E-001	Romos et al., 1981
Beagle	female	11	NS	12.00000	1.60E-001	Romos et al., 1981
Beagle	female	7	NS	12.55000	7.56E-002	Romos et al., 1981
Beagle	female	11	NS	12.80000	2.50E-001	Romos et al., 1981
Beagle	female	7	NS	13.45000	1.06E-001	Romos et al., 1981
Beagle	female	7	NS	14.10000	9.00E-002	Romos et al., 1981
Beagle	female	4	120	7.10000	NS	Worden et al., 1975
Beagle	female	4	176	9.20000	NS	Worden et al., 1975
Beagle	female	4	232	10.10000	NS	Worden et al., 1975
Beagle	female	4	288	10.20000	NS	Worden et al., 1975
Beagle	female	4	344	10.50000	NS	Worden et al., 1975
Beagle	female	4	400	10.80000	NS	Worden et al., 1975
Beagle	female	4	456	10.90000	NS	Worden et al., 1975
Beagle	female	4	568	11.80000	NS	Worden et al., 1975
Beagle	female	4	680	11.80000	NS	Worden et al., 1975
Beagle	female	4	792	13.00000	NS	Worden et al., 1975
Beagle	male	50	396	10.00000	NS	Mauderly, 1974
Beagle	male	10	1278	12.00000	1.44E0000	Mauderly, 1974
Beagle	male	NS	30	1.50000	NS	NAS, 1971
Beagle	male	NS	60	3.50000	NS	NAS, 1971
Beagle	male	NS	90	6.00000	NS	NAS, 1971
Beagle	male	NS	120	7.80000	NS	NAS, 1971
Beagle	male	NS	150	9.80000	NS	NAS, 1971
Beagle	male	NS	180	11.00000	NS	NAS, 1971
Beagle	male	NS	210	11.80000	NS	NAS, 1971
Beagle	male	NS	240	12.50000	NS	NAS, 1971
Beagle	male	4	120	7.80000	NS	Worden et al., 1975
Beagle	male	4	176	10.50000	NS	Worden et al., 1975
Beagle	male	4	232	12.20000	NS	Worden et al., 1975
Beagle	male	4	288	12.30000	NS	Worden et al., 1975

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Beagle	male	4	344	12.40000	NS	Worden et al., 1975
Beagle	male	4	400	12.40000	NS	Worden et al., 1975
Beagle	male	4	568	12.90000	NS	Worden et al., 1975
Beagle	male	4	726	12.50000	NS	Worden et al., 1975
Beagle	male	4	792	12.70000	NS	Worden et al., 1975
Beagle	both	4	180	6.40000	NS	Borzelleca et al., 1964
Beagle	both	4	271	9.60000	NS	Borzelleca et al., 1964
Beagle	both	4	362	9.90000	NS	Borzelleca et al., 1964
Beagle	both	4	453	10.40000	NS	Borzelleca et al., 1964
Beagle	both	4	545	9.90000	NS	Borzelleca et al., 1964
Beagle	both	4	635	9.60000	NS	Borzelleca et al., 1964
Beagle	both	4	726	10.00000	NS	Borzelleca et al., 1964
Beagle	both	4	817	10.70000	NS	Borzelleca et al., 1964
Beagle	both	4	908	11.30000	NS	Borzelleca et al., 1964
Beagle	both	100	396	9.10000	1.96E0000	Mauderly, 1974
Beagle	both	20	1278	11.10000	2.25E0000	Mauderly, 1974
Beagle	both	12	364	9.00000	2.89E0000	Mauderly et al., 1979
Beagle	NS	NS	1	0.30000	NS	NAS, 1971
Beagle	NS	NS	61	2.80000	NS	NAS, 1971
Beagle	NS	NS	122	5.30000	6.25E-002	NAS, 1971
Beagle	NS	NS	183	7.15000	3.06E-002	NAS, 1971
Beagle	NS	NS	243	8.25000	5.06E-002	NAS, 1971
Beagle	NS	NS	304	9.30000	1.00E-002	NAS, 1971
Beagle	NS	NS	365	9.80000	2.25E-002	NAS, 1971
Beagle	NS	39	210	9.10000	1.69E0000	Pickrell et al., 1971
Beagle	male	39	1	0.31000	NR	Altman and Dittmer, 1974
Beagle	male	39	7	0.55000	NR	Altman and Dittmer, 1974
Beagle	male	39	14	0.80000	NR	Altman and Dittmer, 1974
Beagle	male	39	21	1.08000	NR	Altman and Dittmer, 1974
Beagle	male	39	28	1.30000	NR	Altman and Dittmer, 1974
Beagle	male	39	35	1.67000	NR	Altman and Dittmer, 1974
Beagle	male	39	42	2.05000	NR	Altman and Dittmer, 1974
Beagle	male	39	49	2.51000	NR	Altman and Dittmer, 1974
Beagle	male	39	56	2.95000	NR	Altman and Dittmer, 1974
Beagle	male	39	63	3.31000	NR	Altman and Dittmer, 1974
Beagle	male	39	70	3.81000	NR	Altman and Dittmer, 1974
Beagle	male	39	84	4.80000	NR	Altman and Dittmer, 1974
Beagle	male	39	98	5.71000	NR	Altman and Dittmer, 1974
Beagle	male	39	112	6.52000	NR	Altman and Dittmer, 1974

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Beagle	female	31	1	0.30000	NR	Altman and Dittmer, 1974
Beagle	female	31	7	0.52000	NR	Altman and Dittmer, 1974
Beagle	female	31	14	0.77000	NR	Altman and Dittmer, 1974
Beagle	female	31	21	1.02000	NR	Altman and Dittmer, 1974
Beagle	female	31	28	1.26000	NR	Altman and Dittmer, 1974
Beagle	female	31	35	1.50000	NR	Altman and Dittmer, 1974
Beagle	female	31	42	1.82000	NR	Altman and Dittmer, 1974
Beagle	female	31	49	2.24000	NR	Altman and Dittmer, 1974
Beagle	female	31	56	2.63000	NR	Altman and Dittmer, 1974
Beagle	female	31	63	2.98000	NR	Altman and Dittmer, 1974
Beagle	female	31	70	3.36000	NR	Altman and Dittmer, 1974
Beagle	female	31	84	4.34000	NR	Altman and Dittmer, 1974
Beagle	female	31	98	5.10000	NR	Altman and Dittmer, 1974
Beagle	female	31	112	5.75000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	1	0.24000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	7	0.41000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	14	0.62000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	21	0.80000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	28	1.04000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	35	1.35000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	42	1.82000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	49	2.28000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	56	2.83000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	63	3.27000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	70	3.78000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	84	4.88000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	98	5.93000	NR	Altman and Dittmer, 1974
Cocker Spaniel	male	31	112	6.82000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	1	0.24000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	7	0.41000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	14	0.62000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	21	0.80000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	28	1.04000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	35	1.35000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	42	1.74000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	49	2.14000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	56	2.56000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	63	2.95000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	70	3.39000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	84	4.27000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	98	5.08000	NR	Altman and Dittmer, 1974
Cocker Spaniel	female	37	112	5.77000	NR	Altman and Dittmer, 1974

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
German Shepherd	male	22	1	0.49000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	7	0.87000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	14	1.43000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	21	2.06000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	28	2.95000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	35	3.88000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	42	5.00000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	49	NS	NR	Altman and Dittmer, 1974
German Shepherd	male	22	56	11.50000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	63	NS	NR	Altman and Dittmer, 1974
German Shepherd	male	22	70	16.00000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	84	20.00000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	98	24.50000	NR	Altman and Dittmer, 1974
German Shepherd	male	22	112	28.25000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	1	NS	NR	Altman and Dittmer, 1974
German Shepherd	female	14	7	0.50000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	14	0.89000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	21	1.46000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	28	2.02000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	35	2.84000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	42	3.77000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	49	4.52000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	56	13.00000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	63	NS	NR	Altman and Dittmer, 1974
German Shepherd	female	14	70	17.00000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	84	20.75000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	98	24.00000	NR	Altman and Dittmer, 1974
German Shepherd	female	14	114	27.25000	NR	Altman and Dittmer, 1974
Great Dane	both	2	NS	5.78000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	11.50000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	18.40000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	24.00000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	30.20000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	34.20000	NS	Arnold and Elvehjem, 1939
Great Dane	both	2	NS	39.00000	NS	Arnold and Elvehjem, 1939
Mongrel	female	1	3650	13.50000	NS	Amoroso et al., 1964
Mongrel	male	1	1460	59.00000	NS	Amoroso et al., 1964
Mongrel	female	7	NS	15.90000	NS	Golob et al., 1977
Mongrel	female	7	NS	15.90000	NS	Golob et al., 1977
NS	both	8	NS	24.00000	6.40E0001	Brown et al., 1984

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
NS	NS	6	4	0.49800	1.19E-002	Mortola, 1983
NS	NS	3	1	0.29720	4.62E-004	Mortola, 1984
Shetland Sheepdog	male	15	1	0.21000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	7	0.39000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	14	0.58000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	21	0.76000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	28	1.04000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	35	1.47000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	42	1.92000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	49	2.42000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	56	2.92000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	63	3.44000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	70	3.92000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	84	4.96000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	98	5.93000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	male	15	112	6.96000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	1	0.20000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	7	0.36000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	14	0.55000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	21	0.73000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	28	0.97000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	35	1.27000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	42	1.67000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	49	2.06000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	56	2.44000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	63	2.83000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	70	3.23000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	84	4.04000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	98	4.86000	NR	Altman and Dittmer, 1974
Shetland Sheepdog	female	14	112	5.67000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	1	0.19000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	7	0.37000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	14	0.57000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	21	0.77000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	28	1.01000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	35	1.26000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	42	1.59000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	49	1.94000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	56	2.25000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	63	2.55000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	70	2.94000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	84	3.73000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	98	4.45000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	male	21	112	5.14000	NR	Altman and Dittmer, 1974

TABLE 3-10 (cont.)

Species	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Wire Haired Fox Terrier	female	23	1	0.19000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	7	0.38000	NR	Altman and Dittmer, 1974
Short Haired Fox Terrier	female	23	14	0.56000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	21	0.74000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	28	0.96000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	35	1.20000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	42	1.48000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	49	1.79000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	56	2.10000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	63	2.37000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	70	2.71000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	84	3.42000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	98	4.02000	NR	Altman and Dittmer, 1974
Wire Haired Fox Terrier	female	23	112	4.59000	NR	Altman and Dittmer, 1974

NS = Not specified; NR = not reported

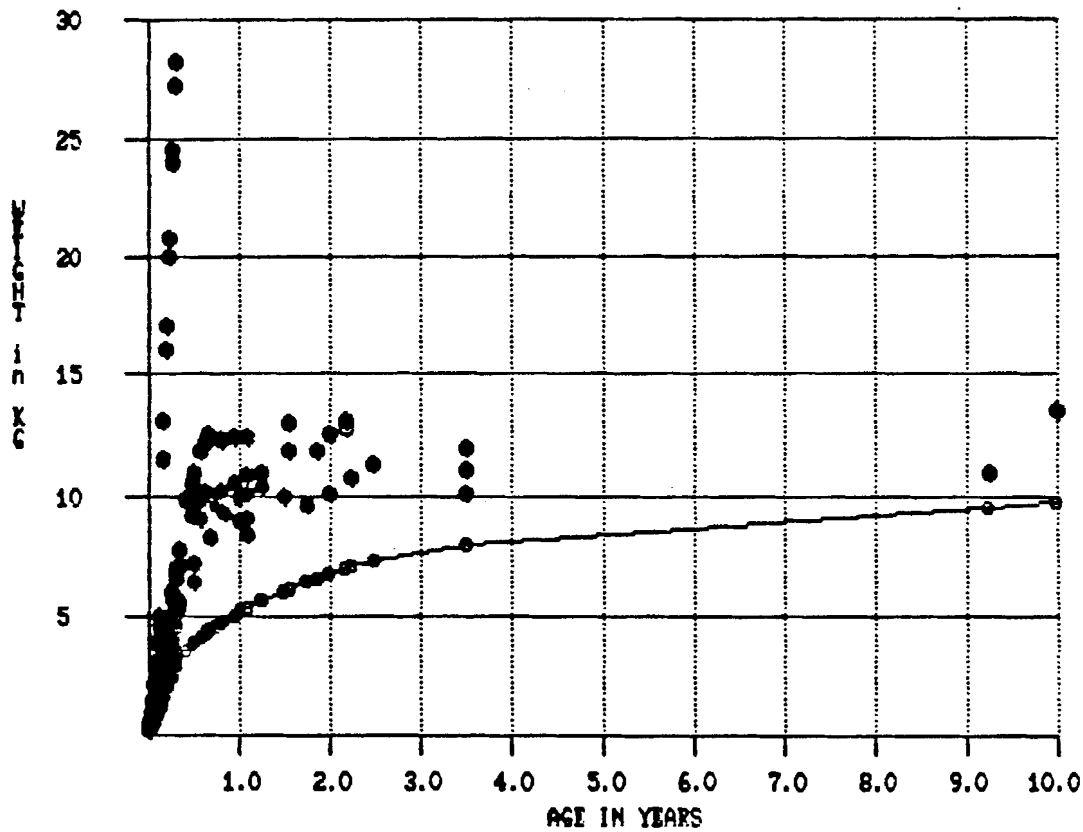


FIGURE 3-44

Growth Data on Dogs

(See Table 3-10 for data points and references)

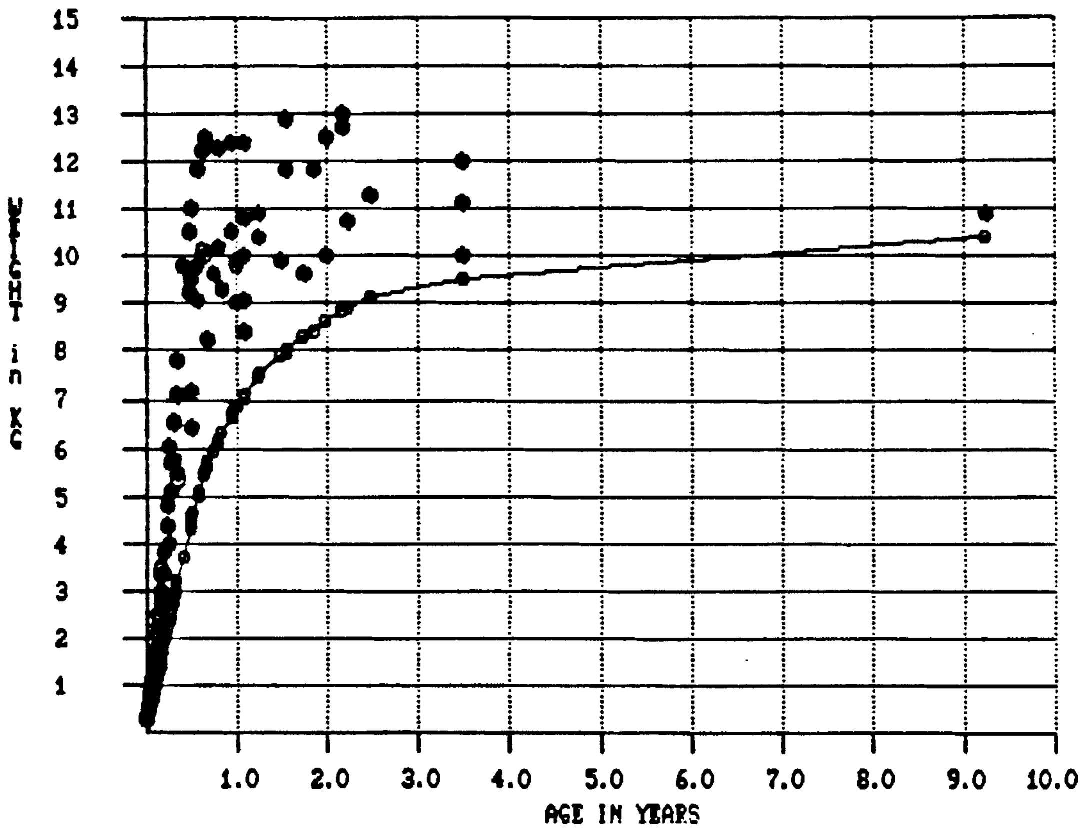


FIGURE 3-45

Growth Data on Beagle Dogs

(All data reported in Table 3-10)

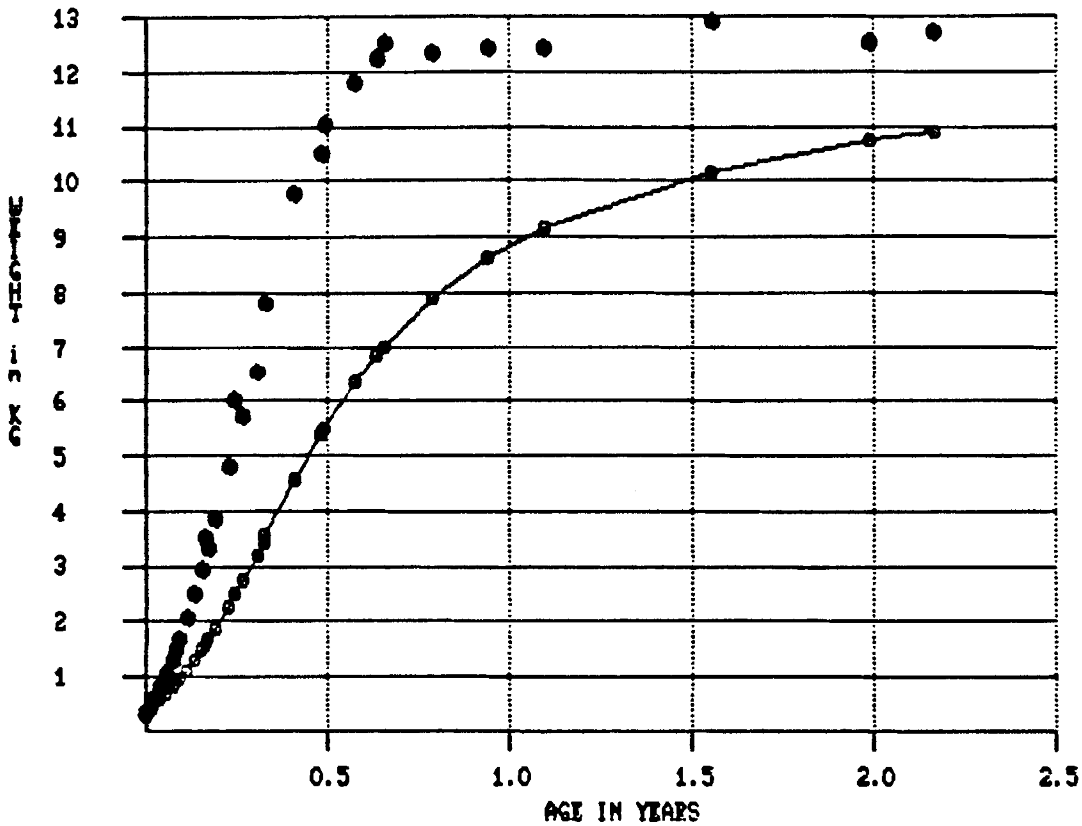


FIGURE 3-46

Recommended Growth Curve for Male Beagle Dogs

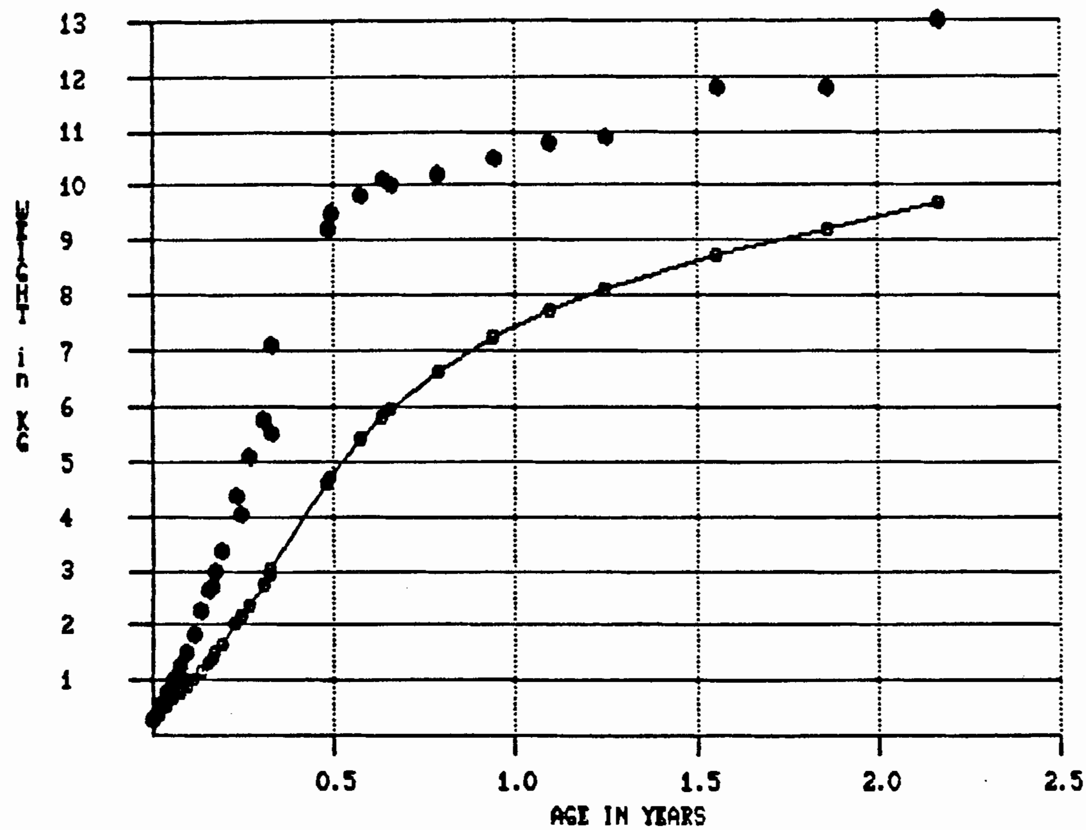


FIGURE 3-47

Recommended Growth Curve for Female Beagle Dogs secondary sources, they appear to be based on different sets of data that are nonetheless remarkably consistent. As with cats and rodents, sex-specific differences in growth patterns are evident. Male beagles grow more rapidly than females, and the growth of males shows a definite plateau after ~7 months, while the growth rate of females slows, but does not plateau, at about the same time.

Growth data are not available over the 15-year recommended lifespan of the beagle. Because toxicity studies on beagles seldom encompass the lifespan, recommended subchronic and chronic body weights will be based on 90 and 730 days postweaning, as was done with cats and experimental rodents, using the recommended age for beagles at weaning of 42 days.

Using the growth curves for Figures 3-46 and 3-47, recommended subchronic body weights for male and female beagles are 2.4 and 1.97 kg, respectively, and the corresponding chronic body weights are 10.8 and 10.1 kg. For deriving recommended body weights over a greater portion of the lifespan, mature body weights of 14 kg for both male and female beagles are proposed.

3.3.3. Rabbits. The U.S. EPA has not recommended a reference body weight for rabbits. Growth and body weight data on rabbits are summarized in Table 3-11 and plotted in Figure 3-48. Other body weights reported in the literature include 3.7 kg (ARS/Sprague-Dawley, 1974), 2.0 kg (Lehman, 1959) and 2.55 kg (Boxenbaum, 1983).

Body weights for rabbits (Sanford, 1979) are somewhat lower than most other weights for rabbits of comparable ages. The weights for the 46- and 82-day-old Dutch rabbits (Arrington et al., 1974) are consistent with the growth data given by Sanford (1979), and the weights of Dutch rabbits (age not specified) (Cizek, 1961) are all well below the mature weights reported

TABLE 3-11

Growth and Body Weight Data on Rabbits

Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Albino+CB	NS	11	NS	2.80000	NS	Bruce, 1950
California	both	20	1	0.05000	NS	Gaman et al., 1970
California	both	20	7	0.14000	NS	Gaman et al., 1970
California	both	20	14	0.22500	NS	Gaman et al., 1970
California	both	20	21	0.30000	NS	Gaman et al., 1970
California	both	20	28	0.50000	NS	Gaman et al., 1970
California	both	20	35	0.77000	NS	Gaman et al., 1970
California	both	20	42	0.97500	NS	Gaman et al., 1970
California	both	9	42	1.10000	NS	Gaman et al., 1970
California	both	9	56	1.45000	NS	Gaman et al., 1970
California	both	18	56	1.45000	NS	Gaman et al., 1970
California	both	18	63	1.52500	NS	Gaman et al., 1970
California	both	18	70	1.77500	NS	Gaman et al., 1970
California	both	9	70	1.95000	NS	Gaman et al., 1970
California	both	18	77	2.00000	NS	Gaman et al., 1970
California	both	9	84	2.20000	NS	Gaman et al., 1970
Dutch	female	6	NS	1.79000	NS	Cizek, 1961
Dutch	female	6	NS	1.89000	NS	Cizek, 1961
Dutch	female	6	NS	1.96000	NS	Cizek, 1961
Dutch	female	6	NS	2.07000	NS	Cizek, 1961
Dutch	female	6	NS	2.13000	NS	Cizek, 1961
Dutch	female	12	NS	2.16500	2.83E-001	Cizek, 1961
Dutch	female	6	NS	2.19000	NS	Cizek, 1961
Dutch	female	6	NS	2.28000	NS	Cizek, 1961
Dutch	female	6	NS	2.29000	NS	Cizek, 1961
Dutch	female	6	NS	2.30000	NS	Cizek, 1961
Dutch	female	6	NS	2.32000	NS	Cizek, 1961
Dutch	female	12	NS	2.57100	2.41E-001	Cizek, 1961
Dutch	male	12	NS	1.79900	7.39E-002	Cizek, 1961
Dutch	male	6	NS	1.91000	NS	Cizek, 1961
Dutch	male	6	NS	1.95000	NS	Cizek, 1961
Dutch	male	12	NS	2.00200	1.73E-001	Cizek, 1961
Dutch	male	6	NS	2.09000	NS	Cizek, 1961
Dutch	male	6	NS	2.16000	NS	Cizek, 1961
Dutch	male	6	NS	2.19000	NS	Cizek, 1961
Dutch	male	6	NS	2.20000	NS	Cizek, 1961
Dutch	male	6	NS	2.22000	NS	Cizek, 1961
Dutch	male	6	NS	2.23000	NS	Cizek, 1961
Dutch	male	6	NS	2.23000	NS	Cizek, 1961
Dutch	male	6	NS	2.27000	NS	Cizek, 1961

TABLE 3-11 (cont.)

Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Dutch	both	24	46	0.88100	NS	Arrington et al., 1974
Dutch	both	24	82	1.40000	NS	Arrington et al., 1974
Dutch	NS	22	NS	2.10000	NS	Bruce, 1950
Himalayan	NS	16	NS	1.90000	NS	Bruce, 1950
Lop Eared	NS	10	NS	3.50000	NS	Bruce, 1950
New Zealand White	female	10	NS	2.40000	4.00E-002	Barbee et al., 1984
New Zealand White	female	10	NS	2.80000	4.00E-002	Barbee et al., 1984
New Zealand White	female	10	NS	3.30000	4.00E-002	Barbee et al., 1984
New Zealand White	female	10	NS	3.40000	9.00E-002	Barbee et al., 1984
New Zealand White	female	10	NS	3.80000	9.00E-002	Barbee et al., 1984
New Zealand White	male	10	NS	3.20000	4.00E-002	Barbee et al., 1984
New Zealand White	male	10	NS	3.50000	4.00E-002	Barbee et al., 1984
New Zealand White	male	10	NS	3.60000	4.00E-002	Barbee et al., 1984
New Zealand White	male	10	NS	3.90000	9.00E-002	Barbee et al., 1984
New Zealand White	male	10	NS	2.90000	1.00E-002	Barbee et al., 1984
New Zealand White	both	many	1	0.06500	NR	Altman and Dittmer, 1974
New Zealand White	both	many	7	0.14600	NR	Altman and Dittmer, 1974
New Zealand White	both	many	14	0.26000	NR	Altman and Dittmer, 1974
New Zealand White	both	many	21	0.35700	NR	Altman and Dittmer, 1974
New Zealand White	both	many	28	0.58300	NR	Altman and Dittmer, 1974
New Zealand White	both	many	35	0.91600	NR	Altman and Dittmer, 1974
New Zealand White	both	many	42	1.25000	NR	Altman and Dittmer, 1974
New Zealand White	both	many	49	1.56000	NR	Altman and Dittmer, 1974
New Zealand White	both	many	56	1.75000	NR	Altman and Dittmer, 1974
New Zealand White	both	9	98	3.00000	4.00E-002	Mauderly et al., 1979
New Zealand White	both	13	7	0.10200	2.56E-006	Spencer et al., 1985
New Zealand White	both	12	14	0.17800	9.00E-006	Spencer et al., 1985
New Zealand White	both	21	21	0.29900	2.60E-005	Spencer et al., 1985
New Zealand White	male	NS	56	1.95000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	70	2.32000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	84	2.67000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	98	2.98000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	112	3.13000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	136	3.30000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	150	3.45000	NR	Altman and Dittmer, 1974

TABLE 3-11 (cont.)

Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
New Zealand White	male	NS	164	3.53000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	178	3.61000	NR	Altman and Dittmer, 1974
New Zealand White	male	NS	192	3.73000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	56	2.04000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	70	2.37000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	84	2.72000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	98	3.05000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	112	3.26000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	136	3.49000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	150	3.70000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	164	3.85000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	178	4.00000	NR	Altman and Dittmer, 1974
New Zealand White	female	NS	192	4.08000	NR	Altman and Dittmer, 1974
New Zealand	male	25	52	1.95000	NS	Templeton, 1968
New Zealand	male	25	59	2.00000	NS	Templeton, 1968
New Zealand	male	25	73	2.36000	NS	Templeton, 1968
New Zealand	male	25	87	2.77000	NS	Templeton, 1968
New Zealand	male	25	101	3.09000	NS	Templeton, 1968
New Zealand	male	25	115	3.18000	NS	Templeton, 1968
New Zealand	male	25	129	3.32000	NS	Templeton, 1968
New Zealand	male	25	143	3.41000	NS	Templeton, 1968
New Zealand	male	25	157	3.52000	NS	Templeton, 1968
New Zealand	male	25	171	3.59000	NS	Templeton, 1968
New Zealand	female	13	52	2.04000	NS	Templeton, 1968
New Zealand	female	13	59	2.23000	NS	Templeton, 1968
New Zealand	female	13	73	2.41000	NS	Templeton, 1968
New Zealand	female	13	87	2.86000	NS	Templeton, 1968
New Zealand	female	13	101	3.18000	NS	Templeton, 1968
New Zealand	female	13	115	3.27000	NS	Templeton, 1968
New Zealand	female	13	129	3.59000	NS	Templeton, 1968
New Zealand	female	13	143	3.73000	NS	Templeton, 1968
New Zealand	female	13	157	3.91000	NS	Templeton, 1968
New Zealand	female	13	171	4.05000	NS	Templeton, 1968
New Zealand	female	13	186	4.08000	NS	Templeton, 1968
NS	both	NS	56	0.96500	NS	Sanford, 1979
NS	both	NS	70	1.28000	NS	Sanford, 1979
NS	both	NS	84	1.62000	NS	Sanford, 1979
NS	both	NS	112	2.10000	NS	Sanford, 1979
NS	both	NS	126	2.27000	NS	Sanford, 1979
NS	both	NS	140	2.41000	NS	Sanford, 1979
NS	both	NS	154	2.67000	NS	Sanford, 1979

TABLE 3-11 (cont.)

Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
NS	NS	NS	42	1.00000	NS	Davidson and Spreadbury, 1975
NS	NS	NS	53	1.50000	NS	Davidson and Spreadbury, 1975
NS	NS	NS	63	2.00000	NS	Davidson and Spreadbury, 1975
NS	NS	7	11	0.18300	1.76E-003	Fisher and Mortola, 1981
NS	NS	NS	NS	2.50000	NS	Kennaway, 1943
NS	NS	NS	NS	2.50000	NS	Kennaway, 1943
NS	NS	NS	NS	2.50000	NS	Kennaway, 1943
NS	NS	NS	NS	2.40000	NS	Lane-Peter et al., 1967
NS	NS	9	4	0.10200	1.37E-000	Mortola, 1983
NS	NS	4	2	0.07930	3.20E-004	Mortola, 1984
Several	NS	59	NS	2.40000	NS	Bruce, 1950
Wild	female	3	NS	1.30000	2.50E-003	Boyd, 1985
Wild	female	3	NS	1.60000	2.50E-003	Boyd, 1985
Wild	female	40	1	0.03500	1.21E-006	Boyd, 1985
Wild	male	2	NS	1.55000	6.25E-004	Boyd, 1985
Wild	male	2	NS	1.70000	2.50E-003	Boyd, 1985
Wild	male	55	1	0.03700	6.40E-007	Boyd, 1985

NS = Not specified; NR = not reported

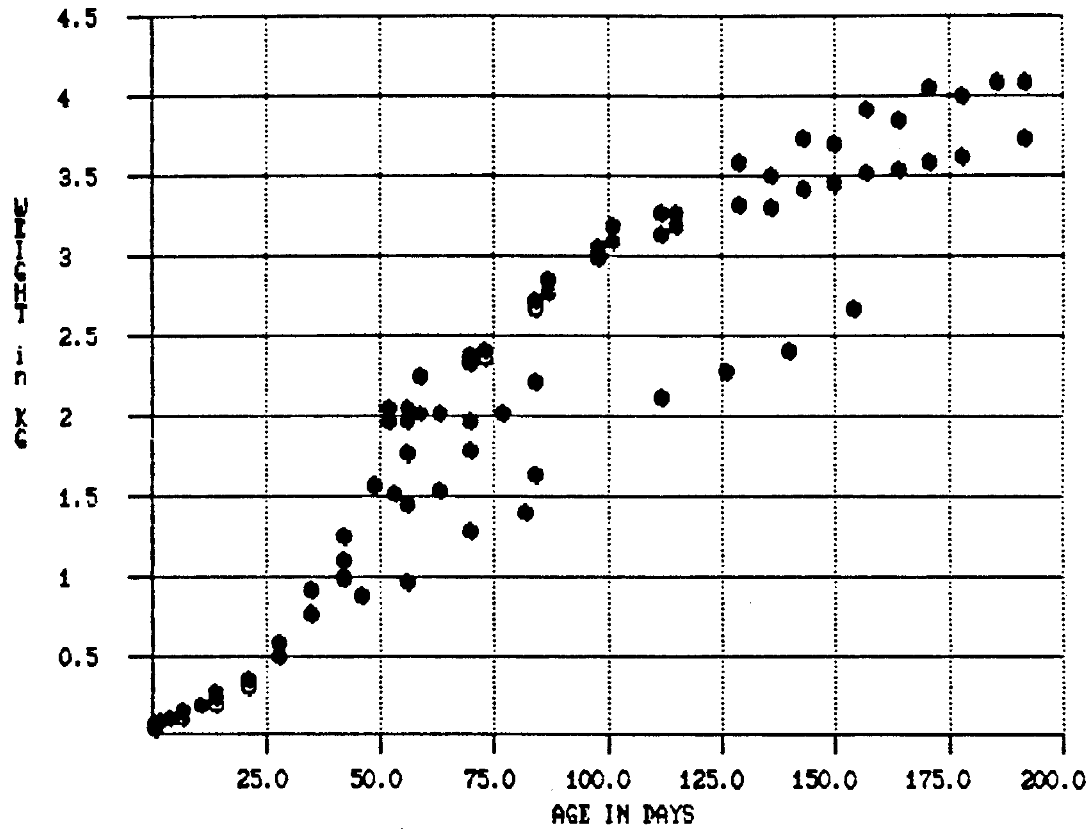


FIGURE 3-48

Growth Data on Rabbits

(See Table 3-11 for points and references)

for New Zealand White rabbits. This suggests that the growth data on New Zealand White rabbits may not be appropriate for estimating the growth of Dutch rabbits. Based on the report by Gaman et al. (1970), California rabbits appear to be somewhat lighter than New Zealand White rabbits. Since the New Zealand White rabbit is by far the most commonly used strain of rabbit in toxicity studies, recommended body weights will be proposed only for this strain.

Recommended growth curves for male and female New Zealand White rabbits are given in Figures 3-49 and 3-50, respectively. These figures both use the early growth data reported by Altman and Dittmer (1974) and Spencer et al. (1985) for males and females combined, as well as the sex-specific growth data reported by Altman and Dittmer (1974) and Templeton (1968) for older animals. The sex-specific growth data reported by Altman and Dittmer (1974) are attributed to unpublished data from Templeton (1968), are similar to the data reported directly by Templeton (1968), and may be for the same group of animals.

As with cats and dogs, growth data are not available over the reference lifespan of 6 years for rabbits. Since toxicity studies are rarely conducted over the lifespan of rabbits, subchronic and chronic body weights will be recommended for periods of 90 days and 730 days postweaning, respectively, using a recommended age at weaning of 56 days. The growth curves are extended by assuming mature adult weights of 4.0 and 4.2 kg for males and females, respectively. Using these assumptions and the growth curve given in Figure 3-49, the recommended chronic and subchronic body weights for the male New Zealand rabbit are 2.86 and 3.76 kg, respectively. The corresponding values for female New Zealand White rabbits are 3.1 and 3.93 kg, based on the same assumptions and the growth curve given in Figure 3-50.

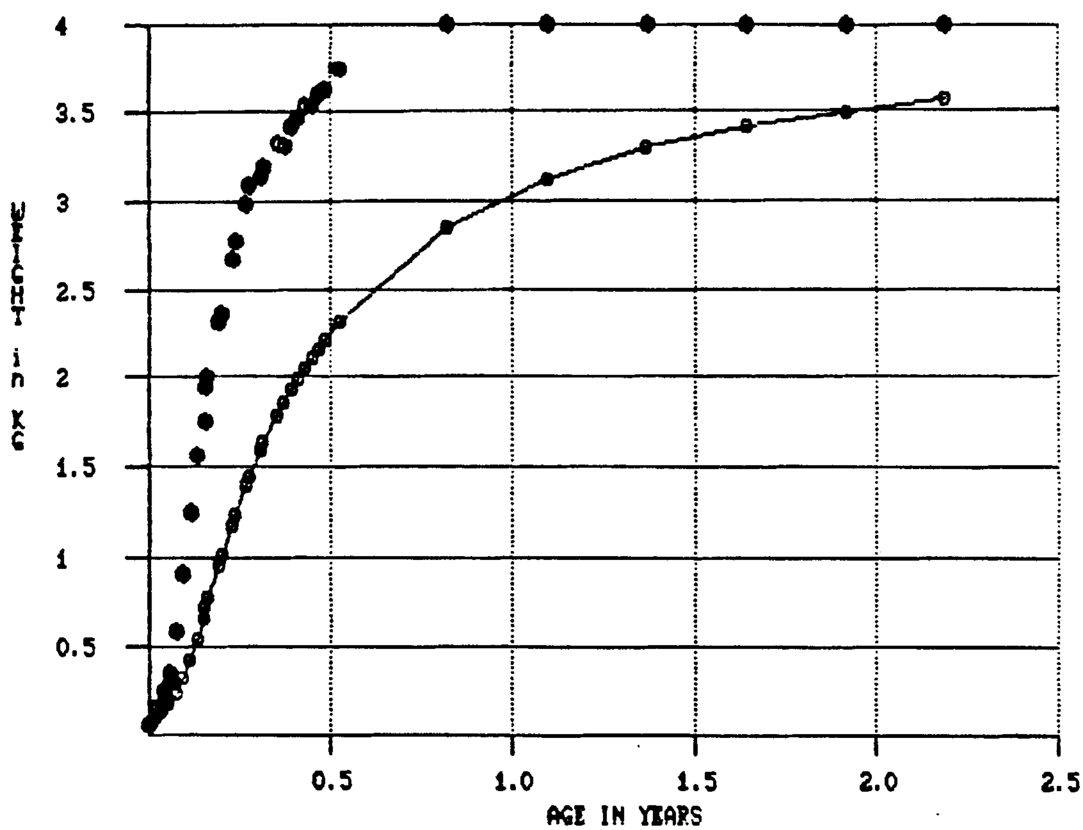


FIGURE 3-49

Recommended Growth Curve for Male New Zealand White Rabbits

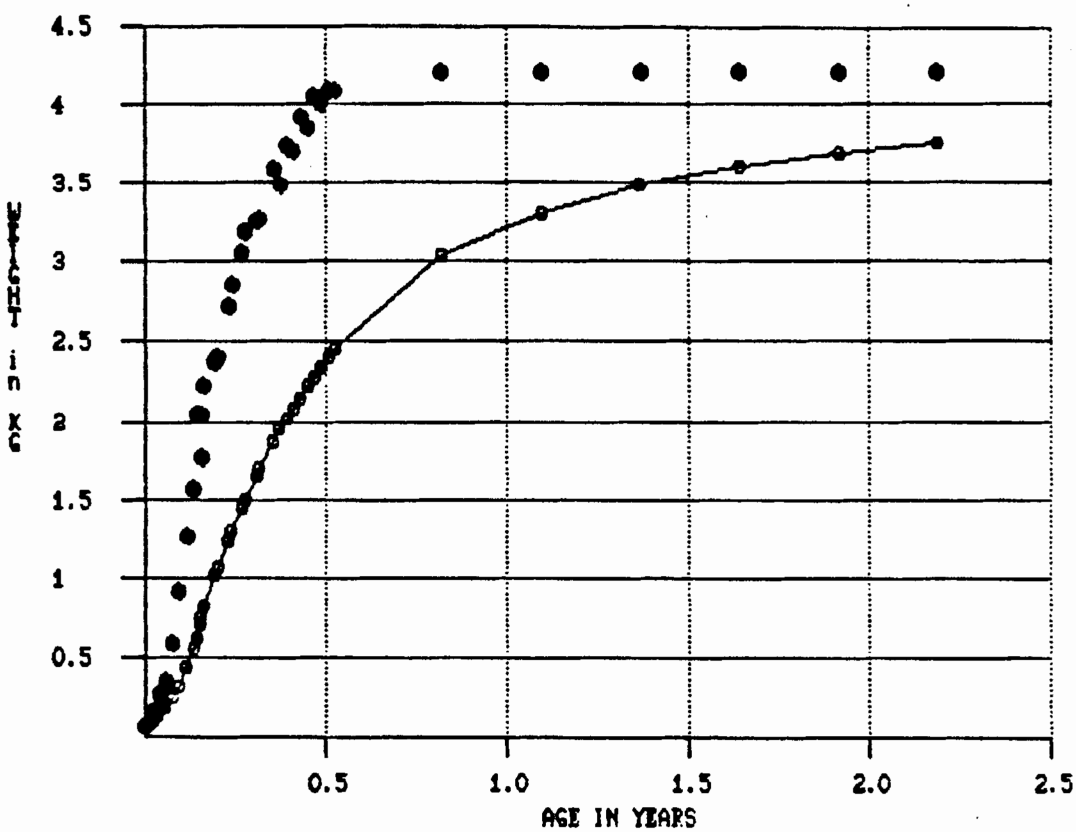


FIGURE 3-50

Recommended Growth Curve for Female New Zealand White Rabbits

3.4. LIVESTOCK

Body and growth data on livestock are summarized in Table 3-12. Body weight data on most strains of livestock are provided primarily to facilitate the demonstration of allometric relationships discussed in subsequent sections of this report. Nonetheless, information on the body weights and consumption patterns of livestock may be useful in risk assessments when an attempt is made to estimate doses in cases of accidental exposure of livestock to toxicants.

3.4.1. Cattle. Growth data on all strains of cattle presented in Table 3-12 are plotted in Figure 3-51. Hereford cattle are clear outliers that reach a mature body weight of ~1200 kg, and the data on this breed are presented separately in Figure 3-52. Other breeds of cattle on which data are available reach mature body weights of ~400-550 kg. Data on these strains are summarized in Figure 3-53. Because cattle are not used in toxicity studies, recommended body weights other than mature body weights are not derived.

3.4.2. Chickens. Growth data on all strains of chickens summarized in Table 3-12 are plotted in Figure 3-54. The variability in the body weights and growth rates of chickens appears to be greater than in most other species of animals included in this report. The smallest strains are crosses of "desi" and White Leghorn strains reported in the Indian literature (Sah et al., 1984) and an unspecified strain of broiler chicken reported in the Eastern European literature (Knizetove et al., 1985). The largest and fastest growing stain on which data are available is the Ross broiler (Prescott et al., 1985).

TABLE 3-12

Growth and Body Weight Data on Livestock

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Cattle	Guernsey, fg	female	1	1460	460.00000	NS	Amoroso et al., 1964
Cattle	Guernsey, fg	female	1	2920	410.00000	NS	Amoroso et al., 1964
Cattle	Jersey	female	1	730	340.00000	NS	Amoroso et al., 1964
Cattle	Several	male	many	112	94.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	140	111.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	158	133.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	186	159.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	224	184.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	252	210.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	276	256.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	280	233.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	336	278.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	364	299.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	392	319.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	420	338.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	448	358.00000	NS	Taylor et al., 1986
Cattle	Several	male	many	476	376.00000	NS	Taylor et al., 1986
Cattle	Ayrshire	female	NS	300	200.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	600	300.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	900	360.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	1200	400.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	1500	425.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	1800	440.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	2100	450.00000	NS	Campbell and Lasley, 1975
Cattle	Ayrshire	female	NS	3600	455.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	360	780.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	720	860.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	1080	960.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	1440	1030.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	1800	1100.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	2160	1140.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	2520	1150.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	2880	1160.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	3240	1155.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	3600	1140.00000	NS	Campbell and Lasley, 1975
Cattle	Hereford	female	NS	3960	1095.00000	NS	Campbell and Lasley, 1975

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Cattle	Holstein	female	NS	300	225.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	600	355.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	900	425.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	1200	475.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	1500	505.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	1800	525.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	2100	535.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	2700	540.00000	NS	Campbell and Lasley, 1975
Cattle	Holstein	female	NS	3600	550.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	300	200.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	600	280.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	900	340.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	1200	370.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	1500	390.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	1800	415.00000	NS	Campbell and Lasley, 1975
Cattle	Jersey	female	NS	3600	420.00000	NS	Campbell and Lasley, 1975
Cattle	NS	NS	20	4	44.20000	NS	Kertz et al., 1984
Cattle	NS	NS	20	11	44.43000	NS	Kertz et al., 1984
Cattle	NS	NS	20	18	44.11000	NS	Kertz et al., 1984
Cattle	NS	NS	20	25	47.20000	NS	Kertz et al., 1984
Cattle	NS	NS	20	31	52.65000	NS	Kertz et al., 1984
Chicken	Broiler	female	32	120	0.45000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	180	0.60000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	240	1.10000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	360	2.15000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	480	2.95000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	600	3.50000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	660	3.65000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	720	3.75000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	780	3.80000	NS	Knizetova et al., 1985
Chicken	Broiler	female	32	840	3.80000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	120	0.45000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	180	0.75000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	240	1.20000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	360	2.60000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	480	4.00000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	660	4.80000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	720	5.05000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	780	5.20000	NS	Knizetova et al., 1985
Chicken	Broiler	male	11	840	5.25000	NS	Knizetova et al., 1985

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Chicken	Cornish	female	NS	1	0.03200	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	7	0.05900	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	14	0.10500	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	21	0.17200	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	28	0.25600	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	35	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	42	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	49	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	56	0.63600	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	63	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	70	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	84	1.04500	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	98	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	112	1.31800	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	126	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	female	NS	140	1.54500	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	1	0.03200	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	7	0.05900	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	14	0.10900	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	21	0.18200	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	28	0.26800	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	35	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	42	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	49	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	56	0.72700	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	63	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	70	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	84	1.27200	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	98	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	112	1.72700	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	126	NS	NS	Altman and Dittmer, 1974
Chicken	Cornish	male	NS	140	2.09100	NS	Altman and Dittmer, 1974
Chicken	I/I+ C+/-	both	135	42	0.55590	NS	Fox and Smyth, 1985
Chicken	I/I+ C+/-	both	135	56	0.81510	NS	Fox and Smyth, 1985
Chicken	I/I+ c/c	both	123	42	0.45740	NS	Fox and Smyth, 1985
Chicken	I/I+ c/c	both	123	56	0.80490	NS	Fox and Smyth, 1985
Chicken	I+/I+ C+/-	both	123	42	0.57040	NS	Fox and Smyth, 1985
Chicken	I+/I+ c/c	both	121	42	0.53280	NS	Fox and Smyth, 1985
Chicken	I+/I+ c/c	both	121	56	0.78600	NS	Fox and Smyth, 1985
Chicken	I+/I+ C+/-	both	123	56	0.84170	NS	Fox and Smyth, 1985

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Chicken	New Hampshire	female	NS	1	0.03600	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	7	0.08200	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	14	0.15400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	21	0.25000	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	28	0.36300	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	35	0.50400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	42	0.64000	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	49	0.80700	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	56	0.94800	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	63	1.10700	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	70	1.28400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	84	1.55100	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	98	1.82800	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	112	2.01900	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	126	2.25400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	female	NS	140	2.30900	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	1	0.04100	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	7	0.08600	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	14	0.15400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	21	0.27200	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	28	0.40400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	35	0.56300	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	42	0.73500	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	49	0.93400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	56	1.15200	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	63	1.32500	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	70	1.62800	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	84	1.84900	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	98	2.55400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	112	2.99400	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	126	3.29300	NS	Altman and Dittmer, 1974
Chicken	New Hampshire	male	NS	140	3.37500	NS	Altman and Dittmer, 1974
Chicken	Ross broiler	male	3	1	0.04400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	1	0.04400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	7	0.16400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	14	0.33400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	21	0.76500	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	28	1.15500	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	35	1.53900	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	42	1.77800	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	49	2.33400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	63	3.25400	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	77	3.93400	NS	Prescott et al., 1985

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Chicken	Ross broiler	male	3	91	4.73000	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	105	5.46000	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	119	5.75800	NS	Prescott et al., 1985
Chicken	Ross broiler	male	3	140	6.49000	NS	Prescott et al., 1985
Chicken	Ross broiler	male	2	161	6.50000	NS	Prescott et al., 1985
Chicken	Several	female	44	1	0.02710	4.00E-006	Sah et al., 1984
Chicken	Several	female	44	28	0.07510	2.30E-005	Sah et al., 1984
Chicken	Several	female	18	84	0.32750	3.42E-004	Sah et al., 1984
Chicken	Several	female	18	140	0.65720	2.18E-003	Sah et al., 1984
Chicken	Several	male	36	1	0.02900	4.20E-006	Sah et al., 1984
Chicken	Several	male	36	28	0.08740	2.07E-005	Sah et al., 1984
Chicken	Several	male	27	84	0.38790	1.08E-003	Sah et al., 1984
Chicken	Several	male	16	140	0.74480	2.72E-004	Sah et al., 1984
Chicken	White Leghorn	female	NS	1	0.03600	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	7	0.07300	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	14	0.11800	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	21	0.19500	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	28	0.27200	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	35	0.36700	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	42	0.43600	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	49	0.54900	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	56	0.64000	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	63	0.72100	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	70	0.77600	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	84	0.93400	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	98	1.10700	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	112	1.27000	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	126	1.40200	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	female	NS	140	1.55100	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	1	0.03600	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	7	0.05900	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	14	0.12300	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	21	0.19100	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	28	0.26800	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	35	0.34500	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	42	0.44900	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	49	0.60300	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	56	0.68900	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	63	0.87500	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	70	0.94400	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	84	1.24300	NS	Altman and Dittmer, 1974

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Chicken	White Leghorn	male	NS	98	NS	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	112	NS	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	126	NS	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	male	NS	140	NS	NS	Altman and Dittmer, 1974
Chicken	White Leghorn	NS	14	21	0.18300	3.24E-004	Dunson and Buss, 1968
Chicken	White Leghorn	NS	4	28	0.20000	7.29E-004	Dunson and Buss, 1968
Chicken	White Leghorn	NS	8	28	0.32000	2.56E-004	Dunson and Buss, 1968
Chicken	White Leghorn	NS	15	140	1.53200	9.42E-002	Dunson and Buss, 1968
Donkeys	NS	female	1	1825	120.00000	NS	Amoroso et al., 1964
Goats	Several	female	3	1095	52.50000	1.41E0001	Watkins et al., 1973
Horses	Equus caballus	female	1	9125	500.00000	NS	Amoroso et al., 1964
Horses	Equus caballus	male	1	2190	410.00000	NS	Amoroso et al., 1964
Horses	Equus caballus	male	1	2920	360.00000	NS	Amoroso et al., 1964
Horses	Equus caballus	male	1	4380	510.00000	NS	Amoroso et al., 1964
Horses	Equus caballus	male	1	5475	600.00000	NS	Amoroso et al., 1964
Horses	NS	NS	NS	1971	481.00000	NS	NAS, 1971
Mules	NS	male	1	4745	210.00000	NS	Amoroso et al., 1964
Pigs	Cross-bred	both	30	70	30.00000	NS	Pond et al., 1985
Pigs	Cross-bred	both	30	126	74.00000	NS	Pond et al., 1985
Pigs	Cross-bred	both	30	154	99.00000	NS	Pond et al., 1985
Pigs	Cross-bred	both	30	175	118.00000	NS	Pond et al., 1985
Pigs	Duroc-Jersey	female	NS	300	95.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	600	140.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	900	165.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	1200	180.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	1500	190.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	1800	195.00000	NS	Campbell and Lasley, 1975
Pigs	Duroc-Jersey	female	NS	2400	198.00000	NS	Campbell and Lasley, 1975
Pigs	NS	female	1	1	2.50000	NS	Conalty, 1967
Pigs	NS	female	1	140	65.00000	NS	Conalty, 1967
Pigs	NS	female	1	280	150.00000	NS	Conalty, 1967
Pigs	NS	female	1	420	180.00000	NS	Conalty, 1967
Pigs	NS	female	1	560	220.00000	NS	Conalty, 1967

TABLE 3-12 (cont.)

Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Pigs	NS	NS	8	1	1.18000	1.37E-001	Clement et al., 1986
Pigs	NS	NS	15	114	30.00000	1.39E0002	Clement et al., 1986
Pigs	NS	NS	3	2	1.04700	4.23E-003	Mortola, 1983
Pigs	NS	NS	3	1	1.16700	9.42E-002	Mortola, 1984
Pigs	_Sus scrofa_	female	1	183	17.00000	NS	Amoroso et al., 1964
Pigs	White cross	NS	51	21	4.85000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	21	5.34000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	28	5.49000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	28	6.15000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	35	7.15000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	35	7.99000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	42	9.77000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	42	10.60000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	42	13.60000	NS	Brooks et al., 1984
Pigs	White cross	NS	51	49	13.06000	NS	Brooks et al., 1984
Sheep	NS	NS	NS	grown	31.50000	5.06E0000	Lane-Peter et al., 1967
Sheep	NS	NS	NS	grown	45.00000	2.03E0001	Lane-Peter et al., 1967
Sheep	NS	NS	NS	weaned	63.00000	2.03E0001	Lane-Peter et al., 1967
Sheep	Ovis aries	female	1	730	52.00000	NS	Amoroso et al., 1964

NS = Not specified

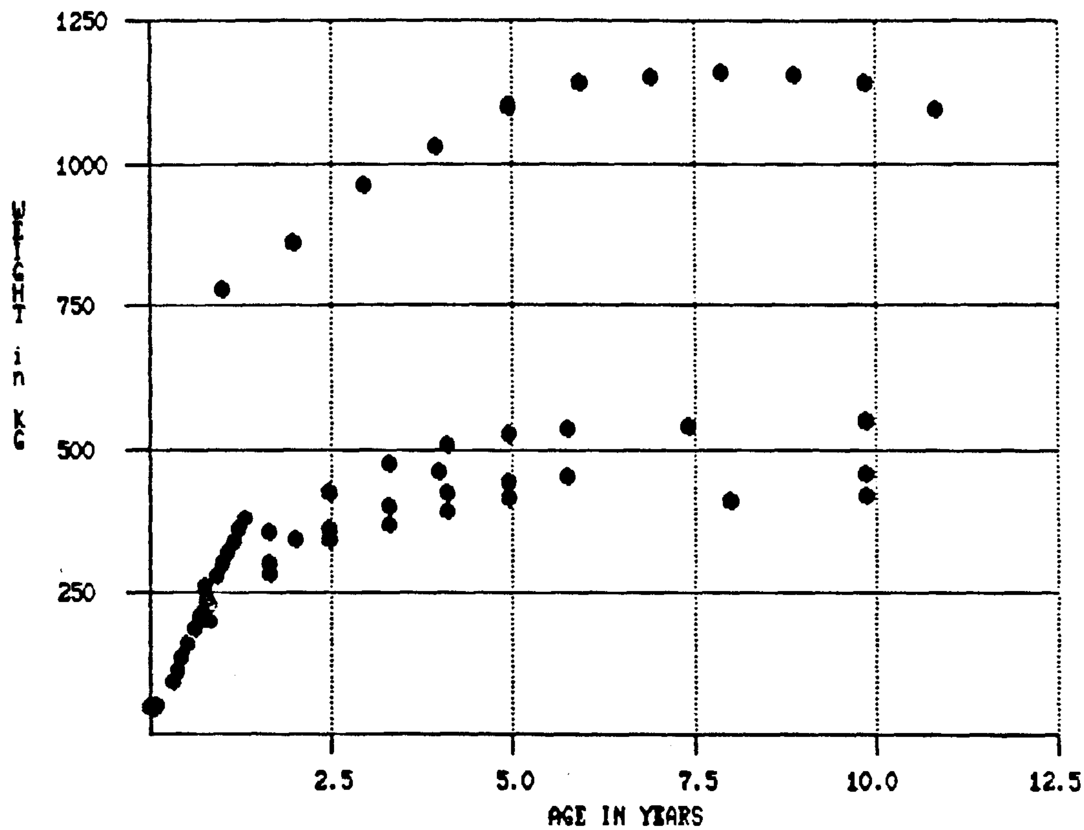


FIGURE 3-51

Growth Data on Cattle

(See Table 3-11 for points and references)

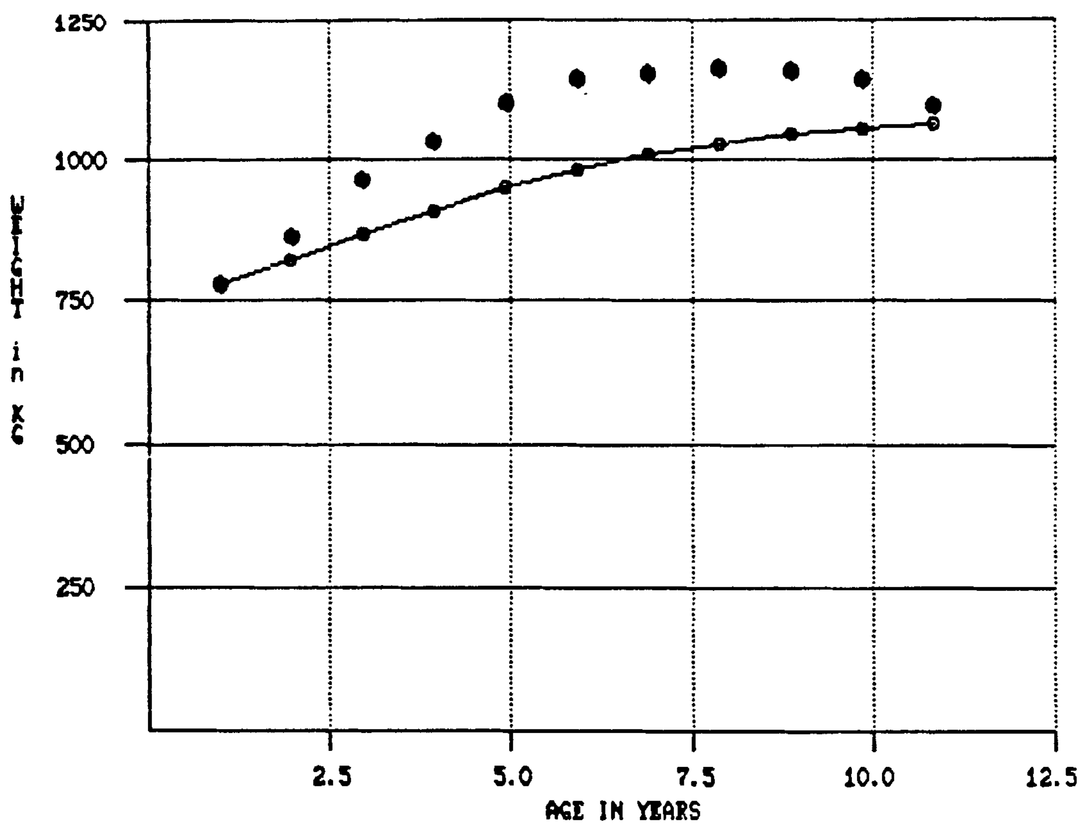


FIGURE 3-52

Growth Curve on Female Hereford Cattle

(See Table 3-12 for points and references)

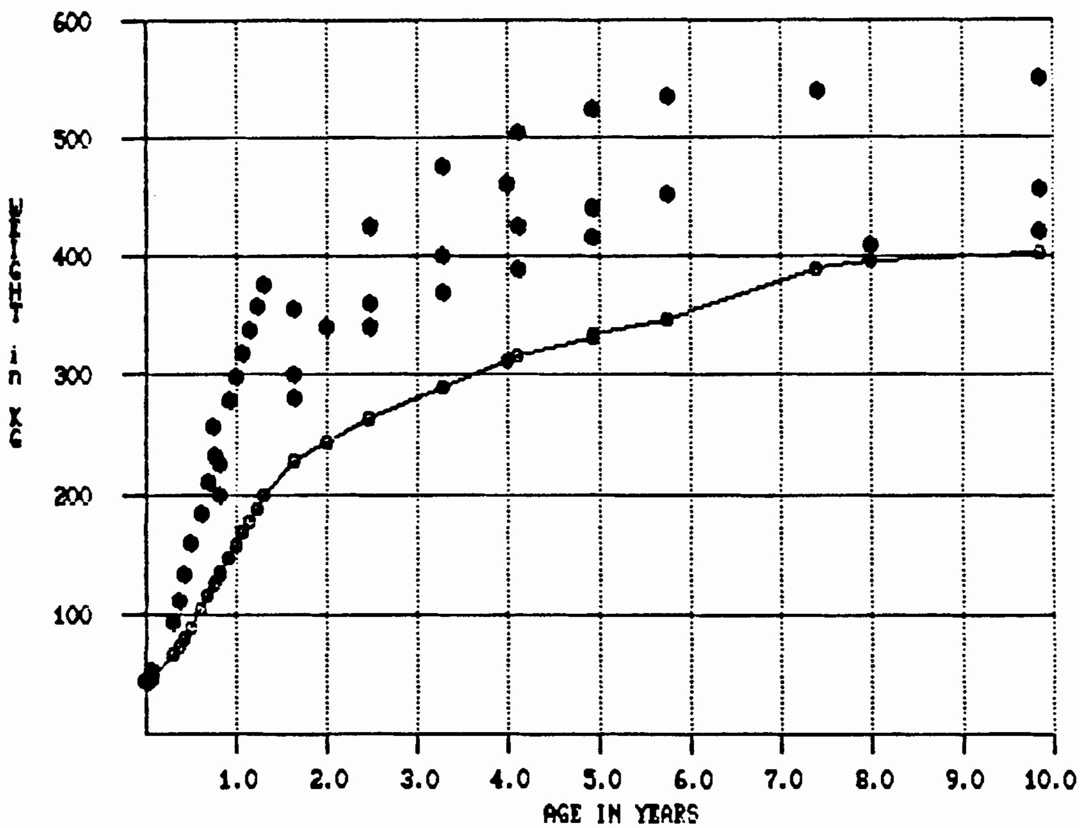


FIGURE 3-53

Growth Curve on Cattle, Excluding Female Hereford Cattle

(See Table 3-12 for points and references)

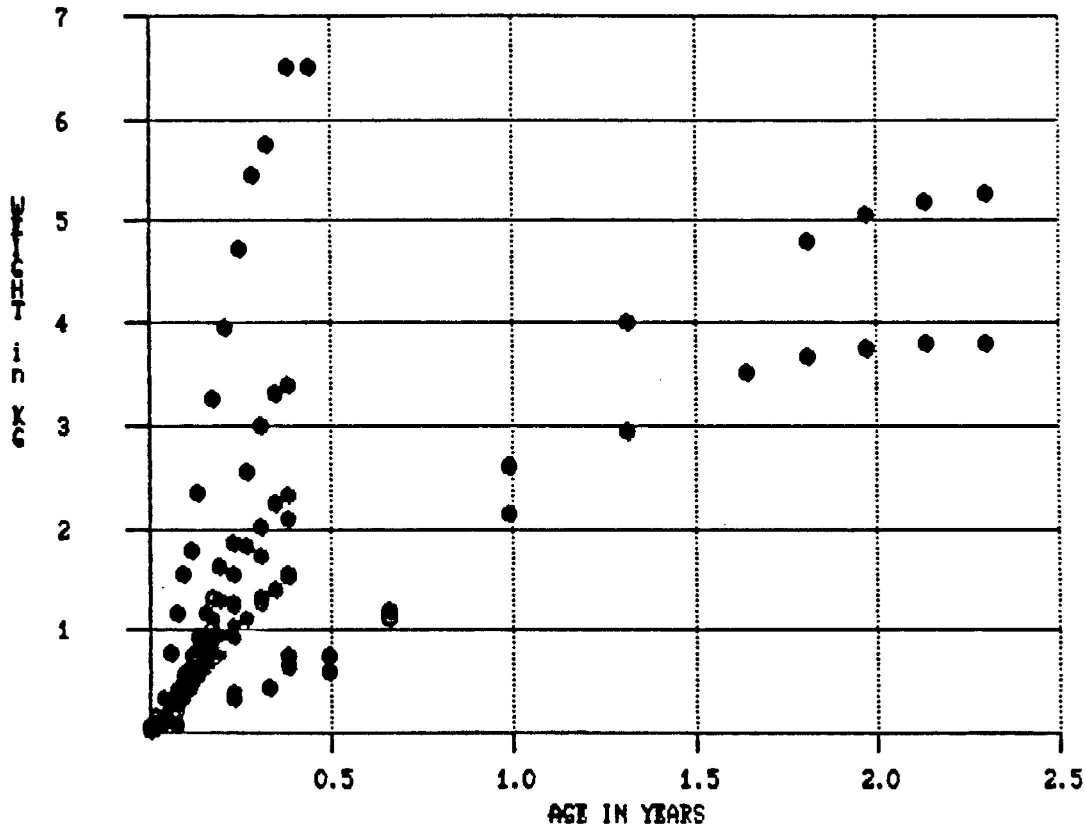


FIGURE 3-54

Growth Data on Chickens

(See Table 3-12 for points and references)

Chickens, particularly the White Leghorn, have been used as animal models for studying peripheral neurotoxins. Growth data on male and female White Leghorns are presented in Figures 3-55 and 3-56. Because bioassays using chickens are not well standardized, no attempt will be made to recommend subchronic or chronic body weights. Depending on the nature of the experiment, the data in Table 3-12 and Figures 3-55 or 3-56 could be used to estimate the most appropriate body weight.

3.4.3. Pigs. All growth data from Table 3-12 on pigs are plotted in Figure 3-57. The growth data reported by Pond et al. (1985) and Conalty (1967), plotted in Figure 3-58, are consistent with each other but show substantially more rapid growth than other reports on the domestic pig (Sus domesticus). Data from these latter reports are plotted in Figure 3-59. The data reported by Amoroso et al. (1964) are for the miniature pig, Sus scrofa, and are not likely to be typical of swine used as livestock. Recommended mature body weights for livestock swine (Sus domesticus) are 200-250 kg. Based on Figures 3-58 and 3-59, other body weight estimates for swine can be derived as needed.

3.5. WILDLIFE

Growth data on wildlife are summarized in Table 3-13. As discussed by Moody et al. (1985) for ferrets and Zatzman et al. (1984) for marmots, many species of wildlife mammals show substantial (30-40%) seasonal variation in body weight. Such seasonal variations are also likely to be seen in livestock and laboratory animals, but are less well documented.

Figures 3-60 and 3-61 summarize the body weights of male and female mink from two control groups used by Aulerich et al. (1979) in a study on the toxicity of PCBs, a compound to which mink are particularly susceptible.

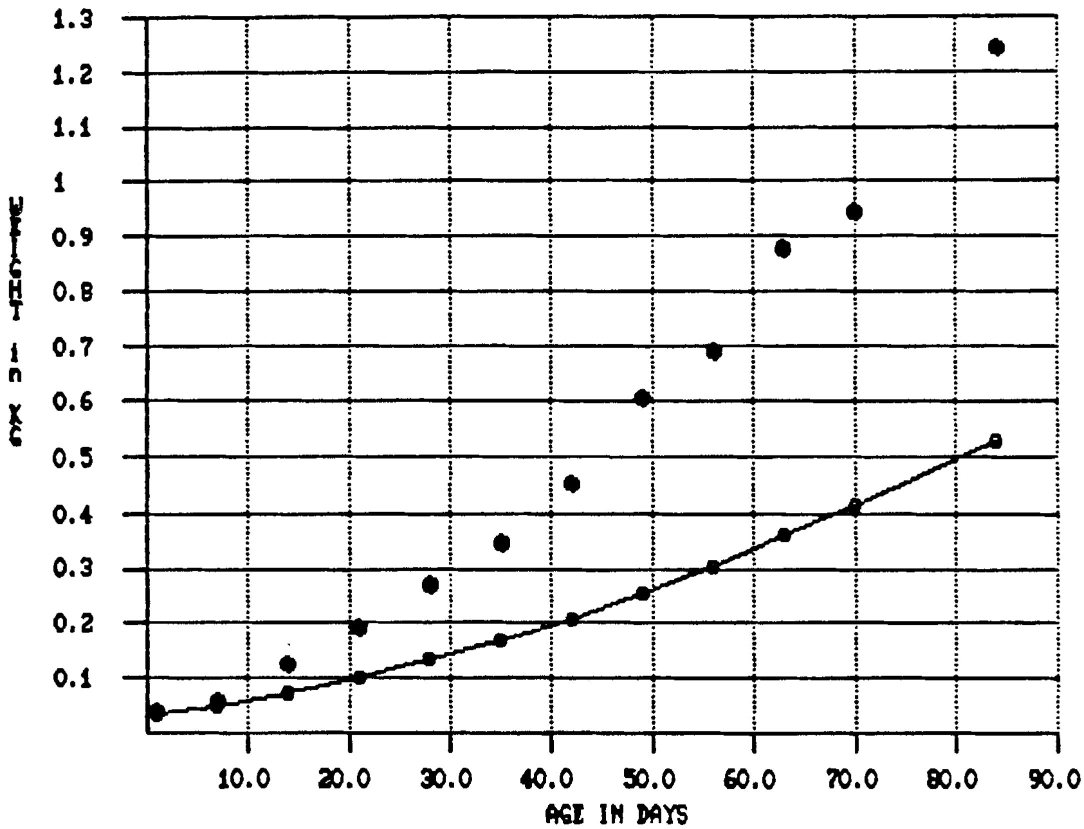


FIGURE 3-55

Growth Data on Male White Leghorn Chickens

(See Table 3-12 for points and references)

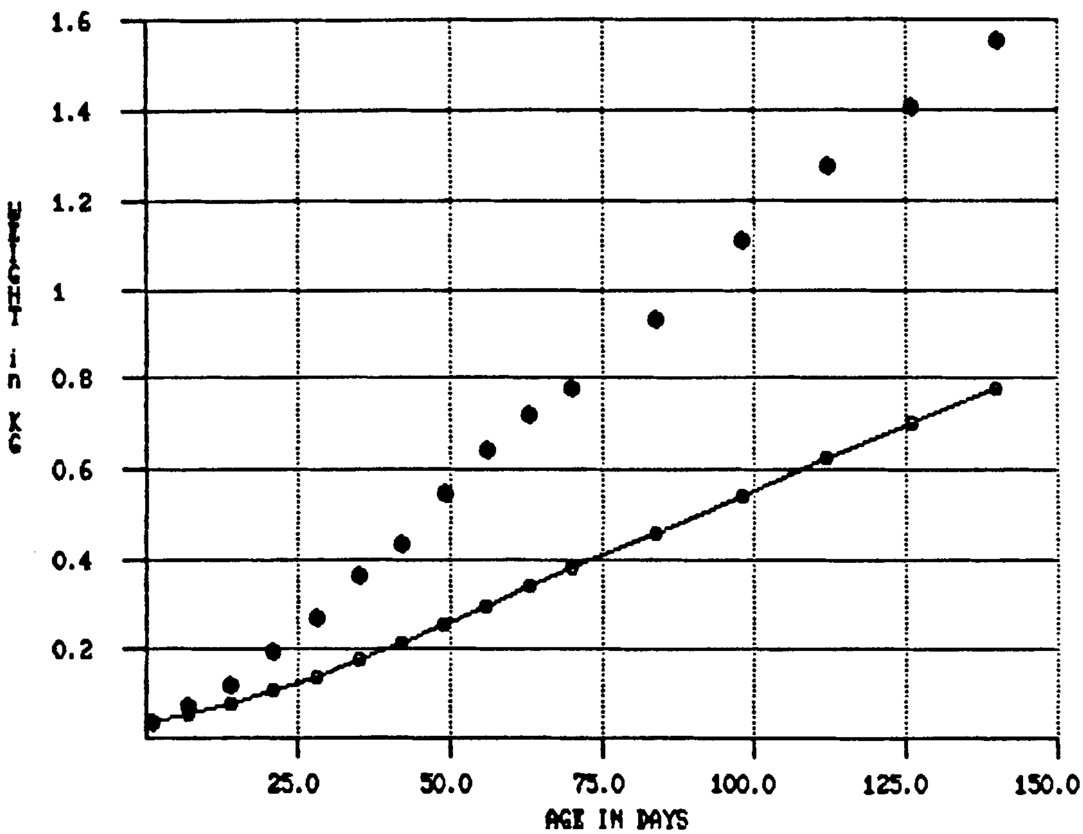


FIGURE 3-56

Growth Data on Female White Leghorn Chickens

(See Table 3-12 for points and references)

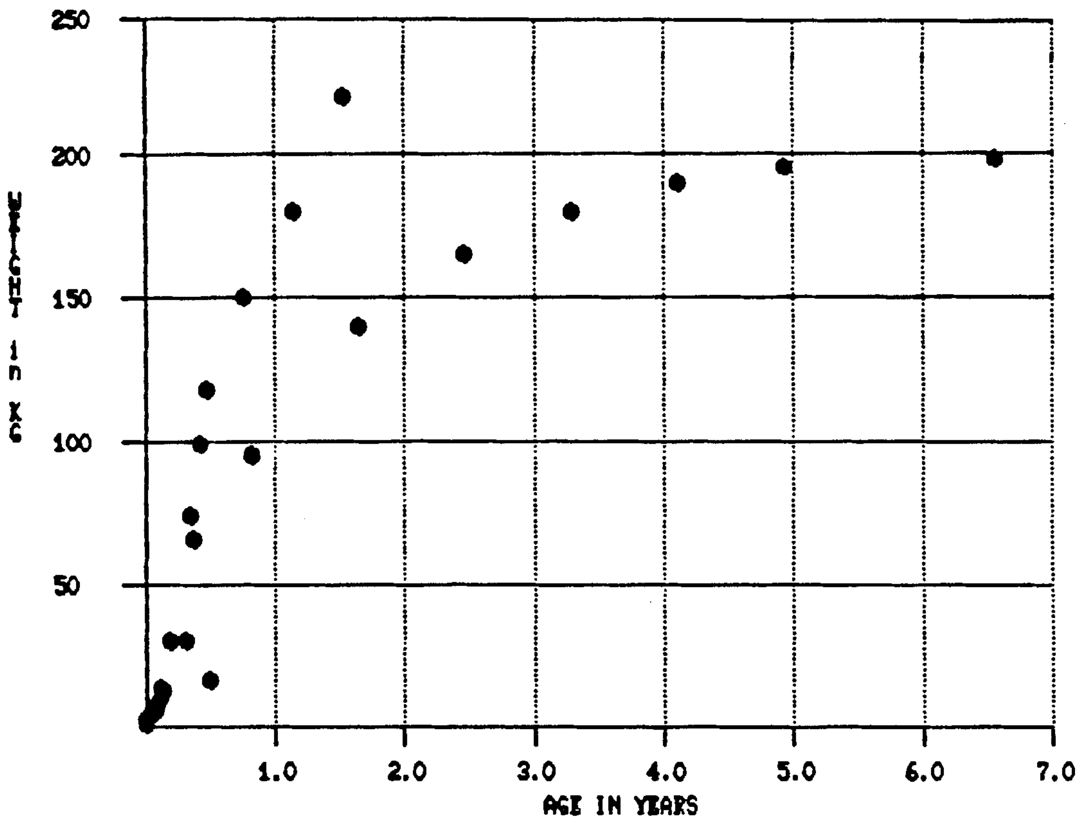


FIGURE 3-57

Growth Data on Domestic and Miniature Pigs

(See Table 3-12 for points and references)

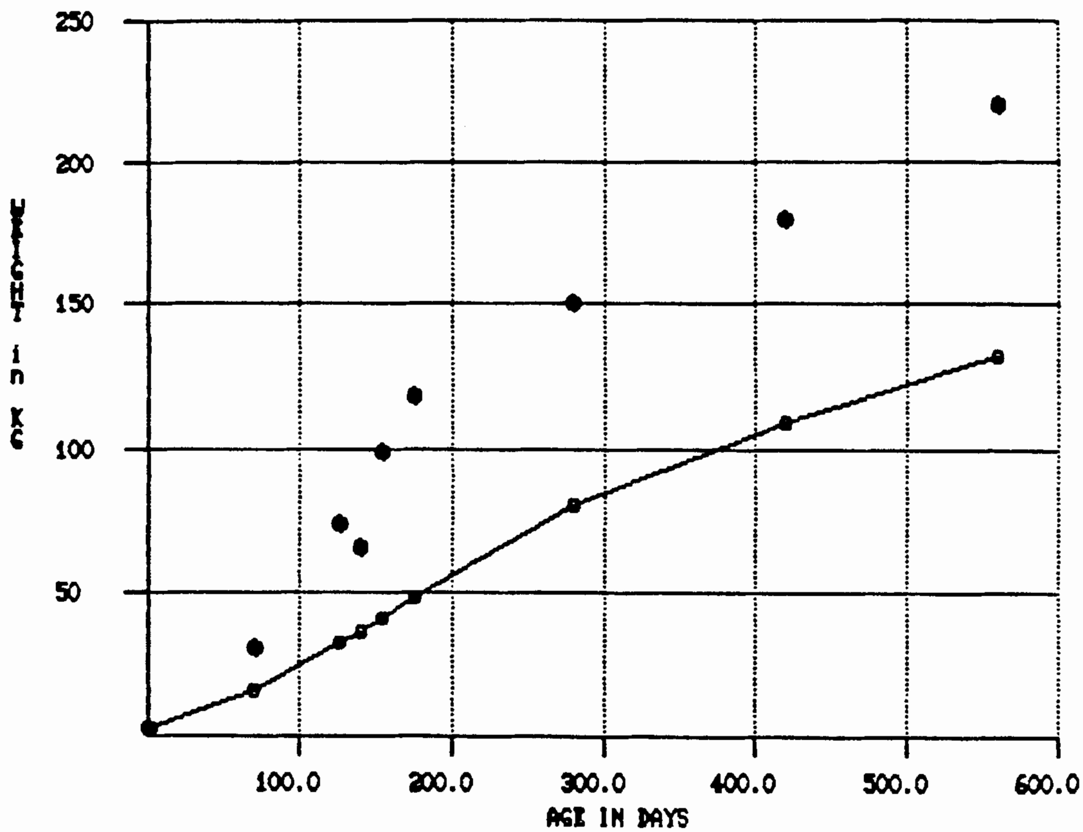


FIGURE 3-58

Growth Data on Larger Domestic Pigs

[Data from Pond et al. (1985) and Conalty (1967)]

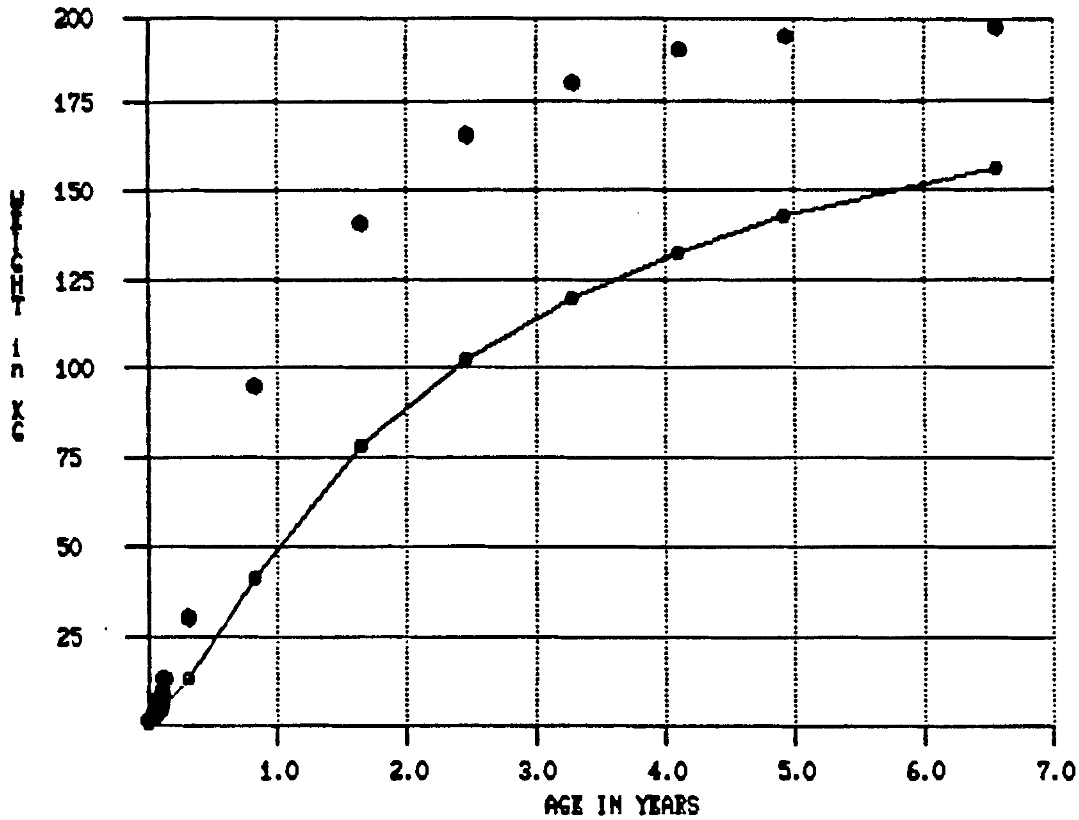


FIGURE 3-59

Growth Data on Smaller Domestic Pigs

(See Table 3-12 for points and references)

TABLE 3-13

Growth and Body Weight Data on Wildlife

Species/Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Ferrets/domestic	female	NS	adult	0.67500	1.27E-002	Moody et al., 1985
Ferrets/domestic	male	NS	adult	2.02500	1.14E-001	Moody et al., 1985
Ferrets/NS	male	9	young	0.71150	6.28E-003	Vinegar et al., 1985
Marmots/yellow-bellied	female	9	adult	3.81000	5.76E-002	Zatzman et al., 1984
Marmots/yellow-bellied	female	9	adult	3.86000	5.76E-002	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	4.62000	2.81E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	4.76000	2.92E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	4.95000	3.03E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.19000	3.48E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.29000	4.36E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.32000	3.97E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.33000	4.23E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.39000	3.72E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.45000	4.10E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.46000	4.62E-001	Zatzman et al., 1984
Marmots/yellow-bellied	male	9	adult	5.50000	4.49E-001	Zatzman et al., 1984
Mink/NS	female	24	90	0.75000	NS	Aulerich et al., 1979
Mink/NS	female	24	90	0.76000	NS	Aulerich et al., 1979
Mink/NS	female	24	103	0.86100	NS	Aulerich et al., 1979
Mink/NS	female	24	103	0.87600	NS	Aulerich et al., 1979
Mink/NS	female	24	118	0.91900	NS	Aulerich et al., 1979
Mink/NS	female	24	118	0.93400	NS	Aulerich et al., 1979
Mink/NS	female	24	132	0.92000	NS	Aulerich et al., 1979
Mink/NS	female	24	132	0.95500	1.11E-002	Aulerich et al., 1979
Mink/NS	female	24	146	0.97100	NS	Aulerich et al., 1979
Mink/NS	female	24	146	0.98400	1.53E-002	Aulerich et al., 1979

TABLE 3-13 (cont.)

Species/Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mink/NS	female	24	160	0.99900	NS	Aulerich et al., 1979
Mink/NS	female	24	160	1.03900	1.57E-002	Aulerich et al., 1979
Mink/NS	female	24	174	1.04100	NS	Aulerich et al., 1979
Mink/NS	female	24	174	1.06600	2.70E-002	Aulerich et al., 1979
Mink/NS	female	24	188	1.03100	NS	Aulerich et al., 1979
Mink/NS	female	24	188	1.06500	1.25E-002	Aulerich et al., 1979
Mink/NS	female	24	202	1.02000	NS	Aulerich et al., 1979
Mink/NS	female	24	202	1.05800	1.88E-002	Aulerich et al., 1979
Mink/NS	female	24	214	1.01400	NS	Aulerich et al., 1979
Mink/NS	female	24	214	1.04100	2.31E-002	Aulerich et al., 1979
Mink/NS	female	24	230	0.93700	NS	Aulerich et al., 1979
Mink/NS	female	24	230	0.96800	1.80E-002	Aulerich et al., 1979
Mink/NS	female	24	245	0.98900	NS	Aulerich et al., 1979
Mink/NS	female	24	245	1.01800	3.14E-003	Aulerich et al., 1979
Mink/NS	female	24	261	0.92700	NS	Aulerich et al., 1979
Mink/NS	female	24	261	0.97000	1.15E-002	Aulerich et al., 1979
Mink/NS	female	24	275	0.93300	NS	Aulerich et al., 1979
Mink/NS	female	24	275	0.96200	1.49E-002	Aulerich et al., 1979
Mink/NS	female	24	292	0.90900	NS	Aulerich et al., 1979
Mink/NS	female	24	292	0.94100	8.06E-003	Aulerich et al., 1979
Mink/NS	female	24	306	0.93600	NS	Aulerich et al., 1979
Mink/NS	female	24	306	0.96800	2.46E-002	Aulerich et al., 1979
Mink/NS	female	24	320	0.94700	NS	Aulerich et al., 1979
Mink/NS	female	24	320	0.96500	2.42E-003	Aulerich et al., 1979
Mink/NS	female	24	438	0.81100	NS	Aulerich et al.,1979
Mink/NS	female	24	438	0.82100	5.89E-003	Aulerich et al., 1979
Mink/NS	male	6	90	1.08300	4.39E-002	Aulerich et al., 1979
Mink/NS	male	5	90	1.13700	NS	Aulerich et al., 1979
Mink/NS	male	6	103	1.29700	3.48E-002	Aulerich et al., 1979

TABLE 3-13 (cont.)

Species/Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mink/NS	male	5	103	1.33900	NS	Aulerich et al., 1979
Mink/NS	male	5	118	1.37800	NS	Aulerich et al., 1979
Mink/NS	male	6	118	1.42700	5.71E-002	Aulerich et al., 1979
Mink/NS	male	5	132	1.56900	NS	Aulerich et al., 1979
Mink/NS	male	6	132	1.56900	2.27E-002	Aulerich et al., 1979
Mink/NS	male	5	146	1.59100	NS	Aulerich et al., 1979
Mink/NS	male	6	146	1.63100	3.60E-003	Aulerich et al., 1979
Mink/NS	male	6	160	1.64900	3.97E-003	Aulerich et al., 1979
Mink/NS	male	5	160	1.66900	NS	Aulerich et al., 1979
Mink/NS	male	6	174	1.65400	1.44E-003	Aulerich et al., 1979
Mink/NS	male	5	174	1.68600	NS	Aulerich et al., 1979
Mink/NS	male	6	188	1.68000	1.37E-003	Aulerich et al., 1979
Mink/NS	male	5	188	1.71000	NS	Aulerich et al., 1979
Mink/NS	male	6	202	1.76600	1.02E-003	Aulerich et al., 1979
Mink/NS	male	5	202	1.78100	NS	Aulerich et al., 1979
Mink/NS	male	6	214	1.73100	1.09E-003	Aulerich et al., 1979
Mink/NS	male	5	214	1.73200	NS	Aulerich et al., 1979
Mink/NS	male	5	230	1.56400	NS	Aulerich et al., 1979
Mink/NS	male	6	230	1.61300	1.76E-003	Aulerich et al., 1979
Mink/NS	male	5	245	1.59600	NS	Aulerich et al., 1979
Mink/NS	male	6	245	1.64900	NS	Aulerich et al., 1979
Mink/NS	male	5	261	1.48300	NS	Aulerich et al., 1979
Mink/NS	male	6	261	1.53500	NS	Aulerich et al., 1979
Mink/NS	male	5	275	1.47600	NS	Aulerich et al., 1979
Mink/NS	male	6	275	1.55300	NS	Aulerich et al., 1979
Mink/NS	male	5	292	1.49600	NS	Aulerich et al., 1979
Mink/NS	male	6	292	1.59100	NS	Aulerich et al., 1979
Mink/NS	male	5	306	1.60700	NS	Aulerich et al., 1979
Mink/NS	male	6	306	1.66900	NS	Aulerich et al., 1979
Mink/NS	male	5	320	1.59500	NS	Aulerich et al., 1979

TABLE 3-13 (cont.)

Species/Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Variance	Reference
Mink/NS	male	6	320	1.67200	NS	Aulerich et al., 1979
Mink/NS	male	6	438	1.64000	NS	Aulerich et al., 1979
Mink/NS	male	5	438	1.69200	NS	Aulerich et al., 1979
Mink/NS	both	NS	1	0.00930	NS	Aulerich et al., 1979
Mink/NS	both	NS	1	0.00962	NS	Aulerich et al., 1979
Mink/NS	both	NS	28	0.15760	NS	Aulerich et al., 1979
Mink/NS	both	NS	28	0.16500	NS	Aulerich et al., 1979
Voles/meadow	both	28	176	0.04100	5.62E-005	Lee and Horvath, 1969
Voles/meadow	NS	7	45	0.04500	5.62E-005	Laughlin et al., 1975
Voles/NS	NS	NS	NS	0.04100	NS	NAS, 1978

NS = Not specified

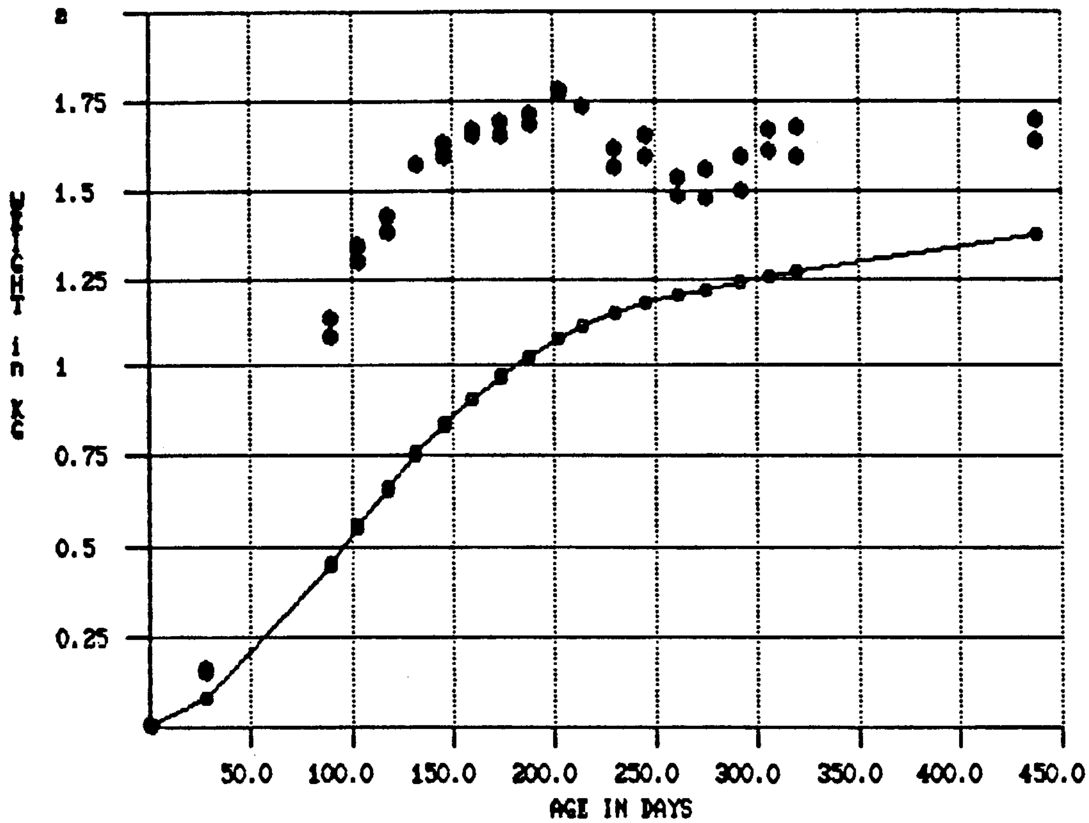


FIGURE 3-60

Recommended Growth Curve for Male Mink
(See Table 3-13 for points and references)

Source: Aulerich et al., 1979

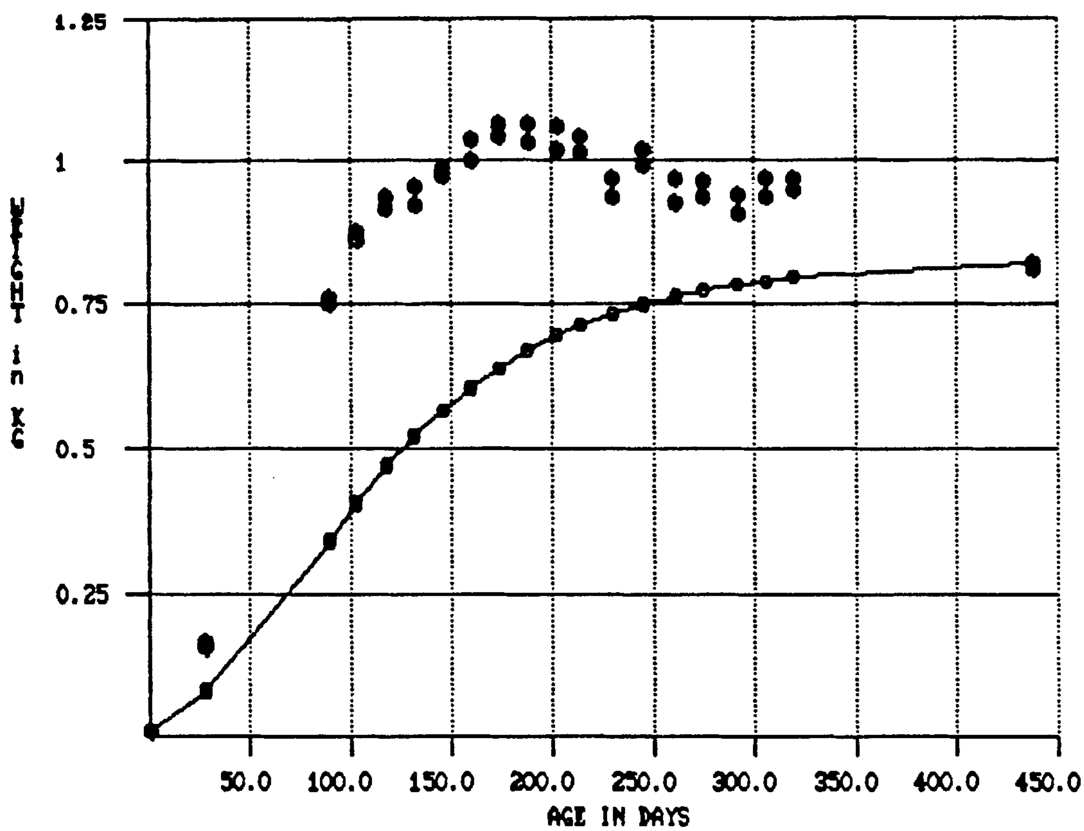


FIGURE 3-61

Recommended Growth Curve for Female Mink
(See Table 3-13 for points and references)

Source: Aulerich et al., 1979

4. INHALATION RATES

The U.S. EPA (1980) has recommended the use of a reference value of 20 m^3/day for humans (10 m^3 breathing volume during the workday). The inhalation rate for the ICRP Reference Man is 23 m^3/day (9.6 m^3 breathing volume at work during light activity). Other recommended values are 21 m^3/day for an adult woman, 15 m^3/day for a 10-year-old child, 3.8 m^3/day for a 1-year-old infant and 0.8 m^3/day for a newborn (Snyder et al., 1975).

Minute volumes for the reference man resting and performing light activity are 7.5 and 20 ℓ/minute, respectively. The reference minute volume for light activity is reasonably close to the reported values for adult humans given in Table 4-1. Assuming that man rests for 8 hours and is involved in light activity for 16 hours each day, the resting minute volume can be multiplied by a factor of 2.1 to approximate a TWA minute volume over an entire day $[((7.5x8hr)+(20x16hr))/24hr)/7.5 \approx 2.11]$. Unless this activity factor is used on the human data, the allometric equations discussed in this section substantially underestimate human breathing volumes for adolescents and adults. Rigorous evaluation of human values is outside the scope of this text. Additional information is provided in U.S. EPA (1985a). Since the minute volumes reported in the literature for experimental mammals and other animals were made when the animals were at rest and not under conditions of normal activity, a similar activity factor could be proposed for these species. This factor is not applied to the allometric equations for nonhuman animals because in most toxicity studies the activity of the animals is restricted by confinement. The use of upper or lower bounds of the allometric equations should be considered if hyperactivity or lethargy is reported. In some instances in which the exposed dose must be estimated

TABLE 4-1

Inhalation Data on Various Animal Groups

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Primates	human		M&F	4	12,593	NS	5.40	Maxwell et al., 1985
	human		M&F	6	12,593	NS	5.90	Maxwell et al., 1985
	human		M&F	8	12,593	NS	5.90	Maxwell et al., 1985
	human		M&F	21	17,885	74.0	7.70	White et al., 1985
	human		F	20	6.6	3.420	0.57090	Cross, 1949
	human		F	29	9,855	64.150	8.0	Aitken et al., 1986
	human		M	16	5	3.670	0.61240	Cross, 1949
	human		M	37	9,855	94.550	9.80	Aitken et al., 1986
	human		NS	15	8	NS	0.690	Haddad et al., 1979
	human		NS	15	35	NS	0.810	Haddad et al., 1979
	human		NS	15	63	NS	1.080	Haddad et al., 1979
	human		NS	22	<1	3.40	1.3930	Fisher et al., 1982
	human		NS	12	<1	3.50	1.4110	Fisher et al., 1982
	human		NS	10	NS	NS	1.41230	Fisher et al., 1982
	human		NS	10	NS	NS	1.41230	Fisher et al., 1982
	human		NS	15	91	NS	1.440	Haddad et al., 1979
	human		NS	23	<1	3.430	1.4920	Fisher et al., 1982
	human		NS	15	120	NS	1.530	Haddad et al., 1979
	human		NS	8	NS	NS	1.57730	Fisher et al., 1982
	human		NS	4	<1	3.470	1.9830	Fisher et al., 1982
	human		NS	NS	NS	70	7.50	Hugh-Jones et al., 1978
	human		NS	6	NS	68.50	8.730	Guyton, 1947
	monkey	rhesus	M&F	39	NS	2.630	1.0140	Karel and Weston, 1946
	monkey	rhesus	M	4	NS	4.050	1.120	Liu and DeLauter, 1977
	monkey	rhesus	M	4	NS	4.050	1.120	Liu and DeLauter, 1977
	monkey	rhesus	NS	NS	NS	2.680	0.860	Lumb, 1963
	monkey		NS	6	NS	2.680	0.8630	Guyton, 1947
Laboratory rodents	guinea pig	Hartley	M&F	10	98	0.5120	0.1710	Mauderly et al., 1979
	guinea pig	Hartley, C.R.	F	6	NS	0.32550	0.0790	Horike et al., 1982
	guinea pig	Hartley, C.R.	F	10	NS	0.32550	0.1040	Horike et al., 1982
	guinea pig	Hartley, large	M	10	NS	0.8170	0.4040	Blake and Banchero, 1985
	guinea pig	Hartley, small	M	5	NS	0.2690	0.2530	Blake and Banchero, 1985
	guinea pig	Hartley	M	36	NS	0.350	0.24970	Skornik et al., 1981
	guinea pig		M	6	NS	0.340	0.220	Murphy and Ulrich, 1964
	guinea pig		M	6	NS	0.3090	0.25450	Murphy and Ulrich, 1964
	guinea pig		M	6	NS	0.3790	0.26460	Murphy and Ulrich, 1964
	guinea pig		NS	2	3	0.09110	0.07610	Mortola, 1984
	guinea pig		NS	200	NS	0.2190	0.1390	Amdur and Mead, 1958
	guinea pig		NS	49	NS	0.4770	0.1540	Guyton, 1947
	guinea pig		NS	61	NS	0.4660	0.1560	Guyton, 1947
	guinea pig		NS	NS	NS	0.4710	0.160	Lumb, 1963
	guinea pig		NS	8	NS	0.1940	0.1620	Mead, 1960

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Laboratory rodents (cont.)	hamster	Syrian[Sch:Syr]	M&F	10	98	0.110	0.050	Mauderly et al., 1979
	hamster	Syrian	M&F	10	112	0.1110	0.050	Mauderly and Tesarek, 1975
	hamster	Djungarian	M	12	NS	0.03240	0.02240	Schlenker, 1985
	hamster	golden	M	10	NS	0.11540	0.04202	Holloway and Heath, 1984
	hamster	golden	M	16	NS	0.110	0.07090	Javaheri and Lucey, 1986
	hamster	Syrian F1B	M	10	NS	0.06380	0.03450	Schlenker, 1984
	hamster	Syrian F1B	M	10	NS	0.08860	0.04050	Schlenker, 1984
	hamster	Syrian F1B	M	10	NS	0.1020	0.0420	Schlenker, 1984
	hamster	Syrian	M	8	NS	0.1080	0.02930	Strope et al., 1980
	hamster	Syrian	M	7	NS	0.1420	0.05041	Walker et al., 1985
	hamster	Syrian	M	40	105	0.1290	0.0710	Rubin et al., 1978
	hamster	white	M	4	NS	0.090	0.030	Chapin, 1955
	hamster	white	M	4	NS	0.10	0.0330	Chapin, 1955
	hamster	white	M	4	NS	0.130	0.0420	Chapin, 1955
	hamster		NS	4	5	0.00643	0.00298	Mortola and Noworaj, 1985
	hamster		NS	NS	NS	0.0910	0.050	Lumb, 1963
	hamster		NS	65	NS	0.0920	0.0610	Guyton, 1947
	mice		NS	5	2.8	0.00250	0.00230	Mortola, 1984
	mice		NS	56	NS	0.020	0.0240	Guyton, 1947
	mouse	CBA Ca Lac Cbi	M	1	NS	0.02370	0.02090	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.02190	0.02190	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.02450	0.02190	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.02660	0.02820	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.03130	0.03050	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.02690	0.03160	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.03310	0.03430	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.03550	0.04170	DePledge, 1985
	mouse	CBA Ca Lac Cbi	M	1	NS	0.03890	0.04950	DePledge, 1985
	mouse	CBA	M	10	20	0.0080	0.01450	Criborn, 1969
	mouse	CBA	M	10	31	0.0140	0.0160	Criborn, 1969
	mouse	CBA	M	10	51	0.02450	0.0220	Criborn, 1969
	mouse	CBA	M	10	91	0.02450	0.02950	Criborn, 1969
	mouse	CD-1	M	19	37	0.02620	0.03799	Fairchild, 1972
	mouse	CD-1	M	9	55.5	0.03130	0.05039	Fairchild, 1972
	mouse	CD-1	M	10	74	0.03740	0.06769	Fairchild, 1972
	mouse	HA/ICR	M	8	90	0.03380	0.03617	Fairchild, 1972
	mouse	HA/ICR	M	8	69	0.02990	0.05083	Fairchild, 1972
	mouse	SwissWebLAI/COX	M	10	NS	0.03040	0.04880	Schlenker, 1985
	mouse		NS	NS	NS	0.01980	0.0230	Lumb, 1963

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Laboratory rodents (cont.)	rat	F344/Crl Lov	M&F	20	365	0.2930	0.1950	Mauderly, 1986
	rat	F344/Crl Lov	M&F	20	183	0.2670	0.2380	Mauderly, 1986
	rat	F344/Crl Lov	M&F	20	91	0.1820	0.240	Mauderly, 1986
	rat	F344/Crl Lov	M&F	20	730	0.3310	0.2590	Mauderly, 1986
	rat	Long-Evans	M&F	10	98	NS	0.2150	Mauderly, 1986
	rat	Fisher	F	32	NS	0.2330	0.1610	Diamond and O'Donnell, 1977
	rat	F334/Crl Lov	F	10	365	0.2190	0.1540	Mauderly, 1986
	rat	F334/Crl Lov	F	10	183	0.1990	0.1810	Mauderly, 1986
	rat	F334/Crl Lov	F	10	91	0.1450	0.2160	Mauderly, 1986
	rat	F334/Crl Lov	F	10	730	0.2550	0.2540	Mauderly, 1986
	rat	F344	F	20	77	0.14610	0.14430	Dorato et al., 1983
	rat	F344	F	19	91	0.15790	0.1470	Dorato et al., 1983
	rat	F344	F	19	238	0.1940	0.15390	Dorato et al., 1983
	rat	F344	F	19	161	0.180	0.15540	Dorato et al., 1983
	rat	F344	F	19	280	0.20140	0.15590	Dorato et al., 1983
	rat	F344	F	19	322	0.20690	0.15840	Dorato et al., 1983
	rat	F344	F	19	112	0.16670	0.1590	Dorato et al., 1983
	rat	F344	F	19	196	0.19080	0.16720	Dorato et al., 1983
	rat	Sprague-Dawley	F	11	NS	0.2510	0.1750	Cummings and Heitcamp, 1981
	rat	Wistar, Charles	F	12	97	NS	0.09820	Martin-Body and Sinclair, 1985
	rat	Wistar, Charles	F	12	99	NS	0.1930	Martin-Body and Sinclair, 1985
	rat	F344/Crl Lov	M	10	365	0.3680	0.2360	Mauderly, 1986
	rat	F344/Crl Lov	M	10	91	0.2910	0.2640	Mauderly, 1986
	rat	F344/Crl Lov	M	10	730	0.4070	0.2640	Mauderly, 1986
	rat	F344/Crl Lov	M	10	183	0.3360	0.2920	Mauderly, 1986
	rat	F344	M	20	77	0.21840	0.16140	Dorato et al., 1983
	rat	F344	M	20	91	0.24850	0.18610	Dorato et al., 1983
	rat	F344	M	20	280	0.38880	0.19110	Dorato et al., 1983
	rat	F344	M	20	238	0.36630	0.1920	Dorato et al., 1983
	rat	F344	M	20	322	0.40950	0.20040	Dorato et al., 1983
	rat	F344	M	20	112	0.27980	0.20130	Dorato et al., 1983
	rat	F344	M	20	161	0.31780	0.20380	Dorato et al., 1983
	rat	F344	M	20	196	0.34280	0.21550	Dorato et al., 1983
	rat	Sprague-Dawley	M	19	NS	0.40	0.1450	Bowen and Carpenter, 1979
	rat	Sprague-Dawley	M	19	NS	0.40	0.1450	Bowen and Carpenter, 1979
	rat	Sprague-Dawley	M	NS	NS	0.40	0.1450	Bowen et al., 1979
	rat	Sprague-Dawley	M	5	NS	NS	0.1540	Johanson and Pierce, 1971
	rat	Sprague-Dawley	M	5	NS	NS	0.1540	Johanson and Pierce, 1971
	rat	Sprague-Dawley	M	12	NS	NS	0.1750	Johanson and Pierce, 1971
	rat	Sprague-Dawley	M	8	NS	0.3060	0.19030	Lai et al., 1978
	rat	Sprague-Dawley	M	5	NS	0.4350	0.20611	Holloway and Heath, 1984
	rat	Sprague-Dawley	M	8	NS	0.3050	0.21380	Lai et al., 1978
	rat	Sprague-Dawley	M	8	NS	0.3050	0.2150	Lai et al., 1978

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Laboratory rodents (cont.)	rat	Sprague-Dawley	M	16	NS	0.4250	0.2390	Bartlett and Tennet, 1970
	rat	Sprague-Dawley	M	8	NS	0.2840	0.27580	Lai et al., 1978
	rat	Sprague-Dawley	M	8	NS	0.2910	0.45950	Lai et al., 1978
	rat	Wistar	M	10	35	0.05230	0.08690	Leong et al., 1964
	rat	Wistar	M	10	49	0.10980	0.11290	Leong et al., 1964
	rat	Wistar	M	10	70	0.21130	0.16150	Leong et al., 1964
	rat	Wistar	M	6	NS	0.30	0.17220	Walker et al., 1985
	rat	Wistar	M	10	126	0.29850	0.22490	Leong et al., 1964
	rat	cotton	NS	27	NS	0.0770	0.040	Guyton, 1947
	rat	cotton	NS	NS	NS	0.0770	0.040	Lumb, 1963
	rat	white	NS	35	NS	0.1130	0.0730	Guyton, 1947
	rat	white	NS	NS	NS	0.1120	0.0740	Lumb, 1963
	rat	white	NS	32	NS	0.110	0.0760	Guyton, 1947
	rat		NS	4	2	0.00720	0.00660	Mortola, 1984
	rat		NS	48	NS	0.30	0.2750	Lin et al., 1983
Other laboratory mammals	cat		NS	4	1.7	0.11880	0.0950	Mortola, 1984
	cat		NS	NS	NS	2.450	0.3220	Lumb, 1963
	cat		NS	6	NS	2.750	0.420	Mazzarelli et al., 1986
	cat		NS	19	NS	2.40	0.48050	Wang and Nims, 1948
	cat		NS	4	NS	2.550	0.68350	Bartlett and Tennet, 1970
	cat		NS	6	NS	3.250	0.77380	Siafakas et al., 1983
	cat		NS	6	NS	3.250	0.7850	Siafakas et al., 1983
	cat		NS	6	547	3.620	0.830	Gautier, 1986
	dog	beagle	M&F	12	364	9.0	3.30	Mauderly et al., 1979
	dog	beagle	M&F	100	395.5	9.10	3.720	Mauderly, 1974
	dog	beagle	M&F	20	1,277.5	11.10	4.060	Mauderly, 1974
	dog	beagle	F	50	395.5	8.40	3.60	Mauderly, 1974
	dog	beagle	F	10	1,277.5	10	3.610	Mauderly, 1974
	dog	beagle	F	36	3,375	10.90	3.810	Mauderly, 1974
	dog	mongrel	F	1	3,650	13.50	6.60	Amoroso et al., 1964
	dog	beagle	M	50	395.5	10	3.650	Mauderly, 1974
	dog	beagle	M	10	1,277.5	12.0	4.510	Mauderly, 1974
	dog	mongrel	M	1	1,460	59.0	11.90	Amoroso et al., 1964
	dog	beagle	NS	12	NS	9.20	1.6620	Stara et al., 1980
	dog	beagle	NS	39	210	9.10	5.280	Pickrell et al. 1971
	dog		NS	3	1	0.29720	0.24180	Mortola, 1984
	dog		NS	1	NS	16.40	4.10	Lumb, 1963
	dog		NS	1	NS	28.60	5.150	Lumb, 1963
	dog		NS	1	NS	19.10	5.450	Lumb, 1963
	dog		NS	1	NS	30.50	6.250	Lumb, 1963

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Other laboratory mammals (cont.)	rabbit	Dutch	M&F	42	NS	2.0510	1.6450	Barrow et al., 1971
	rabbit	New Zealand white	M&F	9	98	3.0	1.240	Mauderly et al., 1979
	rabbit	New Zealand white	NS	5	NS	2.170	0.4490	Maskrey and Nicol, 1980
	rabbit	New Zealand white	NS	5	NS	2.170	0.7440	Maskrey and Nicol, 1980
	rabbit		NS	4	1.7	0.07930	0.05540	Mortola, 1984
	rabbit		NS	31	NS	2.020	0.80	Guyton, 1947
	rabbit		NS	NS	NS	2.070	0.80	Lumb, 1963
	rabbit			58	NS	2.0	0.920	Barrow, 1976
Livestock	camel		NS	NS	NS	550	55.0	Hugh-Jones et al., 1978
	cattle	guernsey, fg	F	1	1,460	460	125.60	Amoroso et al., 1964
	cattle	guernsey, fg	F	1	2,920	410	127.80	Amoroso et al., 1964
	cattle	jersey, heifer	F	1	730	340	59.30	Amoroso et al., 1964
	chicken	leghorn	M&F	6	NS	1.80	0.4050	Gleeson, 1986
	chicken		NS	NS	NS	2.60	0.3230	Lasiewski and Calder, 1971
	donkey		F	1	1,825	120	19.10	Amoroso et al., 1964
	goat	several	F	3	1,095	52.50	12.340	Watkins et al., 1973
	horse	shetland type	M&F	3	NS	167.0	28.60	Mauderly, 1975
	horse	Fquus caballus	F	1	9,125	500	31.20	Amoroso et al., 1964
	horse	shetland type	F	1	NS	135.0	23.20	Mauderly, 1975
	horse	shetland type	F	1	NS	161.0	45.20	Mauderly, 1975
	horse	Equus caballus	M	1	NS	510	35.10	Amoroso et al., 1964
	horse	Equus caballus	M	1	2,190	410	40.0	Amoroso et al., 1964
	horse	Equus caballus	M	1	2,920	360	54.10	Amoroso et al., 1964
	horse	Equus caballus	M	1	5,475	600	59.70	Amoroso et al., 1964
	horse	shetland type	M	1	NS	205.0	19.90	Mauderly, 1975
	horse		NS	NS	1,971	481.0	208.0	NAS, 1971
	mule		M	1	4,745	210	19.50	Amoroso et al., 1964
	pig	Sus scrofa	F	1	183	17.0	19.10	Amoroso et al., 1964
	pig		NS	8	1.3	1.180	0.46920	Clement et al., 1986
	pig		NS	3	1	1.16700	0.66590	Mortola, 1984
	pig		NS	15	114	30	7.2570	Clement et al., 1986
	sheep	Ovis aries	F	1	730	52.0	28.0	Amoroso et al., 1964
	sheep		M	6	NS	36.0	5.580	Albelda et al., 1986
	sheep		NS	7	NS	38.0	7.60	Abraham et al., 1981

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Wildlife	deer	red	NS	NS	NS	83.0	9.0	Hugh-Jones et al., 1978
	ferret		M	9	NS	0.71150	0.1570	Vinegar et al., 1985
	fox	Arctic	NS	3	NS	3.60	0.6850	Casey et al., 1979
	fox	Arctic	NS	NS	NS	3.60	0.6850	Withers et al., 1979
	giraffe		NS	NS	NS	400	30.0	Hugh-Jones et al., 1978
	lemming	brownng	NS	NS	NS	0.0640	0.05220	Withers et al., 1979
	lemming	brown	NS	6	NS	0.0640	0.05220	Casey et al., 1979
	lemming	collared	NS	6	NS	0.0470	0.03020	Casey et al., 1979
	lemming	varying	NS	NS	NS	0.0470	0.03010	Withers et al., 1979
	llama		NS	NS	NS	105.0	8.50	Hugh-Jones et al., 1978
	lynx	Canada	NS	1	NS	12.930	3.740	Casey et al., 1979
	lynx		NS	NS	NS	12.930	3.740	Withers et al., 1979
	manatee		NS	NS	NS	250	45.0	Lumb, 1963
	marmot		NS	NS	NS	2.130	0.1740	Lumb, 1963
	muskrat		M&F	10	NS	0.79450	0.3550	MacArthur, 1984
	porpoise		NS	NS	NS	170	9.70	Lumb, 1963
	seal		NS	NS	NS	27.520	3.970	Lumb, 1963
	sloth	Bradypus grise-	NS	NS	NS	3.10	0.4850	Lumb, 1963
	sloth	Cholepus hoffm-	NS	NS	NS	4.50	0.8440	Lumb, 1963
	squirrel	Arctic ground	NS	3	NS	0.680	0.4290	Casey et al., 1979
	squirrel	Arctic ground	NS	NS	NS	1.460	0.4290	Withers et al., 1979
	vole	tundra	NS	6	NS	0.0320	0.02740	Casey et al., 1979
	vole	tundra	NS	NS	NS	0.0320	0.02740	Withers et al., 1979
	weasel	least	NS	4	NS	0.0750	0.05350	Casey et al., 1979
	weasel	least	NS	NS	NS	0.0750	0.05350	Withers et al., 1979
	wolverine		NS	NS	NS	14.0	2.9360	Withers et al., 1979
	wolverine		NS	3	NS	14.10	2.9360	Casey et al., 1979

TABLE 4-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Minute Volume (ℓ)	Reference
Birds	bobwhite		M&F	5	NS	0.1990	0.1350	Boggs and Kilgore, 1983
	burrowing owl		M&F	5	NS	0.1660	0.1290	Boggs and Kilgore, 1983
	duck	white peking	NS	5	NS	2.50	0.9310	Jones, 1985
	duck		NS	NS	NS	1.60	0.7650	Lasiewski and Calder, 1971
	goose		NS	NS	NS	6.80	1.50	Lasiewski and Calder, 1971
	ostrich		NS	NS	NS	88.0	8.10	Lasiewski and Calder, 1971
	pigeon		NS	NS	NS	0.3820	0.12740	Lasiewski and Calder, 1971
	quail	painted	NS	NS	NS	0.04340	0.02380	Lasiewski and Calder, 1971
Other	lizard	monitor		4	NS	0.030	0.00140	Bickler and Anderson, 1986
	turtle	diamond-back	NS	NS	NS	0.6850	0.0510	Lumb, 1963

NS = Not specified

from studies on inhalation exposure of free-living animals, the use of an activity correction factor may be appropriate.

The U.S. EPA (1980) has used the following equations to calculate inhalation rates (I) in units of m^3/day for mice and rats:

$$I \text{ (mice)} = 0.0345[W/0.025]^{2/3} \quad (4\text{-}1)$$

$$I \text{ (rats)} = 0.105[W/0.133]^{2/3} \quad (4\text{-}2)$$

where W is body weight in kg. The equation for rats is based on observations summarized by Altman and Dittmer (1972) and originally published by Guyton (1947), in which rats with a mean body weight of 0.1128 had a mean minute volume of 72.9 mℓ (0.105 m^3/day). The equation for mice is similarly derived but the mouse weight is erroneously indicated to be 0.025 kg. The actual value reported by Guyton (1947) is 0.0198 kg and is reported in Altman and Dittmer (1972) as 0.02 kg. The minute volume reported by Guyton (1947) is 24.54 mℓ (0.0353 m^3/day). Taking body weight ratios to the 2/3 power assumes that breathing rates are proportional to body surface area.

Reported minute volumes for a wide range of animals at rest are summarized in Table 4-1 and illustrated in Figures 4-1 (linear plot) and 4-2 (log-log plot). While Figure 4-2 shows a relatively clear relationship between log body weight and log minute volume, certain points are atypical and are not considered in the derivation of recommended values. Three of these points come from the study by Amoroso et al. (1964): sheep, miniature pigs, and Guernsey cattle. Most of the reported values given by Amoroso et al. (1964) are high compared with other studies. In this study, tidal volume was measured by a flow transducer attached to a mask that was sealed with jelly and made air-tight with an inflatable cuff. In addition, none of the animals were trained or subjected to such measurements prior to the published recordings. These factors may have contributed to the atypically high recorded minute volumes.

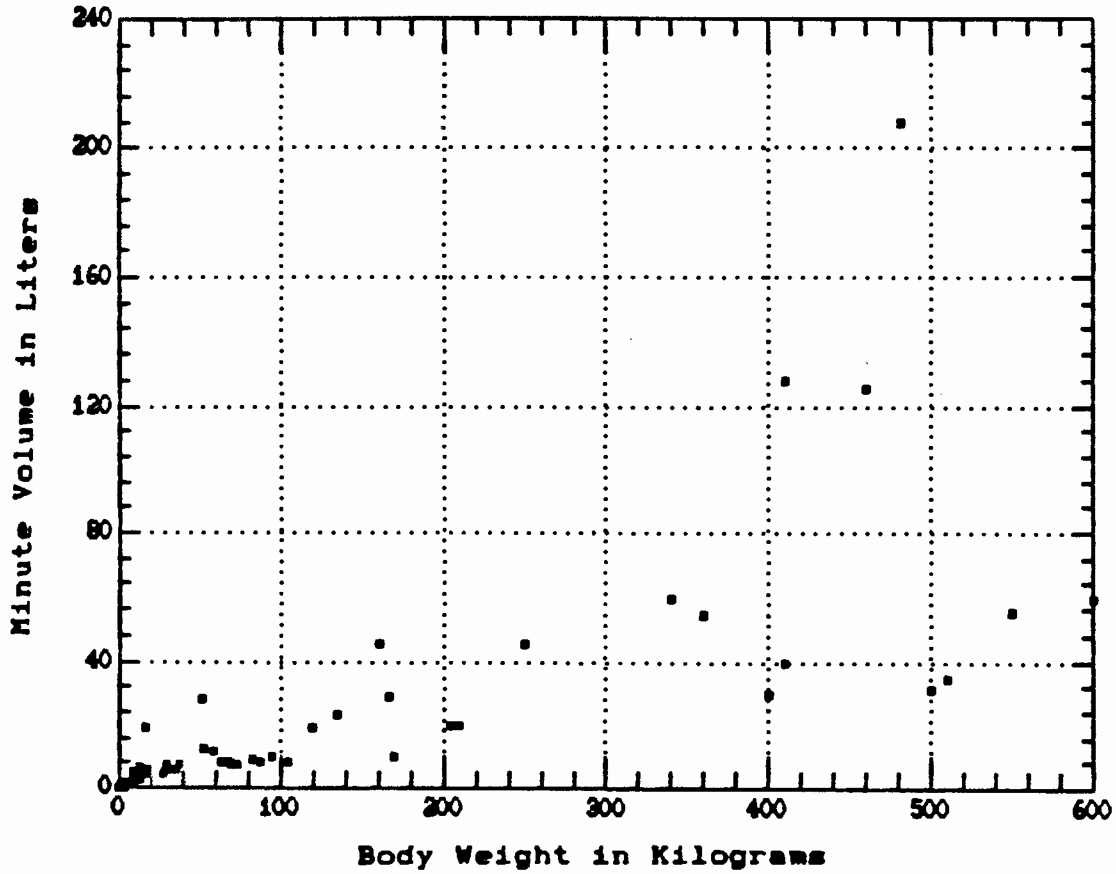


FIGURE 4-1

Linear Plot of the Relationship of
Minute Volume (ℓ) to Body Weight (kg)

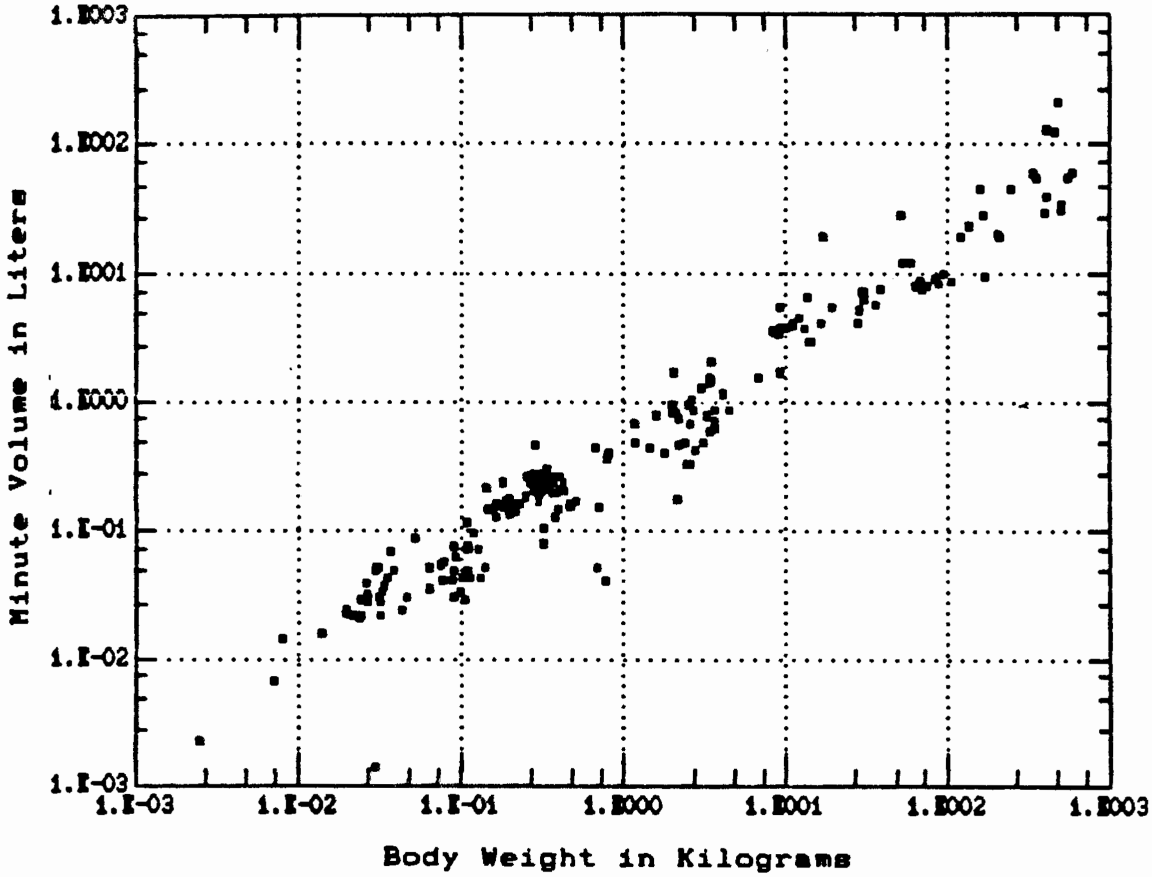


FIGURE 4-2

Log-Log Plot of the Relationship of
Minute Volume (ℓ) to Body Weight (kg)

In the study by Lai et al. (1978), one group of rats, subjected to tracheal cannulation without anesthesia, had an atypically high mean minute volume compared with three other groups in the study and compared with minute volumes of rats reported in other studies. This group of rats is not used in the recommendation of reference values.

Also excluded are reported minute volumes for the Monitor lizard (Lumb, 1963), the Diamond-back turtle (Bickler and Anderson, 1986) and the value reported for horses by NAS (1971).

The exclusion of the above points is not intended to suggest that the studies were flawed or that the values are erroneous or necessarily outliers in the statistical sense. Given the experimental difficulties in recording minute volumes, the substantial degree of scatter is to be expected. Nonetheless, the excluded points are clearly at variance with the majority of the data on the same species or other species of similar body weights. The exclusion of these points does not have a substantial effect on the statistical analyses below or on the recommendations of reference inhalation rates for risk assessment.

The work of Guyton (1947) is the best study of comparative respiratory volumes in laboratory animals and is commonly cited in the recent literature as the basis for assumed respiratory volumes. Guyton (1947) used five different methods, only one of which involved anesthesia, to measure respiratory rates of animals at rest. As noted by Guyton (1947) and confirmed by the larger data set in Figure 4-2, there is a strong positive correlation between body weight and minute volume for species, covering a substantial weight range (0.0066-600 kg). As noted by Guyton (1947) and Adolph (1949), however, this relationship does not appear to be based on the surface area proportionality. Guyton (1947) proposed a proportionality of body weight to the 3/4 power. An analysis of the data summarized in Table 4-1, excluding only those points discussed previously, bears out this relationship remarkably well:

$$\ln MV = -0.88 + 0.7579 \ln (W) \quad (4\text{-}3)$$

or

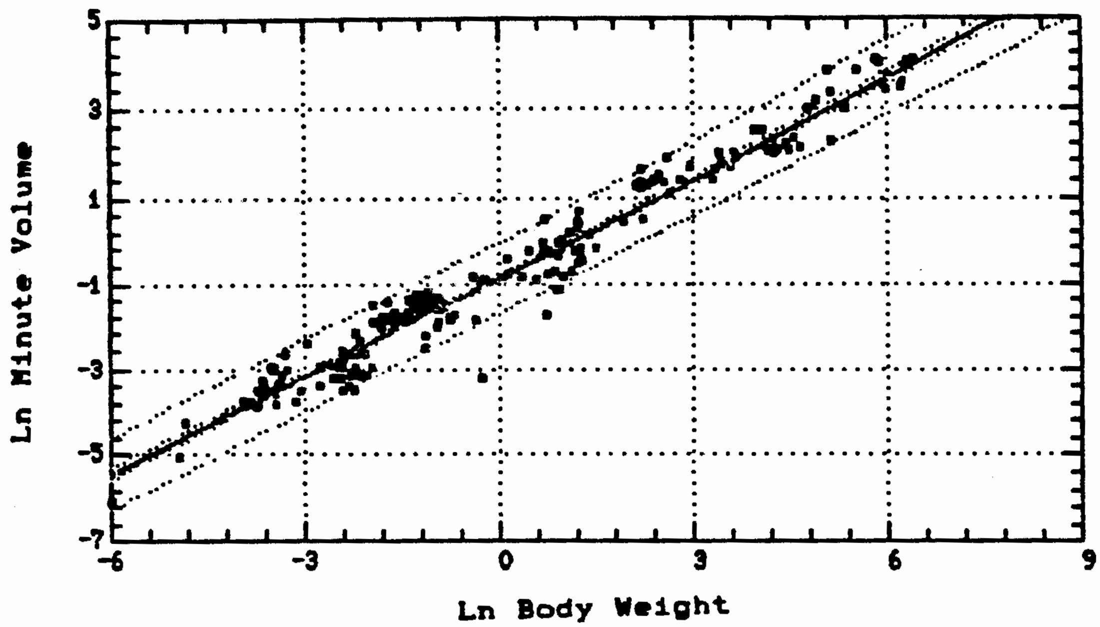
$$MV = 0.46 (W)^{0.7579} \quad (4\text{-}4)$$

This relationship, along with summary statistics, is illustrated in Figure 4-3. Equations 4-3 and 4-4 are recommended for calculating minute volumes (MV in ℓ/minute) for body weight (W in kg) for animals at rest if more specific relationships, detailed below, are not available. Equation 4-4 can be converted to a daily inhalation volume (I) by multiplying the right side of the equation by 1.44 (60 minutes/hourx24 hours/day divided by 1000 ℓ/m^3) to yield:

$$I = 0.66 (W)^{0.7579} \quad (4\text{-}5)$$

This equation is based on the breathing pattern of animals reportedly at rest. When applied to risk assessments, consideration should be given to upper or lower bound estimates of breathing rates, based on the summary statistics provided in Figure 4-3, if unusually high or low levels of activity are reported in the study under review.

No species, with the possible exceptions of the Monitor lizard and Diamond-back turtle, are clear outliers to the above relationships. Even for the apparent outliers, it is unclear if the differences in minute volumes from those of species of similar body weights are due to true species differences or experimental variability or error. Nonetheless, if species-specific information is available on the relationship of body weight



B0: -0.88283 SE: 0.0281 T: -31.417
B1: 0.75794 SE: 0.010103 T: 75.021
CORR: 0.98084 MSE: 0.17593 DF: 222

FIGURE 4-3

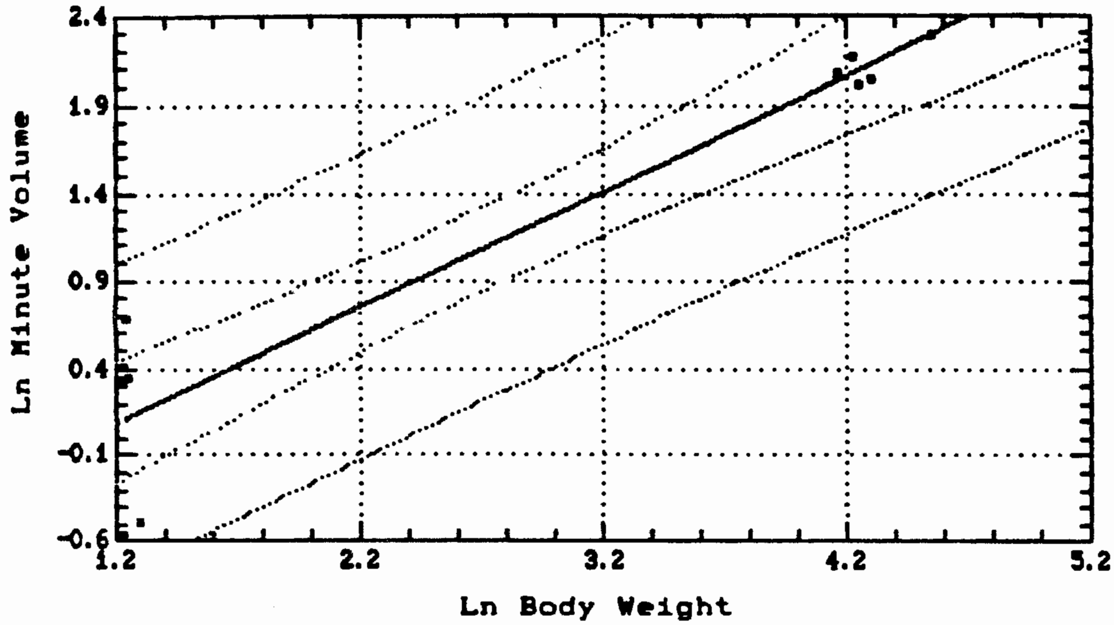
Allometric Relationship of
Minute Volume (ℓ) to Body Weight (kg) for All Species

to inhalation rate, this information should be used in deriving species-specific recommended values. As summarized in Table 4-2 and Figures 4-4 through 4-14, species-specific allometric equations can be proposed for most species of concern in risk assessment. The high correlation coefficients noted in Table 4-2 are generally due to separate clusters of points for very young and adult animals. Most of the data on the breathing rates of newborn animals come from the work of Mortola (1983, 1984) and Mortola and Noworaj (1985). Recently, Mortola (1987) reviewed the available data on breathing in newborn mammals, including an assessment of allometric relationships. Within either group, young or adult animals, the correlation coefficients are much lower, reflecting either experimental variability or the importance of biological variables other than body weight. This intraspecies variation is particularly evident in Figure 4-6, which plots data on individual Rhesus monkeys reported by Karel and Weston (1946). The data reported by Cross (1949) appear to be atypically low, both for human infants when compared with the more recent data of Fisher et al. (1982) as for humans and monkeys combined (see Figure 4-7). The allometric relationship for guinea pigs has a very low correlation coefficient. The reasons for the poor correlation in this species are not apparent.

TABLE 4-2

Allometric Relationships for Inhalation Rate in m^3/day (I) to Body Weight in kg (W)

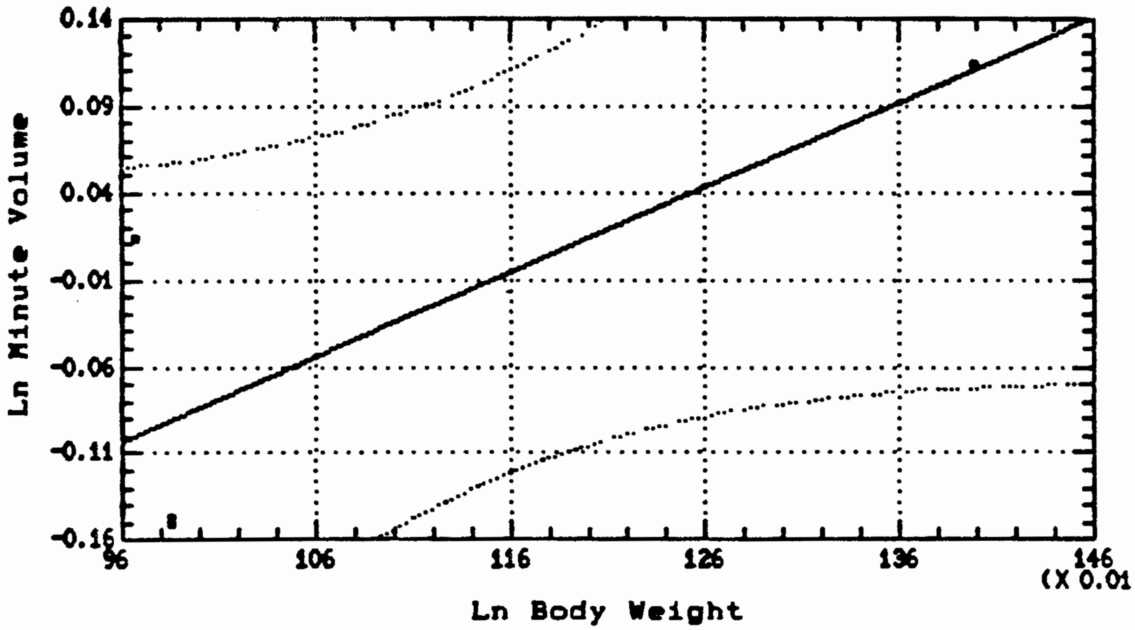
Animal Group	Allometric Equation	r^2	Figure
All species combined	$I = 0.66\ W^{0.7579}$	0.96	4-3
Monkeys	$I = 0.81\ W^{0.4862}$	0.72	4-5
Guinea pigs	$I = 0.44\ W^{0.5156}$	0.32	4-8
Hamsters	$I = 0.50\ W^{0.9017}$	0.86	4-9
Mice	$I = 1.99\ W^{1.0496}$	0.87	4-10
Rats	$I = 0.80\ W^{0.8206}$	0.77	4-11
Cats	$I = 0.32\ W^{0.5945}$	0.81	4-12
Dogs	$I = 0.67\ W^{0.7091}$	0.89	4-13
Rabbits	$I = 0.46\ W^{0.8307}$	0.88	4-14



B0: -0.70048 SE: 0.22409 T: -3.1258
B1: 0.65865 SE: 0.070967 T: 9.281
CORR: 0.94656 MSE: 0.14002 DF: 10

FIGURE 4-4

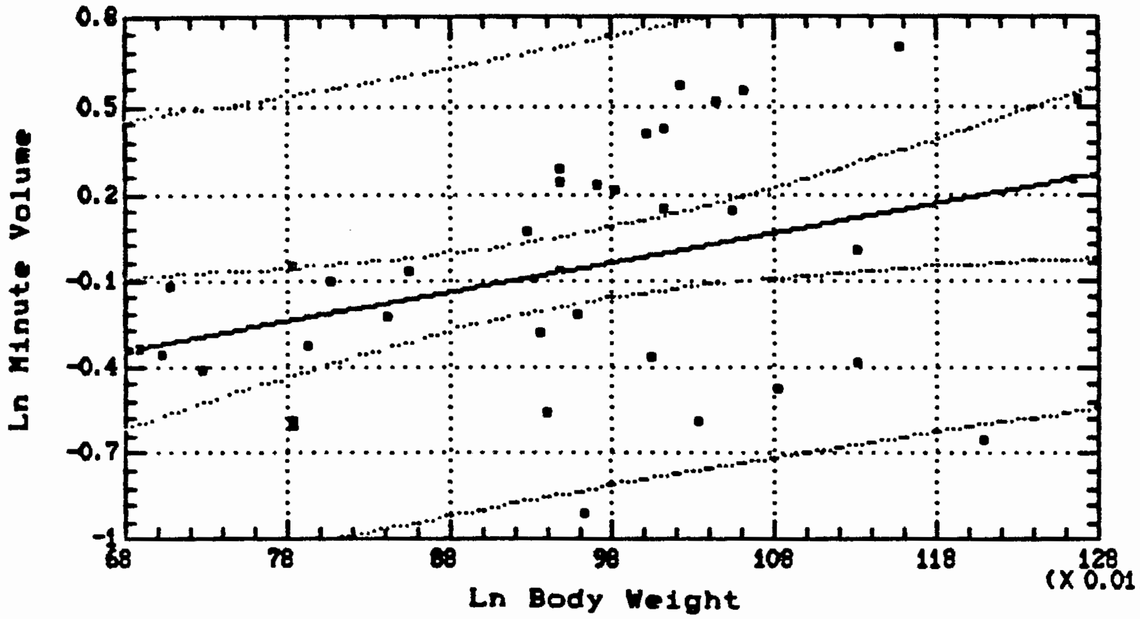
Allometric Relationship of
Minute Volume (ℓ) to Body Weight (kg) for Humans



B0: -0.56924 SE: 0.20599 T: -2.7634
B1: 0.48616 SE: 0.17675 T: 2.7506
CORR: 0.8462 MSE: 6.5944E-3 DF: 3

FIGURE 4-5

Allometric Relationship of
Minute Volume (ℓ) to Body Weight (kg) for Monkeys
(All data in Table 4-1)

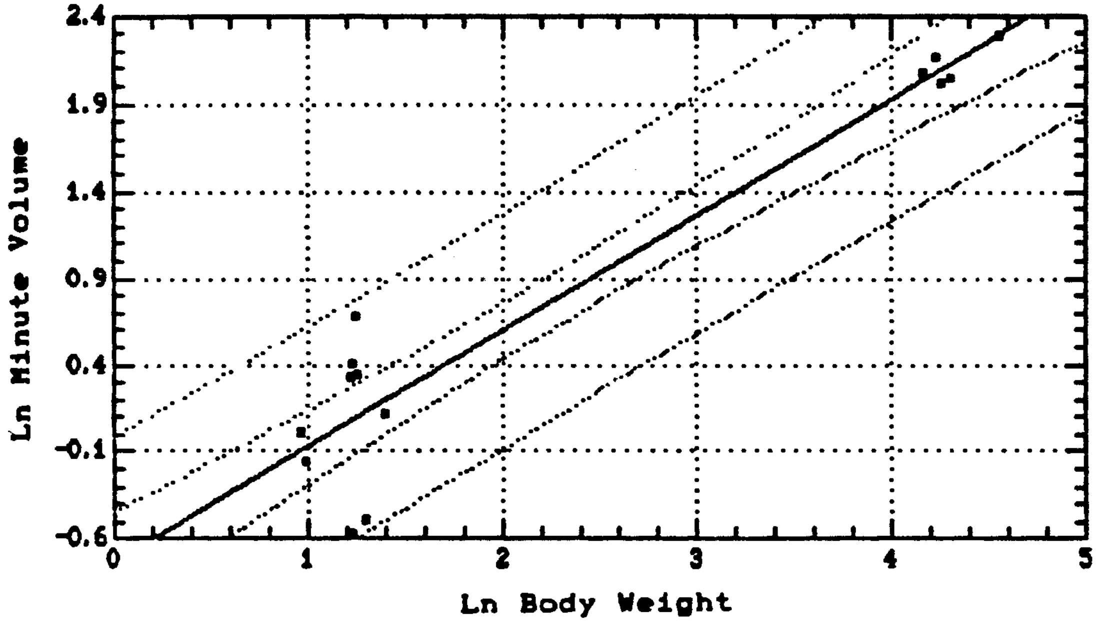


B0: -1.0573 SE: 0.39644 T: -2.6669
B1: 1.0381 SE: 0.40928 T: 2.5365
CORR: 0.38487 MSE: 0.14022 DF: 37

FIGURE 4-6

Allometric Relationship of Minute Volume (ℓ) to Body Weight (kg) for Individual Rhesus Monkeys

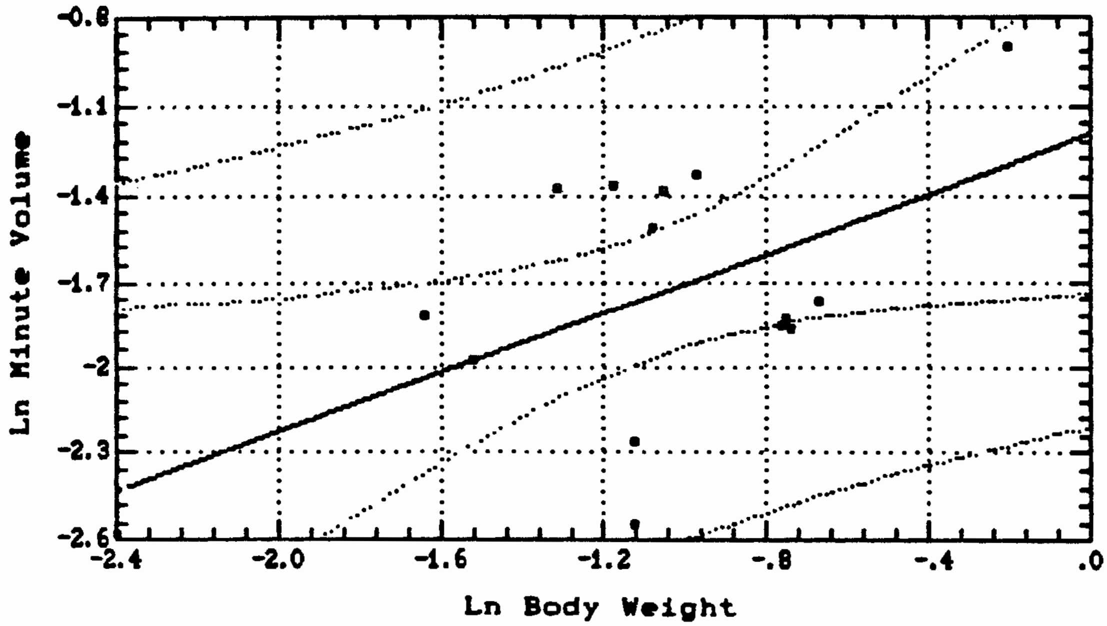
(Data from Karel and Weston, 1946, not summarized in Table 4-1)



B0: -0.74125 SE: 0.13836 T: -5.3575
B1: 0.66789 SE: 0.050731 T: 13.165
CORR: 0.95935 MSE: 0.095919 DF: 15

FIGURE 4-7

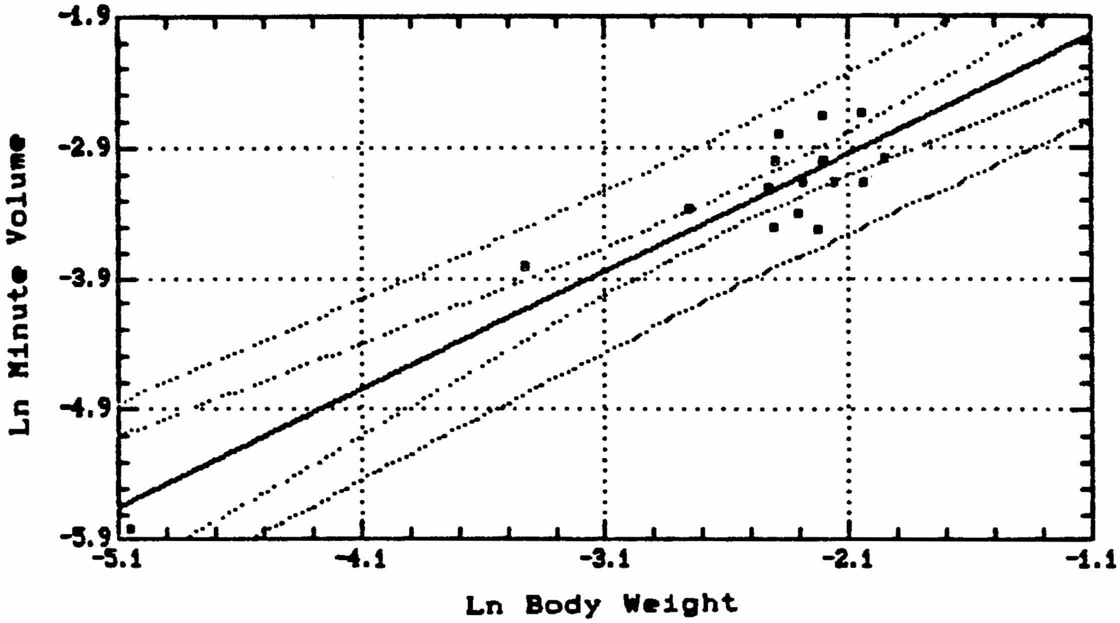
Allometric Relationship of Minute Volume (ℓ)
to Body Weight (kg) for Humans and Monkeys Combined



B0: -1.1909 SE: 0.25402 T: -4.6884
B1: 0.51559 SE: 0.21094 T: 2.4442
CORR: 0.56113 MSE: 0.15895 DF: 13

FIGURE 4-8

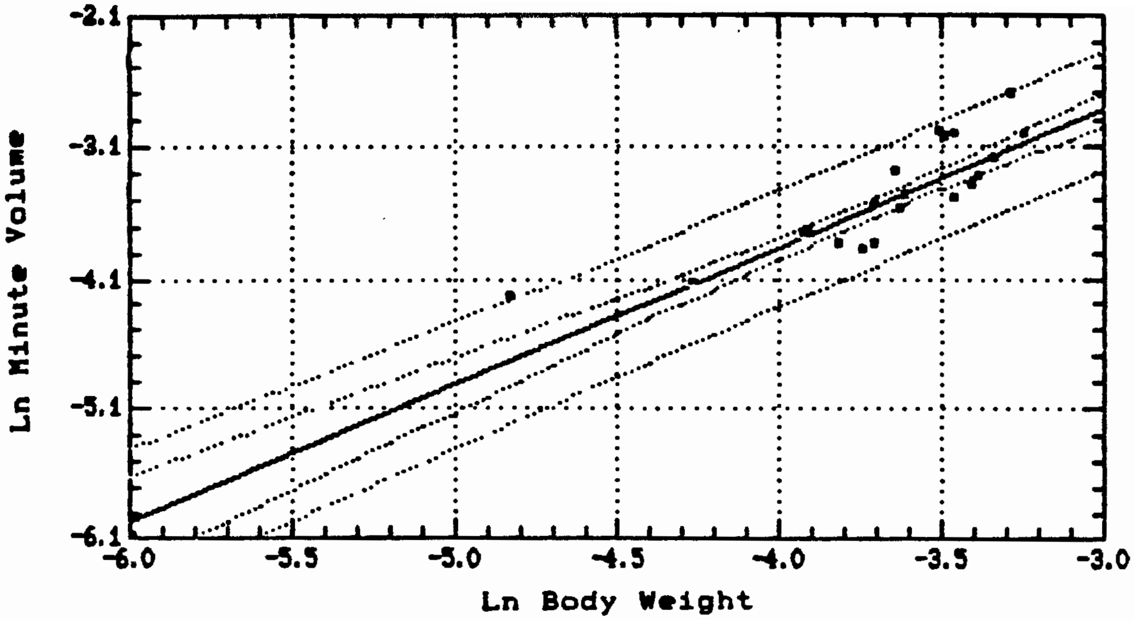
Allometric Relationship of Minute Volume (ℓ) to Body Weight (kg) for Guinea Pigs



B0: -1.054 SE: 0.24428 T: -4.3147
B1: 0.90168 SE: 0.094009 T: 9.5914
CORR: 0.92726 MSE: 0.076956 DF: 15

FIGURE 4-9

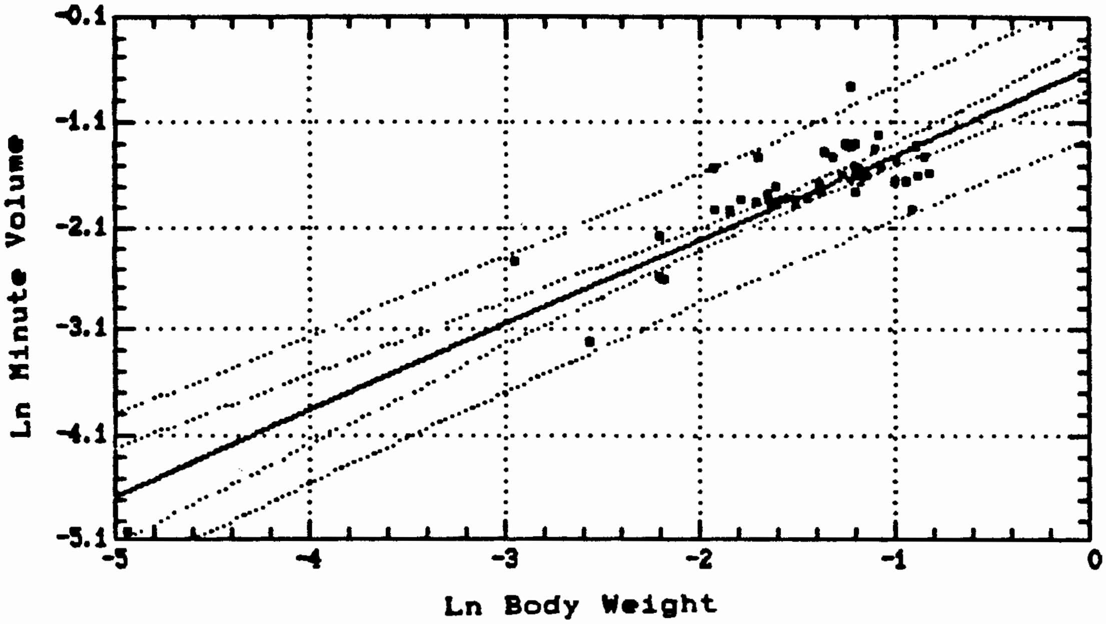
Allometric Relationship of Minute Volume (ℓ) to Body Weight (kg) for Hamsters



B0: 0.32599 SE: 0.2764 T: 1.1794
B1: 1.0496 SE: 0.07377 T: 14.228
CORR: 0.93324 MSE: 0.045477 DF: 30

FIGURE 4-10

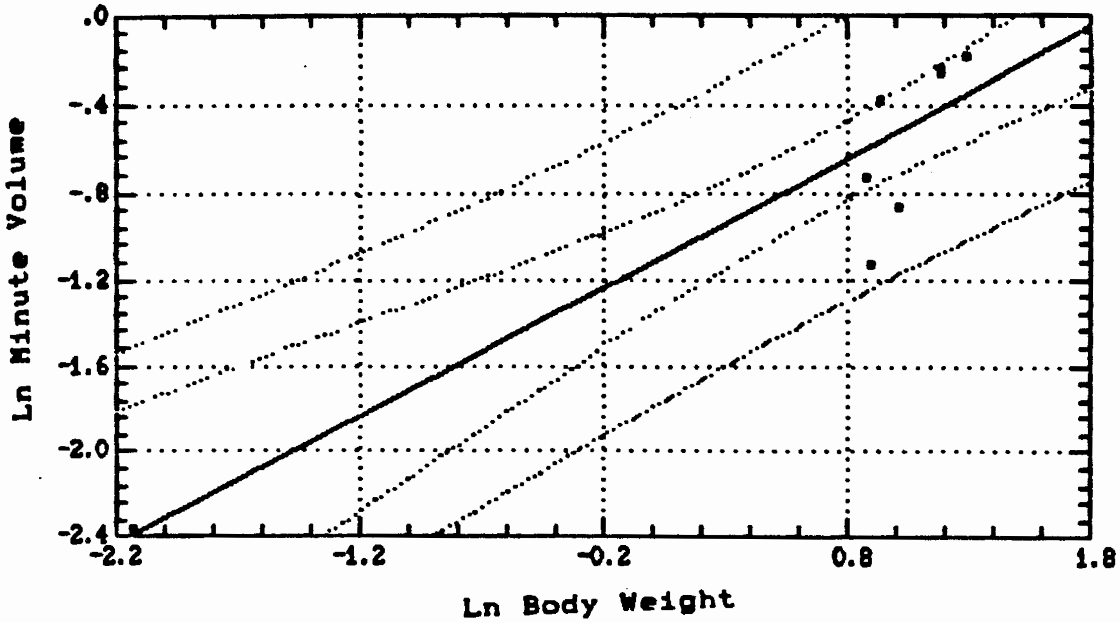
Allometric Relationship of Minute Volume (ℓ)
to Body Weight (kg) for Mice



B0: -0.57838 SE: 0.10607 T: -5.4531
B1: 0.82061 SE: 0.06357 T: 12.909
CORR: 0.87704 MSE: 0.096214 DF: 50

FIGURE 4-11

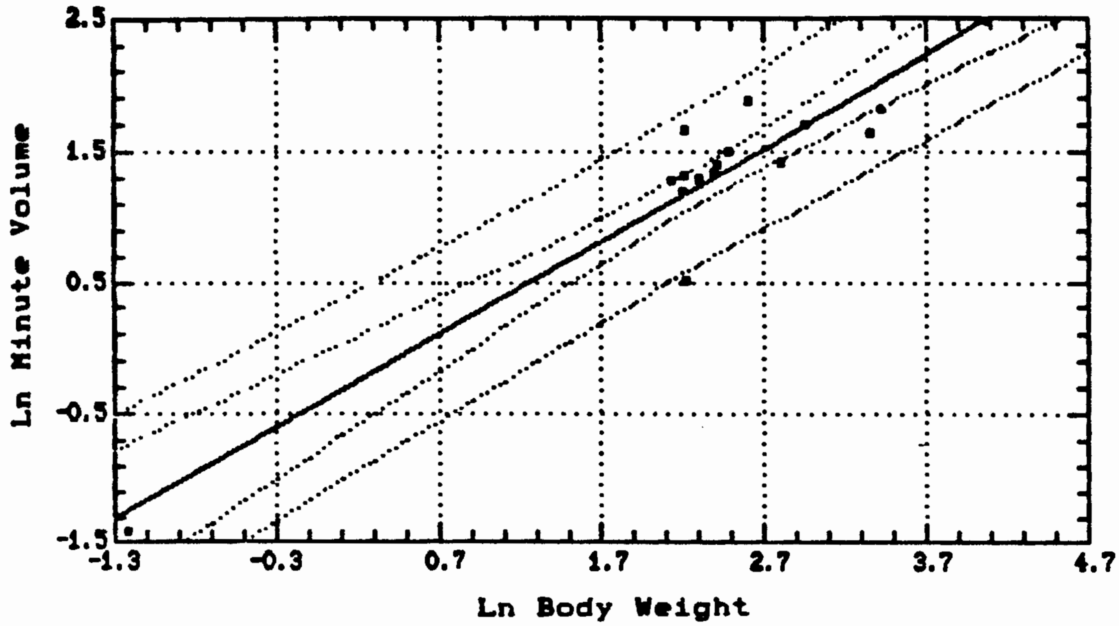
Allometric Relationship of Minute Volume (ℓ)
to Body Weight (kg) for Rats



B0: -1.1287 SE: 0.10625 T: -10.623
B1: 0.59451 SE: 0.091748 T: 6.4798
CORR: 0.89869 MSE: 0.07798 DF: 10

FIGURE 4-12

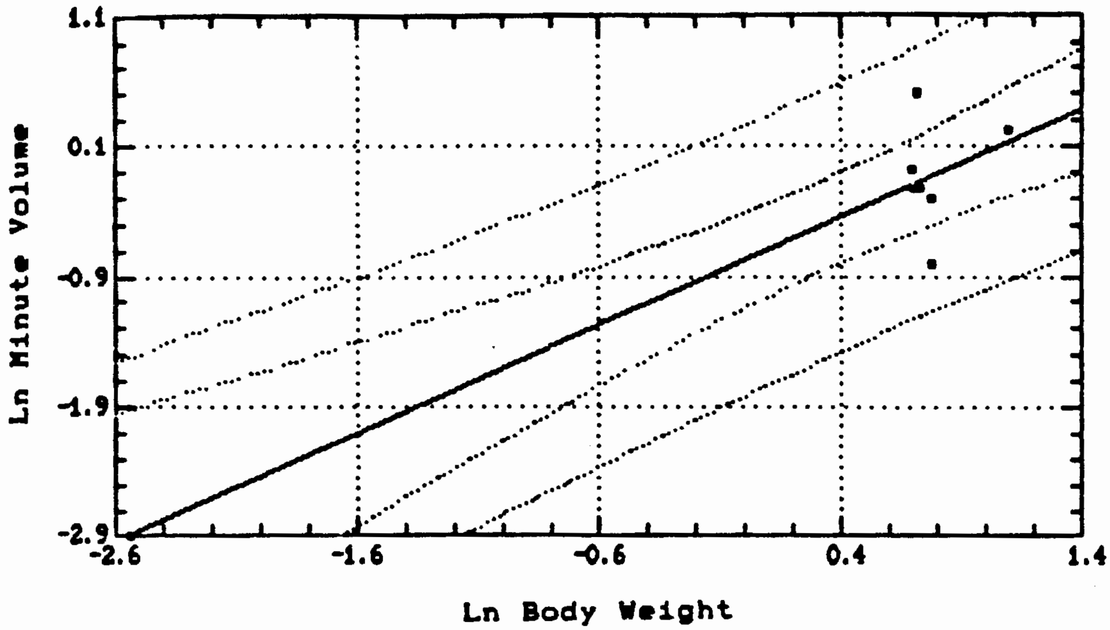
Allometric Relationship of Minute Volume (ℓ)
to Body Weight (kg) for Cats



B0: -0.39103 SE: 0.17066 T: -2.2913
B1: 0.7091 SE: 0.065154 T: 10.883
CORR: 0.94212 MSE: 0.078804 DF: 15

FIGURE 4-13

Allometric Relationship of Minute Volume (ℓ) to Body Weight (kg) for Dogs



B0: -0.7827 SE: 0.14872 T: -5.2627
B1: 0.83065 SE: 0.1277 T: 6.5048
CORR: 0.93585 MSE: 0.15914 DF: 6

FIGURE 4-14

Allometric Relationship of Minute Volume (ℓ)
to Body Weight (kg) for Rabbits

5. WATER CONSUMPTION

The U.S. EPA (1980) has used a reference value of 2 ℓ/day for water consumption of a 70 kg man. The Office of Drinking Water uses this value and a reference drinking water rate of 1 ℓ/day for a 10 kg child. The Agency has not adopted recommended values for experimental animals.

The rate of water consumption can be affected by many factors including ambient temperature, level of activity, diet, and abnormal physiological or pathological conditions. Chew (1965) extensively reviewed the literature on water balance in mammals, and a similar review was provided by Bartholomew and Cade (1963) on land birds. More recent comprehensive reviews were not found during the preparation of this report. Classic papers on water metabolism include those by Adolph (1947) and Bailey (1923). Only a few of the many examples of factors affecting water intake are given below.

The effects of reproductive status on water intake can be substantial. For instance, pregnant or lactating cows consume about 4 times as much water as nonlactating cows (Mount and Ingram, 1971), and chickens in the egg-producing stage consume about twice the amount of water of nonproducing chickens (Howard, 1975).

Also, several examples have been reported on the effect of diet on water consumption. For guinea pigs, the amount of "greens" (usually kale or lettuce) in the diet is inversely related to water requirements. Guinea pigs receiving a green food supplement require only 50-100 mℓ water/day, but without the supplement, guinea pigs require 25-100 mℓ/day (Ediger, 1976). Dogs consuming canned food, with an average moisture content of 75%, may not require any additional water consumption (Corbin, 1976). A significant increase in the salt content of the diet can substantially increase water consumption, as demonstrated in mink when given 1 and 2% salt-enhanced diets. No change in water consumption was seen in mink fed a 0.5% salt-enhanced diet (Erikson et al., 1984). Variations of dietary salt within normal limits does not appear to affect the water intake of humans (Luft et al., 1983).

Seasonal differences or changes in ambient temperature also can affect water intake for lions (Green et al., 1984) and for turkeys (Parker et al., 1972). Remarkable decreases in water and food consumption occur in hibernating animals before hibernation for marmots (Zatzman et al., 1984). In some cases, seasonal differences are not substantial, as with the early food and water intake of neonatal calves (Kertz et al., 1984).

In a study on chickens with hereditary diabetes insipidus, Dunson et al. (1972) reviewed information on several strains of laboratory animals, none of which are commonly used in toxicity bioassays, with hereditary polydipsia.

These and other confounding factors may be related to the generally poor intraspecies correlations of water intake and body weight discussed below. Despite the number of variables that can affect water consumption, interspecies correlations covering a wide range of body weights are generally high. Using data on several mammalian species, Adolph (1943) proposed the following relationship:

$$L = 0.01\ W^{0.88} \qquad (5\text{-}1)$$

where L is water consumption in mℓ/hour and W is body weight in grams. A similar relationship ($W^{0.9}$) had been noted somewhat earlier by Richter (1938).

Table 5-1 summarizes data on water consumption for several species of animals. [Many of the references cited in this table are reviews or standard texts (Arrington, 1978; Bruce, 1950; Chew, 1975; Cizek, 1961;

TABLE 5-1

Water Consumption Data on Various Animal Groups

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Primates	baboon	<u>P. ursinus</u>	NS			21.1	1.31	Chew, 1965
	human		M			70	2.184	Adolph and Dill, 1938
	human		M			65	2.275	Altman and Dittmer, 1968
	human		M	24	6935+	78.6	3.239	Luft et al., 1983
	monkey	rhesus	F			8	0.45	Templeton, 1968
	monkey	rhesus	F			9	0.45	Arrington, 1972
	monkey	rhesus	M			11	0.45	Arrington, 1972
	monkey	rhesus	M			11	0.45	Templeton, 1968
	monkey	NS	NS			5.45	0.39	Chew, 1965
Laboratory rodents	gerbil	Mongolian	M&F	20	215	0.06125	0.0038	Harriman, 1969a
	gerbil	Mongolian	M&F	16-20	adult	0.06125	0.00565	McManus, 1972
	gerbil	Mongolian	F			0.075	0.004	Templeton, 1968
	gerbil		F			0.075	0.004	Arrington, 1972
	gerbil	Mongolian	M			0.085	0.004	Templeton, 1968
	gerbil	Mongolian	M	11	70-80	0.0705	0.0055	Laughlin et al., 1975
	gerbil		M			0.085	0.004	Arrington, 1972
	guinea pig		F			1.025	0.09	Arrington, 1972
	guinea pig	albino short-hair	M	5	10	0.2	0.04	Hirsch, 1973
	guinea pig	albino short-hair	M	5	20	0.27	0.052	Hirsch, 1973
	guinea pig	albino short-hair	M	5	30	0.11	0.08	Hirsch, 1973
	guinea pig	albino short-hair	M	5	60	0.52	0.11	Hirsch, 1973
	guinea pig	albino short-hair	M	5	40	0.415	0.115	Hirsch, 1973
	guinea pig	albino short-hair	M	5	50	0.48	0.12	Hirsch, 1973
	guinea pig	albino short-hair	M	5	70	0.58	0.151	Hirsch, 1973
	guinea pig		M			1.2	0.09	Arrington, 1972

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Laboratory rodents	guinea pig		NS			0.1	0.08	Latt, 1976
	guinea pig		NS		adult	0.8	0.084	Bruce, 1950
	guinea pig		NS		adult	0.8	0.084	Lane-Peter et al., 1967
	guinea pig		NS			0.3	0.12	Latt, 1976
	guinea pig		NS			0.4	0.145	Latt, 1976
	guinea pig		NS			0.5	0.16	Latt, 1976
	guinea pig		NS			0.7	0.18	Latt, 1976
	guinea pig		F			1	0.09	Templeton, 1968
	guinea pig		M			1.2	0.09	Templeton, 1968
	hamster	Syrian	F			0.0545	0.009	Templeton, 1968
	hamster	Syrian	F			0.1175	0.01	Arrington, 1972
	hamster	Syrian	M			0.05125	0.009	Templeton, 1968
	hamster	golden	NS		adult	0.09	0.008	Lane-Peter et al., 1967
	hamster		NS			0.025	0.005	Latt, 1976
	hamster		NS		adult	0.09	0.008	Bruce, 1950
	hamster		NS			0.05	0.01	Latt, 1976
	hamster		NS			0.1	0.02	Latt, 1976
	hamster		NS			0.15	0.025	Latt, 1976
	mouse	A/J	F	15	(100-110)	0.0209	0.0047	Kutscher, 1974
	mouse	BALB/c	F	15	(100-110)	0.0201	0.0056	Kutscher, 1974
	mouse	CB A	F	15	(100-110)	0.0259	0.0065	Kutscher, 1974
	mouse	Crl,CD-1,CR,BR	F	40	182	0.03075	0.0063	Chvedoff et al., 1980
	mouse	Crl,CD-1,CR,BR	F	40	364	0.03475	0.0076	Chvedoff et al., 1980
	mouse	Crl,CD-1,1CR,BR	F	40	546	0.03375	0.00645	Chvedoff et al., 1980
	mouse	C3H	F	15	(100-110)	0.0228	0.0062	Kutscher, 1974
	mouse	C57Bl/6Jms	F	63		0.0252	0.00359	Suzuki et al., 1975
	mouse	C57	F	15	(100-110)	0.0223	0.0062	Kutscher, 1974
	mouse	DBA	F	15	(100-110)	0.0247	0.0079	Kutscher, 1974
	mouse	STR/1N	F	13	152	0.0284	0.0068	Silverstein, 1960

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Laboratory rodents (cont.)	mouse	SWR	F	15	(100-110)	0.0217	0.011	Kutscher, 1974
	mouse	white	F	8	(105-120)	0.0282	0.0096	Chew and Hinegardner, 1957
	mouse	white	F	8	396	0.0335	0.0106	Chew and Hinegardner, 1957
	mouse	white	F	8	70	0.0248	0.0107	Chew and Hinegardner, 1957
	mouse		F			0.0265	0.0055	Arrington, 1972
	mouse	A/HeN	M	12	152	0.0297	0.0048	Silverstein, 1960
	mouse	A/J	M	15	(100-110)	0.0252	0.0049	Kutscher, 1974
	mouse	A/LN	M	7	152	0.0241	0.0057	Silverstein, 1960
	mouse	BALB/cAnN	M	8	152	0.0256	0.0043	Silverstein, 1960
	mouse	BALB/c	M	15	(100-110)	0.027	0.0048	Kutscher, 1974
	mouse	CBA	M	15	(100-110)	0.031	0.0071	Kutscher, 1974
	mouse	Charles River	M	7	adult	0.0453	0.0043	DeLacey et al., 1975
	mouse	Charles River	M	8	adult	0.0424	0.00479	DeLacey et al., 1975
	mouse	Cr1,CD-1,CR,BR	M	40	182	0.0405	0.0065	Chvedoff et al., 1980
	mouse	Cr1,CD-1,CR,BR	M	40	546	0.04475	0.00715	Chvedoff et al., 1980
	mouse	Cr1,CD-1,CR,BR	M	40	364	0.0455	0.00835	Chvedoff et al., 1980
	mouse	C3H	M	15	(100-110)	0.0264	0.0068	Kutscher, 1974
	mouse	C57B1/6Jms	M	60		0.0287	0.00391	Suzuki et al., 1975
	mouse	C57L/HeN	M	13	152	0.0264	0.0046	Silverstein, 1960
	mouse	C57	M	15	(100-110)	0.0275	0.0066	Kutscher, 1974
	mouse	DBA/2JN	M	9	152	0.0265	0.0054	Silverstein, 1960
	mouse	DBA	M	15	(100-110)	0.0309	0.0078	Kutscher, 1974
	mouse	STR/N	M	12	152	0.0291	0.01	Silverstein, 1960
	mouse	STR/1N	M	8	152	0.0337	0.01	Silverstein, 1960
	mouse	SWR	M	15	(100-110)	0.0286	0.0094	Kutscher, 1974
	mouse	white	M	8	396	0.0369	0.0106	Chew and Hinegardner, 1957
	mouse	white	M	8	(105-120)	0.0324	0.0109	Chew and Hinegardner, 1957
	mouse	white	M	8	70	0.0297	0.0121	Chew and Hinegardner, 1957

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Laboratory rodents (cont.)	mouse		M			0.03	0.0055	Arrington, 1972
	mouse	albino	NS			0.02875	0.00735	Chew, 1965
	mouse	deer	NS		adult	0.02	0.005	Bruce, 1950
	mouse	deer	NS		adult	0.02	0.005	Lane-Peter et al., 1967
	mouse	deer	NS			0.0189	0.0235	Chew, 1965
	mouse	meadow	NS			0.0315	0.066	Chew, 1965
	mouse	pine	NS			0.0182	0.0018	Chew, 1965
	mouse	white-foot	NS			0.02425	0.0355	Chew, 1965
	mouse	white	NS			0.029	0.00715	Chew, 1965
	mouse		NS		weanling	0.008	0.0025	Bruce, 1950
	mouse		NS			0.01	0.003	Latt, 1976
	mouse		NS			0.025	0.005	Latt, 1976
	mouse		NS		adult	0.025	0.006	Bruce, 1950
	mouse		NS		adult	0.025	0.006	Lane-Peter et al., 1967
	mouse		NS			0.05	0.006	Latt, 1976
	mouse		NS			0.075	0.008	Latt, 1976
	mouse	white			adult	0.0275	0.0065	Bruce, 1950
	rat	kangaroo	M&F	4		0.105	0.0058	Bailey, 1923
	rat		F			0.29	0.0275	Arrington, 1972
	rat		F	1	adult	0.26	0.028	Bruce, 1950
	rat		F	1	adult	0.36	0.03	Bruce, 1950
	rat		F	1	adult	0.26	0.038	Bruce, 1950
	rat		F	1	adult	0.275	0.085	Bruce, 1950
	rat		F	1	adult	0.36	0.085	Bruce, 1950
	rat	albino	M	14	(80-105)	0.2891	0.0354	Moyer, 1966
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0136	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0136	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.019	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0242	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0242	Delorme and Wojcik, 1982

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Laboratory rodents (cont.)	rat	Sprague-Dawley	M	10	24-52	0.05	0.0289	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0289	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	8	+12	0.442	0.039	Grunberg et al., 1984
	rat	Sprague-Dawley	M	8	180	0.38	0.04	Grunberg et al., 1984
	rat	Sprague-Dawley	M	8	+6	0.422	0.041	Grunberg et al., 1984
	rat		M			0.375	0.0275	Arrington, 1972
	rat	albino	NS	adult		0.3	0.024	Lane-Peter et al., 1967
	rat	cotton	NS	young adult		0.13	0.023	Bruce, 1950
	rat	cotton	NS	young adult		0.13	0.023	Lane-Peter et al., 1967
	rat	D. morroensis	NS			0.068	0.0148	Chew, 1965
	rat	D. panaminitinu	NS			0.079	0.016	Chew, 1965
	rat	Norway albino	NS			0.207	0.027	Chew, 1965
	rat	Norway	NS			0.241	0.02145	Chew, 1965
	rat	wood	NS			0.139	0.0181	Chew, 1965
	rat	wood	NS			0.11	0.0366	Chew, 1965
	rat	wood	NS			0.05	0.01	Latt, 1976
	rat		NS			0.1	0.02	Latt, 1976
	rat		NS		adult	0.25	0.02	Bruce, 1950
	rat		NS		adult	0.3	0.024	Bruce, 1950
	rat		NS			0.15	0.025	Latt, 1976
	rat		NS			0.2	0.03	Latt, 1976
	rat		NS		adult	0.225	0.031	Adolph, 1947
	rat		NS			0.25	0.035	Latt, 1976
Other laboratory mammals	cat		F			3	0.3	Arrington, 1978
	cat		F			3	0.3	Templeton, 1968
	cat	mixed	M	12	+7	4.5	0.1526	Taton et al., 1984
	cat	mixed	M	12	+42	4.3	0.1772	Taton et al., 1984
	cat	mixed	M	12	+21	4.4	0.1822	Taton et al., 1984

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Other laboratory mammals (cont.)	cat	mixed	M	10	+63	4.2	0.184	Taton et al., 1984
	cat	mixed	M	5	+294	4.6	0.1863	Taton et al., 1984
	cat	mixed	M	6	+147	4.2	0.1877	Taton et al., 1984
	cat	mixed	M	9	+91	4.1	0.1942	Taton et al., 1984
	cat	mixed	M	8	+119	4.1	0.2001	Taton et al., 1984
	cat	mixed	M	6	+203	4.3	0.206	Taton et al., 1984
	cat	mixed	M	6	+245	4.5	0.207	Taton et al., 1984
	cat	mixed	M	5	+336	4.6	0.2199	Taton et al., 1984
	cat	mixed	M	6	+175	4.3	0.227	Taton et al., 1984
	cat		M			3	0.3	Arrington, 1978
	cat		M			3	0.3	Templeton, 1968
	cat		NS			4.49	0.32	Chew, 1965
	cat		NS			4.49	0.32	Chew, 1965
	dog		M&F	8	adult	24	0.8	Brown et al., 1984
	dog	beagle	F			11.5	0.3	Arrington, 1972
	dog	beagle	F			14.5	0.35	Templeton, 1968
	dog	mongrel	F	7	730 +	15.9	0.33128	Golob et al., 1977
	dog	mongrel	F	7	730 +	15.9	0.5669	Golob et al., 1977
	dog	beagle	M			15.5	0.3	Arrington, 1972
	dog	beagle	M			15.5	0.35	Templeton, 1968
	dog	greyhounds	NS	4		29.2	1.005	McKeever et al., 1985
	dog	greyhounds	NS	4		28.5	1.333	McKeever et al., 1985
	rabbit	Dutch	F	6	+185	2.32	0.174	Cizek, 1961
	rabbit	Dutch	F	6	+164	2.3	0.175	Cizek, 1961
	rabbit	Dutch	F	6	+70	2.13	0.185	Cizek, 1961
	rabbit	Dutch	F	6	+112	2.28	0.185	Cizek, 1961
	rabbit	Dutch	F	6	+143	2.29	0.185	Cizek, 1961
	rabbit	Dutch	F	12		2.571	0.187	Cizek, 1961
	rabbit	Dutch	F	12	+183	2.571	0.187	Cizek, 1961
	rabbit	Dutch	F	6	+91	2.19	0.195	Cizek, 1961
	rabbit	Dutch	F	12	+0	2.165	0.219	Cizek, 1961
	rabbit	Dutch	F	6	+07	1.79	0.22	Cizek, 1961
	rabbit	Dutch	F	6	+21	1.89	0.225	Cizek, 1961
	rabbit	Dutch	F	6	+35	1.96	0.226	Cizek, 1961
	rabbit	Dutch	F	6	+49	2.07	0.226	Cizek, 1961

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Other laboratory mammals (cont.)	rabbit	New Zealand white	F			5	0.3	Templeton, 1968
	rabbit		F			5	0.3	Arrington, 1972
	rabbit	Dutch	M	12	+183	2.002	0.166	Cizek, 1961
	rabbit	Dutch	M	6	+175	2.2	0.169	Cizek, 1961
	rabbit	Dutch	M	6	+154	2.23	0.17	Cizek, 1961
	rabbit	Dutch	M	6	+133	2.19	0.178	Cizek, 1961
	rabbit	Dutch	M	6	+70	2.22	0.185	Cizek, 1961
	rabbit	Dutch	M	6	+112	2.27	0.188	Cizek, 1961
	rabbit	Dutch	M	6	+91	2.23	0.19	Cizek, 1961
	rabbit	Dutch	M	12	+0	1.799	0.202	Cizek, 1961
	rabbit	Dutch	M	6	+49	2.16	0.21	Cizek, 1961
	rabbit	Dutch	M	6	+21	1.95	0.224	Cizek, 1961
	rabbit	Dutch	M	6	+35	2.09	0.225	Cizek, 1961
	rabbit	Dutch	M	6	+07	1.91	0.255	Cizek, 1961
	rabbit	New Zealand white	M			4.5	0.3	Templeton, 1968
	rabbit	New Zealand white	M	10		2.168	0.369	Cizek, 1961
	rabbit	M				4.5	0.3	Arrington, 1972
	rabbit	albino + CB	NS	11	adult	2.8	0.36	Bruce, 1950
	rabbit	albino & cross	NS	11		2.8	0.36	Lane-Peter et al., 1967
	rabbit	Dutch	NS	22	adult	2.1	0.319	Bruce, 1950
	rabbit	Dutch	NS	22		2.1	0.319	Lane-Peter et al., 1967
	rabbit	Himalayan	NS	16	adult	1.9	0.245	Bruce, 1950
	rabbit	Himalayan	NS	16		1.9	0.245	Lane-Peter et al., 1967
	rabbit	lop eared	NS	10	adult	3.5	0.446	Bruce, 1950
	rabbit	lop eared	NS	10		3.5	0.446	Lane-Peter et al., 1967
	rabbit	several	NS	59	adult	2.4	0.328	Bruce, 1950
	rabbit		NS		adult	2.5	0.16	Kennaway, 1943
	rabbit		NS	59		2.4	0.328	Lane-Peter et al., 1967
	rabbit		NS		adult	2.4	0.328	Lane-Peter et al., 1967

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Other laboratory mammals (cont.)	rabbit	Dutch				2.14	0.201	Chew, 1965
	rabbit	Dutch				2.14	0.201	Chew, 1965
Livestock	cattle	Zebu	M&F			151	11.935	Chew, 1965
	cattle	Zebu	M&F			151	11.935	Chew, 1965
	cattle	holstein	F	7		3619	162	Atkeson and Warren, 1934
	cattle	holstein	F	7		3605	205	Atkeson and Warren, 1934
	cattle	holstein	F	7		3330	241.6	Atkeson and Warren, 1934
	cattle	holstein	F	7		3330	422	Atkeson and Warren, 1934
	cattle	jersey, holstein	F			427	17.92	Chew, 1965
	cattle	shorthorn	F			632	32.24	Chew, 1965
	cattle	HO,H,TL	M	12		313	43.1	Becker et al., 1985
	cattle	Kumauni	M			340	8.9	Chew, 1965
	cattle	steer	M			391	8.53	Chew, 1965
	chicken	brown leghorn	F	16		1.65	0.115	Howard, 1975
	chicken	brown leghorn	F	16		1.65	0.225	Howard, 1975
	chicken	white leghorn	M	4		2.257	0.614	Dunson and Buss, 1968
	chicken	white leghorn	M	6		1.603	0.119	Dunson et al., 1972
	chicken	white leghorn	NS	14	21	0.183	0.042	Dunson and Buss, 1968
	chicken	white leghorn	NS	4	28	0.2	0.043	Dunson and Buss, 1968
	chicken	white leghorn	NS	8	28	0.32	0.046	Dunson and Buss, 1968
	chicken	white leghorn	NS	15	84-196	1.532	0.13	Dunson and Buss, 1968
	cow		NS	20	18	44.11	1	Kertz et al., 1984
	cow		NS	20	11	44.43	1.14	Kertz et al., 1984
	cow		NS	20	25	47.2	1.18	Kertz et al., 1984
	cow		NS	20	31	52.65	2.59	Kertz et al., 1984
	horse	pony	M	4		202.5	8.7	Sufit et al., 1985
	horse		NS			611	76	Chew, 1965
	pig	P. angulatus	NS			23.6	2.2	Chew, 1965

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Livestock (cont.)	pig	white cross	NS	51	28	5.49	0.71	Brooks et al., 1984
	pig	white cross	NS	51	28	6.15	0.74	Brooks et al., 1984
	pig	white cross	NS	51	35	7.15	1.09	Brooks et al., 1984
	pig	white cross	NS	51	35	7.99	1.31	Brooks et al., 1984
	pig	white cross	NS	51	42	9.77	1.63	Brooks et al., 1984
	pig	white cross	NS	51	49	13.06	2.15	Brooks et al., 1984
	pig	white cross	NS	51	42	10.6	2.16	Brooks et al., 1984
	pig	white cross	NS	51	42	13.6	2.58	Brooks et al., 1984
	pig		NS			45.5	8.38	Chew, 1965
	pig		NS			149.9	8.7	Chew, 1965
	sheep	Corriedale	NS			52.7	2.06	Chew, 1965
	sheep	Merino	NS			29.9	1.17	Chew, 1965
Wildlife	camel	Dromedarius	NS			243	3.18	Chew, 1965
	deer	desert mule	NS			22.35	1.47	Chew, 1965
	deer	various	NS			34.95	2.84	Chew, 1965
	elephant	E. maximus	NS			3630	139	Chew, 1965
	ferret	domestic	F		adult	0.675	0.0875	Moody et al., 1985
	ferret	domestic	M		adult	2.025	0.0875	Moody et al., 1985
	lion		F	1		149	0.8	Green et al, 1984
	lion		M	1		91	1.07	Green et al, 1984
	lion		M	1		193	3.98	Green et al, 1984
	marmot	yellow-bellied	F	9	+14	3.81	0.134	Zatzman et al., 1984
	marmot	yellow-bellied	F	9	+28	3.86	0.182	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+175	5.32	0.034	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+168	5.33	0.041	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+154	5.29	0.063	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+140	5.46	0.089	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+126	5.5	0.117	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+112	5.45	0.145	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+98	5.39	0.187	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+42	4.62	0.191	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+56	4.76	0.211	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+84	5.19	0.228	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+70	4.95	0.231	Zatzman et al., 1984
	mink		M	4		1.613	0.175	Eriksson et al. 1984
	shrew	short-tailed	NS			0.0258	0.0125	Chew, 1965
	squirrel	C. leucurus	NS			0.085	0.0102	Chew, 1965
	squirrel	ground	NS			0.0925	0.0134	Chew, 1965

TABLE 5-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (ℓ/day)	Water	Reference
Wildlife (cont.)	vole	meadow	NS	7	(40-50)	0.045	0.00205	Laughlin et al., 1975
	vole	red-backed	NS			0.0279	0.025	Chew, 1965
	vole	tundra	NS			0.0426	0.0158	Chew, 1965
Birds	Br. mourning dov	Zenaidura mac.	NS			0.104	0.0103	Bartholomew and Cade, 1963
	Br. Budgerygah		NS			0.03	0.0025	Bartholomew and Cade, 1963
	Br. finch	house	NS			0.0206	0.0033	Bartholomew and Cade, 1963
	Br. pheasant	game	M&F	many	~20	0.112	0.029	Wise and Connan, 1979
	Br. pheasant	game	M&F	many	~40	0.325	0.061	Wise and Connan, 1979
	Br. pheasant	game	M&F	many	~60	0.625	0.075	Wise and Connan, 1979
	Br. pheasant	game	M&F	many	~80	0.93	0.078	Wise and Connan, 1979
	Br. quail	California	NS			0.139	0.0072	Bartholomew and Cade, 1963
	Br. sparrow	house	NS			0.0173	0.0057	Bartholomew and Cade, 1963
	Br. sparrow	Savannah	NS			0.0175	0.0102	Bartholomew and Cade, 1963
	Br. sparrow	Savannah	NS			0.019	0.0131	Bartholomew and Cade, 1963
	Br. sparrow	Savannah	NS			0.017	0.017	Bartholomew and Cade, 1963
	Br. sparrow	song	NS			0.0168	0.0035	Bartholomew and Cade, 1963
	Br. sparrow	song	NS			0.0182	0.0076	Bartholomew and Cade, 1963
	Br. sparrow	song	NS			0.0164	0.0086	Bartholomew and Cade, 1963
	Br. sparrow	white-throated	NS			0.023	0.0061	Bartholomew and Cade, 1963
	Br. sparrow	white-throated	NS			0.0265	0.0102	Bartholomew and Cade, 1963
	Br. towhee	Aberts	NS			0.0468	0.011	Bartholomew and Cade, 1963
	Br. towhee	brown	NS			0.0437	0.0069	Bartholomew and Cade, 1963
	Br. turkey	Amerine, Nichola	M	80	294,329	13.4	0.605	Parker et al., 1972

NS = Not specified

Templeton, 1968; Lane-Peter et al., 1967). Data on water intake that did not specify a body weight are excluded from this table. Statistical analyses of the data reported in Table 5-1 that are most relevant to risk assessment are given in Table 5-2 and illustrated in Figures 5-1 through 5-6.

More so than the data on minute volumes, the data on water consumption show marked intraspecies variability. The only points that are clear outliers, however, are the male marmots [just before hibernation (Zatzman et al., 1984)], which are excluded from the statistical analyses. As illustrated in Figure 5-2, a high correlation is apparent across all species in the allometric relationship of water consumption to body weight:

$$L = 0.11\ W^{0.7872} \qquad r^2 = 0.93 \qquad (5\text{-}2)$$

where L is water consumption and W is body weight in grams. Similar equations and high correlation coefficients are obtained by combining all data on primates (Figure 5-3: includes data on humans, baboons and monkeys), and laboratory mammals (Figure 5-4: includes data on gerbils, guinea pigs, hamsters, mice, rats, cats, dogs and rabbits). Intraspecies correlations are much lower. Only the allometric relationship for the dog, illustrated in Figure 5-5, has a reasonably high (0.87) correlation coefficient and differs remarkably from the general equation (Eq. 5-2). The studies on dogs by Brown et al. (1984), Golob et al. (1977) and McKeever et al. (1985) are well documented and reasonably consistent with the earlier values given in the secondary sources (Arrington, 1972; Templeton, 1968).

Water consumption for dogs and other species will vary greatly, depending on the moisture content of the chow. Allometric relationships to account for this dependency are given in Chapter 7.

TABLE 5-2

Species and Group Specific Allometric Relationships for Water Consumption in ℓ/day to Body Weight in kg (W)[a]

Animal Group	Allometric Equation	r^2	Figure
All species combined	$\ell = 0.11\ W^{0.7872}$	0.93	5-2
Primates	$\ell = 0.09\ W^{0.7945}$	0.95	5-3
Laboratory mammals	$\ell = 0.10\ W^{0.7377}$	0.88	5-4
Laboratory rodents	$\ell^{b} = 0.11\ W^{0.7682}$	0.68	NA
Gerbils	$\ell^{b} = 0.001W^{-0.546}$	-0.44	NA
Guinea pigs	$\ell^{b} = 0.11\ W^{0.1554}$	0.09	NA
Hamsters	$\ell^{b} = 0.06\ W^{0.6583}$	0.55	NA
Mice	$\ell^{b} = 0.04\ W^{0.4700}$	0.08	NA
Rats	$\ell^{b} = 0.06\ W^{0.4138}$	0.24	NA
Cats	$\ell^{a,b} = 0.76\ W^{-0.886}$	-0.36	NA
Dogs	$\ell^{b} = 0.004W^{1.6388}$	0.87	5-5
Rabbits	$\ell^{b} = 0.15\ W^{0.5161}$	0.22	NA
Chickens	$\ell = 0.13\ W^{0.7555}$	0.74	5-6

[a]If data are available on the diet (dry or moist) use equations on Table 7-2. This is particularly important for dogs and cats.

[b]Not recommended for derivng recommended values. Use equation for laboratory mammals.

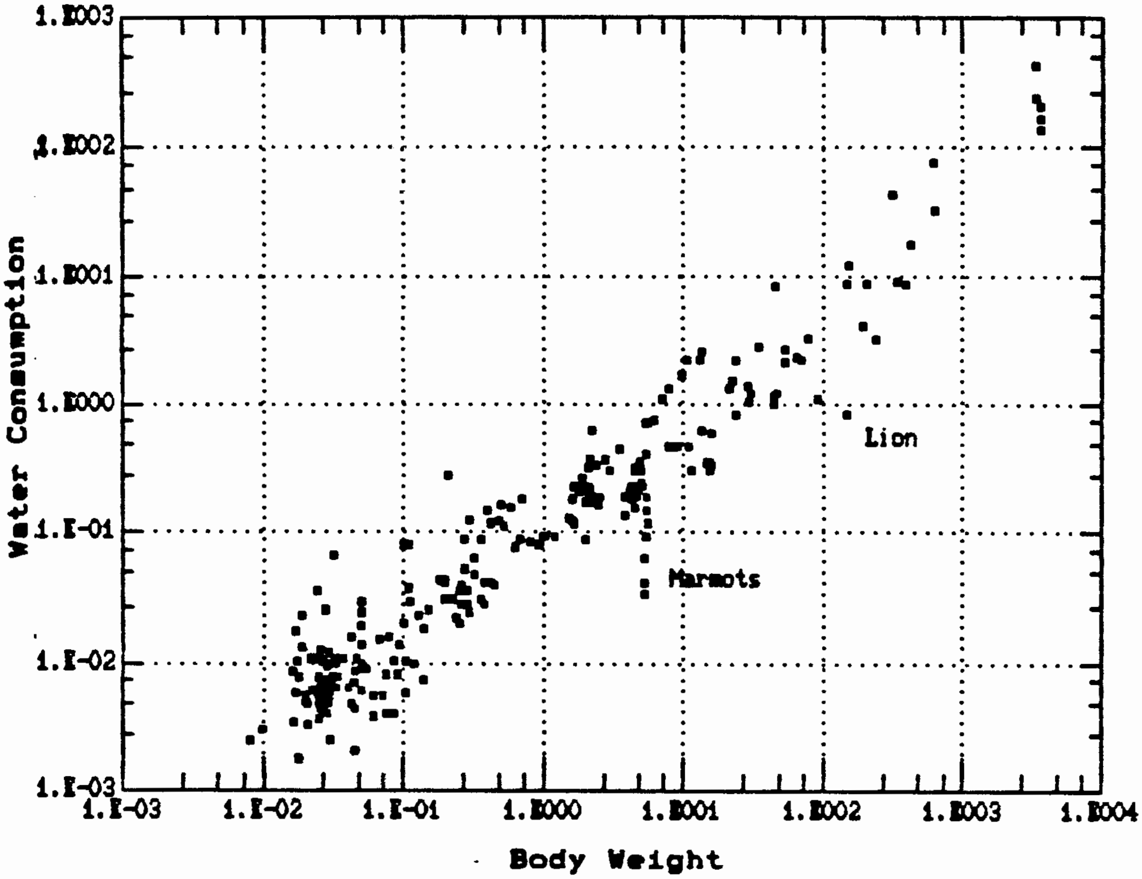


FIGURE 5-1

Plot of Water Consumption (ℓ/day) vs. Body Weight (kg) for All Species
(See Table 5-1 for points and references)

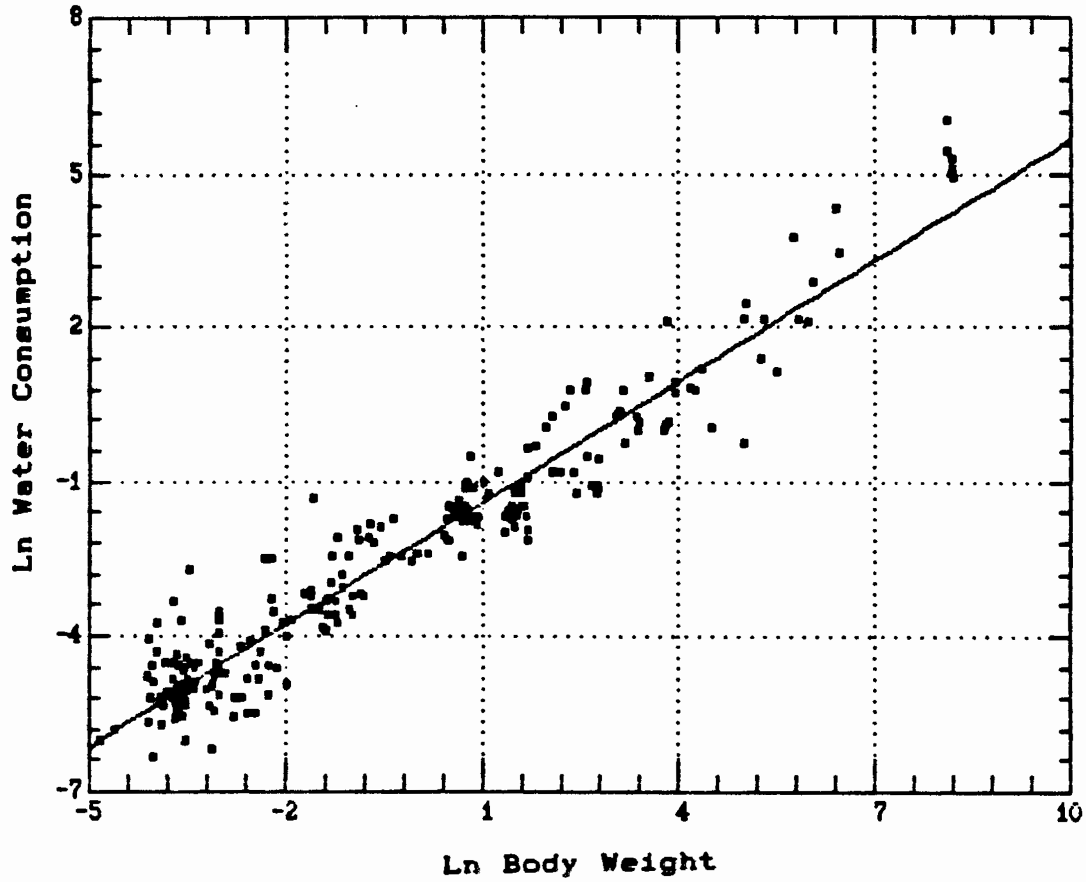
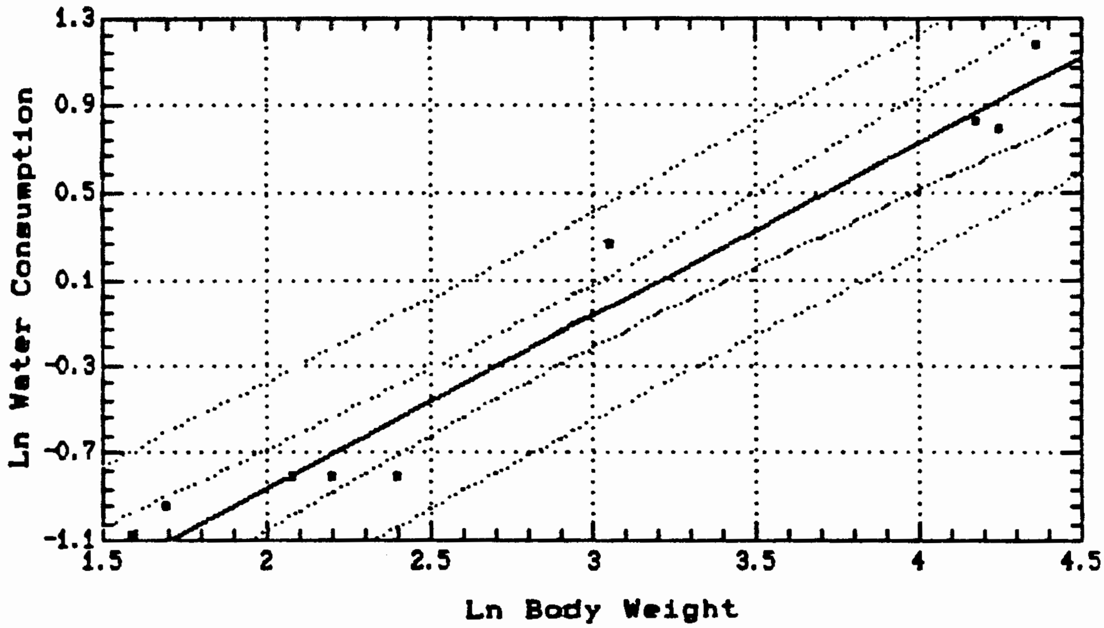


FIGURE 5-2

Allometric Relationship of Drinking Water (ℓ/day) to

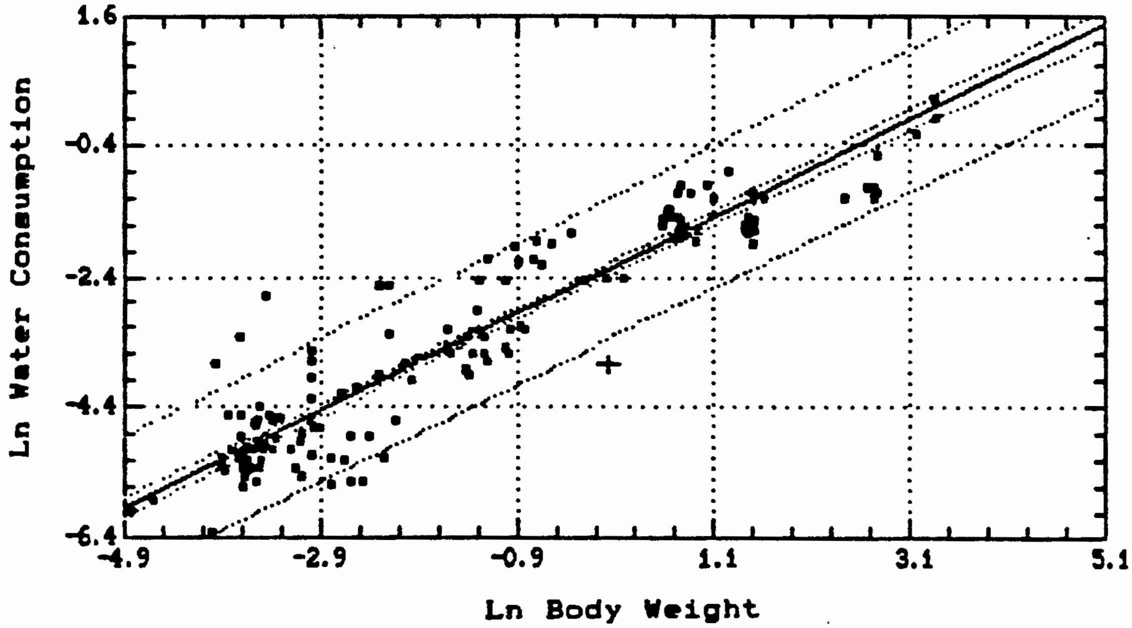
Body Weight (kg) for All Species, Except Marmots



B0: -2.4563 SE: 0.18363 T: -13.377
B1: 0.79451 SE: 0.061253 T: 12.971
CORR: 0.97704 MSE: 0.038961 DF: 8

FIGURE 5-3

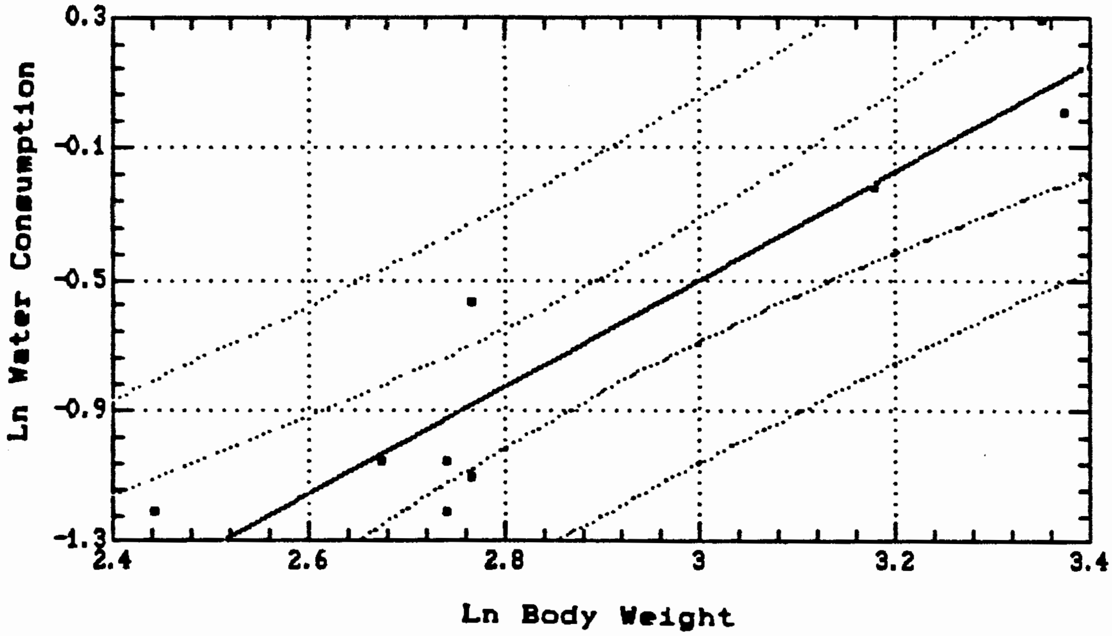
Allometric Relationship of Drinking Water (ℓ/day) to Body Weight (kg) for Primates



B0: -2.3151 SE: 0.04487 T: -51.597
B1: 0.73769 SE: 0.018525 T: 39.821
CORR: 0.94366 MSE: 0.30081 DF: 195

FIGURE 5-4

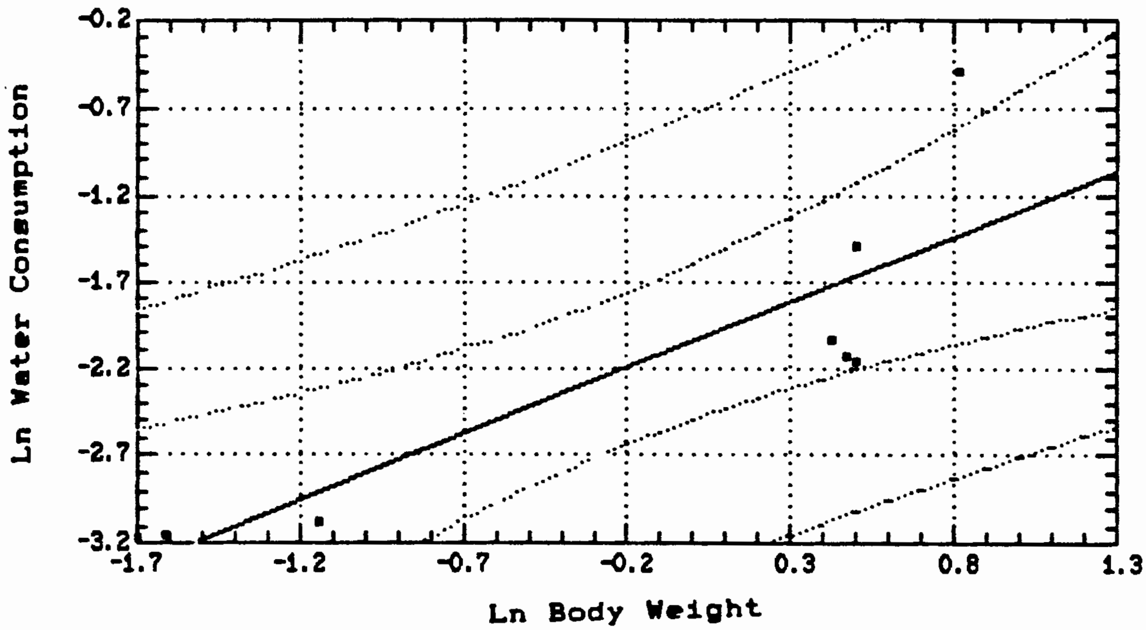
Allometric Relationship of Drinking Water (ℓ/day) to Body Weight (kg) for Laboratory Mammals (Gerbils, Guinea Pigs, Hamsters, Mice, Rats, Cats, Dogs and Rabbits).



B0: -5.4193 SE: 0.69934 T: -7.7491
B1: 1.6388 SE: 0.24042 T: 6.8165
CORR: 0.93224 MSE: 0.049184 DF: 7

FIGURE 5-5

Allometric Relationship of Drinking Water (ℓ/day) to Body Weight (kg) for Dogs



B0: -2.0497 SE: 0.18252 T: -11.23
B1: 0.75551 SE: 0.17874 T: 4.2268
CORR: 0.86522 MSE: 0.2545 DF: 6

FIGURE 5-6

Allometric Relationship of Drinking Water (ℓ/day) to Body Weight (kg) for Chickens

6. FOOD CONSUMPTION

Clear allometric relationships have been demonstrated between metabolic rate and body weight. These have been discussed at some length in both the classic literature (Brody, 1945; Benedict, 1938) and recent publications (Davidson et al., 1986). No allometric equations relating food consumption to body weight, however, were found in the literature. The same factors that affect water consumption rates can affect food consumption (Blundell and Latham, 1979). For instance, Shirley (1984) demonstrated that pregnant or lactating Fischer rats consume about twice the amount of food per day as that consumed by other rats. Because the water content of the diet is inversely related to food consumption, as discussed above, an increase in the water content of the diet may be associated with an increase in food consumption, because food with a high water content has less caloric value than food of comparable quality with a low water content. As discussed below, this may explain an apparent anomalous relationship seen in the food consumption data on cats. Many other examples are available, which suggest that the food consumption of animals will increase as the caloric content of the food decreases (Brody, 1945).

Data on food consumption for a wide variety of animals are summarized in Table 6-1 and plotted in Figure 6-1. Some of the data points were not considered in the derivation of recommended values because they are atypical for the species or other species of similar body weights. The marmots just before hibernation, labeled in Figure 6-1, show a marked decrease in food consumption as well as the decrease in water consumption noted above. One group of cattle from a study by Kertz et al. (1984) is omitted because of an atypically low food consumption not seen in other groups of cattle from the

TABLE 6-1

Food Consumption Data on Various Animal Groups

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Primates	human		F		adult	58	0.871	Snyder et al., 1981
	human		M		adult	70	1.305	Snyder et al., 1981
	human		N		10 years	32	0.84	Snyder et al., 1981
	monkey	rhesus	F			8	0.20	Templeton, 1968
	monkey	rhesus	F			9	0.20	Arrington, 1972
	monkey	rhesus	M			11	0.20	Arrington, 1972
	monkey	rhesus	M			11	0.20	Templeton, 1968
Laboratory rodents	gerbil	Mongolian	M&F	20	weaning	0.048	0.005	Arrington, 1968
	gerbil	Mongolian	M&F	16-20	adult	0.0587	0.00524	McManus, 1972
	gerbil	Mongolian	M&F	20	[215]	0.06125	0.00478	Harriman, 1969a
	gerbil	Mongolian	F			0.075	0.008	Templeton, 1968
	gerbil	Mongolian	M			0.085	0.008	Templeton, 1968
	gerbil		F			0.075	0.008	Arrington, 1972
	gerbil		M			0.085	0.008	Arrington, 1972
	guinea pig	albino short-hair	M	5	10	0.2	0.017	Hirsch, 1973
	guinea pig	albino short-hair	M	5	30	0.11	0.025	Hirsch, 1973
	guinea pig	albino short-hair	M	5	20	0.27	0.025	Hirsch, 1973
	guinea pig	albino short-hair	M	5	40	0.415	0.028	Hirsch, 1973
	guinea pig	albino short-hair	M	5	50	0.48	0.031	Hirsch, 1973
	guinea pig	albino short-hair	M	5	60	0.52	0.032	Hirsch, 1973
	guinea pig	albino short-hair	M	5	70	0.58	0.035	Hirsch, 1973
	guinea pig	Duncan-Hartley	F	45	+0	0.2035	0.0265	Shelton, 1971
	guinea pig	Duncan-Hartley	F	45	+35	0.4425	0.0265	Shelton, 1971
	guinea pig	Duncan-Hartley		15	+0	0.204	0.0285	Shelton, 1971
	guinea pig		F			1.025	0.045	Arrington, 1972
	guinea pig		M			1.2	0.045	Arrington, 1972
	guinea pig		F			1	0.045	Templeton, 1968
	guinea pig		M			1.2	0.045	Templeton, 1968
	hamster	Golden	M&F	12	+42	0.07475	0.0069	Banta et al., 1975
	hamster	Golden	M&F	22	weaning	0.0417	0.00845	Arrington, 1968
	hamster	Golden	M&F	22	weaning	0.041	0.00845	Arrington, 1968
	hamster	Syrian	F	10	+0-+42	0.0474	0.0051	Arrington et al., 1966
	hamster	Syrian	F	10	+0-+42	0.0633	0.0067	Arrington et al., 1966
	hamster	Syrian	F	10	+0-+42	0.0679	0.0067	Arrington et al., 1966
	hamster	Syrian	F	10	+0-+42	0.06735	0.0069	Arrington et al., 1966
	hamster	Syrian	F			0.0545	0.011	Templeton, 1968

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Laboratory rodents (cont.)	hamster	Syrian	F			0.1175	0.011	Arrington, 1972
	hamster	Syrian	M	8	+0-+42	0.05785	0.0055	Arrington et al., 1966
	hamster	Syrian	M	8	+0-+42	0.0652	0.0062	Arrington et al., 1966
	hamster	Syrian	M	8	+0-+42	0.0679	0.0065	Arrington et al., 1966
	hamster	Syrian	M	8	+0-+42	0.0698	0.0067	Arrington et al., 1966
	hamster	Syrian	M			0.05125	0.011	Templeton, 1968
	hamster	Syrian	M			0.1075	0.011	Arrington, 1972
	mouse	Aston	F	13	(80-90)	0.0302	0.0045	Richard and Trayhurn, 1985
	mouse	A/J	F	15	(100-110)	0.0209	0.0049	Kutscher, 1974
	mouse	A/J	M	15	(100-110)	0.0252	0.0057	Kutscher, 1974
	mouse	BALB/c	F	48	+0-7	0.0166	0.00309	Oller et al., 1985
	mouse	BALB/c	F	48	+84-91	0.0219	0.0031	Oller et al., 1985
	mouse	BALB/c	F	48	+56-63	0.02	0.00316	Oller et al., 1985
	mouse	BALB/c	F	48	+35-42	0.0189	0.00344	Oller et al., 1985
	mouse	BALB/c	F	48	+14-21	0.018	0.00351	Oller et al., 1985
	mouse	BALB/c	F	15	(100-110)	0.0201	0.0059	Kutscher, 1974
	mouse	BALB/c	M	48	+0-7	0.0197	0.00327	Oller et al., 1985
	mouse	BALB/c	M	48	+0-7	0.0197	0.00327	Oller et al., 1985
	mouse	BALB/c	M	48	+35-42	0.0242	0.00346	Oller et al., 1985
	mouse	BALB/c	F	15	(100-110)	0.0201	0.0059	Kutscher, 1974
	mouse	BALB/c	M	48	+0-7	0.0197	0.00327	Oller et al., 1985
	mouse	BALB/c	M	48	+0-7	0.0197	0.00327	Oller et al., 1985
	mouse	BALB/c	M	48	+35-42	0.0242	0.00346	Oller et al., 1985
	mouse	BALB/c	M	48	+84-91	0.0285	0.00349	Oller et al., 1985
	mouse	BALB/c	M	48	+56-63	0.0256	0.0036	Oller et al., 1985
	mouse	BALB/c	M	48	+14-21	0.0224	0.00379	Oller et al., 1985
	mouse	BALB/c	M	15	(100-110)	0.027	0.0068	Kutscher, 1974
	mouse	B6C3F1	F	48	+0-7	0.0163	0.00311	Oller et al., 1985
	mouse	B6C3F1	F	48	+56-63	0.0204	0.0034	Oller et al., 1985
	mouse	B6C3F1	F	48	+84-93	0.0214	0.00344	Oller et al., 1985
	mouse	B6C3F1	F	48	+35-42	0.0195	0.00356	Oller et al., 1985
	mouse	B6C3F1	F	48	+14-21	0.018	0.0037	Oller et al., 1985
	mouse	B6C3F1	M	48	+0-7	0.0196	0.00339	Oller et al., 1985
	mouse	B6C3F1	M	48	+35-42	0.0249	0.00364	Oller et al., 1985
	mouse	B6C3F1	M	48	+56-63	0.0269	0.00366	Oller et al., 1985

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Laboratory rodents (cont.)	mouse	B6C3F1	M	48	+84-91	0.0287	0.00367	Oller et al., 1985
	mouse	B6C3F1	M	48	+14-21	0.023	0.0039	Oller et al., 1985
	mouse	CBA	F	15	(100-110)	0.0259	0.0092	Kutscher, 1974
	mouse	CBA	M	15	(100-110)	0.031	0.008	Kutscher, 1974
	mouse	Charles River	M	7	adult	0.0453	0.0055	DeLacey et al., 1975
	mouse	Charles River	M	8	adult	0.0424	0.00566	DeLacey et al., 1975
	mouse	Crl,CD-1,CR,BR	F	40	182	0.03075	0.0052	Chvedoff et al, 1980
	mouse	Crl,CD-1,CR,BR	F	40	364	0.03475	0.00635	Chvedoff et al, 1980
	mouse	Crl,CD-1,CR,BR	M	40	546	0.04475	0.00565	Chvedoff et al, 1980
	mouse	Crl,CD-1,CR,BR	M	40	182	0.0405	0.0059	Chvedoff et al, 1980
	mouse	Crl,CD-1,CR,BR	M	40	364	0.0455	0.006	Chvedoff et al, 1980
	mouse	Crl,CD-1,1CR,BR	F	40	546	0.03375	0.0054	Chvedoff et al, 1980
	mouse	C3H	F	15	(100-110)	0.0228	0.0057	Kutscher, 1974
	mouse	C3H	M	15	(100-110)	0.0264	0.0062	Kutscher, 1974
	mouse	C57Bl	N	13-16	30-71	0.02335	0.0029	Hoover-Plow and Nelson, 1985
	mouse	C57	F	15	(100-110)	0.0223	0.0064	Kutscher, 1974
	mouse	C57	M	15	(100-110)	0.0275	0.0072	Kutscher, 1974
	mouse	DBA	F	15	(100-110)	0.0247	0.0063	Kutscher, 1974
	mouse	DBA	M	15	(100-110)	0.0309	0.0085	Kutscher, 1974
	mouse	I	N	12-16	30-71	0.01915	0.0028	Hoover-Plow and Nelson, 1985
	mouse	striped field	N	10-15		0.0206	0.003	Drozdz, 1968
	mouse	striped field	N	10-15		0.0223	0.00346	Drozdz, 1968
	mouse	SWR	F	15	(100-110)	0.0217	0.0056	Kutscher, 1974
	mouse	SWR	M	15	(100-110)	0.0286	0.0065	Kutscher, 1974
	mouse	white	F	8	70	0.0248	0.0059	Chew and Hinegardner, 1957
	mouse	white	F	8	105-120	0.0282	0.006	Chew and Hinegardner, 1957
	mouse	white	F	8	396	0.0335	0.0066	Chew and Hinegardner, 1957
	mouse	white	M	8	70	0.0297	0.0065	Chew and Hinegardner, 1957
	mouse	white	M	8	105-120	0.0324	0.0068	Chew and Hinegardner, 1957
	mouse	white	M	8	396	0.0369	0.0073	Chew and Hinegardner, 1957
	mouse	wood	N			0.02	0.0046	Chmiel and Harrison, 1981
	mouse	yel-neck field	N	10-15		0.0288	0.00206	Drozdz, 1968
	mouse	yel-neck field	N	10-15		0.0279	0.00212	Drozdz, 1968
	mouse	yel-neck field	N	10-15		0.0241	0.0035	Drozdz, 1968

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Laboratory rodents (cont.)	mouse		F			0.0265	0.0045	Arrington, 1972
	mouse		M			0.03	0.0045	Arrington, 1972
	rat	albino	M	14	(80-105)	0.2891	0.0217	Moyer, K.E., 1966
	rat	Fischer 344	F	120	98-105	0.16695	0.0149	Morrissey and Norred, 1984
	rat	kangaroo	M&F	4		0.105	0.0074	Bailey, 1923
	rat	kangaroo	M&F	4		0.105	0.0074	Bailey, 1923
	rat	king	M	75	+11	0.094	0.00945	Peters and Harper, 1985
	rat	Long-Evans	M	54	913	0.55	0.0208	Holloszy and Smith, 1986
	rat	Long-Evans	M	54	760	0.59	0.024	Holloszy and Smith, 1986
	rat	Long-Evans	M	54	608	0.575	0.0247	Holloszy and Smith, 1986
	rat	Long-Evans	M	54	456	0.53	0.0268	Holloszy and Smith, 1986
	rat	Long-Evans	M	54	304	0.45	0.0271	Holloszy and Smith, 1986
	rat	Sprague-Dawley	F	13	0(1)	0.2568	0.0122	Shirley, 1984
	rat	Sprague-Dawley	F	13	8(pl)	0.2525	0.0164	Shirley, 1984
	rat	Sprague-Dawley	F	13	21(g)	0.3418	0.0178	Shirley, 1984
	rat	Sprague-Dawley	F	13	7(pl)	0.2557	0.0182	Shirley, 1984
	rat	Sprague-Dawley	F	13	6(g)	0.2498	0.0188	Shirley, 1984
	rat	Sprague-Dawley	F	13	4(pl)	0.2559	0.0189	Shirley, 1984
	rat	Sprague-Dawley	F	13	3(pl)	0.2612	0.0192	Shirley, 1984
	rat	Sprague-Dawley	F	13	6(pl)	0.2585	0.0194	Shirley, 1984
	rat	Sprague-Dawley	F	13	3(g)	0.2466	0.0195	Shirley, 1984
	rat	Sprague-Dawley	F	13	9(g)	0.2547	0.0202	Shirley, 1984
	rat	Sprague-Dawley	F	13	5(pl)	0.2607	0.0205	Shirley, 1984
	rat	Sprague-Dawley	F	13	12(g)	0.2638	0.0212	Shirley, 1984
	rat	Sprague-Dawley	F	13	15(g)	0.2743	0.0215	Shirley, 1984
	rat	Sprague-Dawley	F	13	2(pl)	0.2738	0.0231	Shirley, 1984
	rat	Sprague-Dawley	F	13	18(g)	0.307	0.0259	Shirley, 1984
	rat	Sprague-Dawley	F	13	2(1)	0.262	0.0271	Shirley, 1984
	rat	Sprague-Dawley	F	13	3(1)	0.2576	0.0342	Shirley, 1984
	rat	Sprague-Dawley	F	13	5(1)	0.2735	0.0431	Shirley, 1984
	rat	Sprague-Dawley	F	13	6(1)	0.2743	0.0449	Shirley, 1984
	rat	Sprague-Dawley	F	13	1(pl)	0.2941	0.0481	Shirley, 1984
	rat	Sprague-Dawley	F	13	8(1)	0.2763	0.049	Shirley, 1984
	rat	Sprague-Dawley	F	13	9(1)	0.28	0.0505	Shirley, 1984
	rat	Sprague-Dawley	F	13	11(1)	0.2838	0.0525	Shirley, 1984
	rat	Sprague-Dawley	F	13	12(1)	0.2818	0.0619	Shirley, 1984
	rat	Sprague-Dawley	F	13	14(1)	0.2945	0.0663	Shirley, 1984
	rat	Sprague-Dawley	F	13	15(1)	0.2918	0.0702	Shirley, 1984
	rat	Sprague-Dawley	F	13	17(1)	0.2916	0.071	Shirley, 1984

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Laboratory rodents (cont.)	rat	Sprague-Dawley	F	13	18(1)	0.2896	0.0711	Shirley, 1984
	rat	Sprague-Dawley	F	13	20(1)	0.2941	0.0855	Shirley, 1984
	rat	Sprague-Dawley	F	13	21(1)	0.2917	0.0944	Shirley, 1984
	rat	Sprague-Dawley	M	10	24-52	0.05	0.008	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.012	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0136	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	10	24-52	0.05	0.0143	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	8	~180	0.38	0.032	Grunberg et al., 1984
	rat	Sprague-Dawley	M	8	+6	0.422	0.033	Grunberg et al., 1984
	rat	Sprague-Dawley	M	8	+12	0.442	0.036	Grunberg et al., 1984
	rat		F			0.29	0.0135	Arrington, 1972
	rat		F	1	adult	0.26	0.019	Bruce, 1950
	rat		F	1	adult	0.36	0.025	Bruce, 1950
	rat		F	1	adult	0.26	0.027	Bruce, 1950
	rat		F	1	adult	0.275	0.08	Bruce, 1950
	rat		F	1	adult	0.36	0.08	Bruce, 1950
	rat		M			0.375	0.0135	Arrington, 1972
	rat		N		adult	0.225	0.011	Adolph, 1947
Other laboratory mammals	cat	mixed	M&F		105	1.207	0.161	Waterhouse and Carver, 1966
	cat	mixed	M&F		270	2.228	0.192	Waterhouse and Carver, 1966
	cat	mixed	M&F		135	1.577	0.206	Waterhouse and Carver, 1966
	cat	mixed	M&F		365	2.574	0.211	Waterhouse and Carver, 1966
	cat	mixed	M&F		165	1.718	0.216	Waterhouse and Carver, 1966
	cat	mixed	M&F		225	2.175	0.218	Waterhouse and Carver, 1966
	cat	mixed	M&F		195	1.893	0.219	Waterhouse and Carver, 1966
	cat	mixed	M&F		395	2.781	0.223	Waterhouse and Carver, 1966
	cat	mixed	M	12	+7	4.5	0.0549	Taton et al., 1984
	cat	mixed	M	12	+42	4.3	0.0555	Taton et al., 1984
	cat	mixed	M	10	+63	4.2	0.063	Taton et al., 1984
	cat	mixed	M	5	+294	4.6	0.0676	Taton et al., 1984
	cat	mixed	M	5	+336	4.6	0.0681	Taton et al., 1984
	cat	mixed	M	5	+336	4.6	0.0681	Taton et al., 1984
	cat	mixed	M	8	+119	4.1	0.0697	Taton et al., 1984
	cat	mixed	M	6	+147	4.2	0.0727	Taton et al., 1984
	cat	mixed	M	6	+245	4.5	0.0738	Taton et al., 1984
	cat	mixed	M	12	+21	4.4	0.0739	Taton et al., 1984
	cat	mixed	M	9	+91	4.1	0.0742	Taton et al., 1984
	cat	mixed	M	6	+203	4.3	0.0808	Taton et al., 1984
	cat	mixed	M	6	+175	4.3	0.0867	Taton et al., 1984

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Other laboratory mammals (cont.)	cat		M&F	8		0.8843	0.04275	Smalley et al., 1985
	cat		F			3	0.175	Arrington, 1972
	cat		F			3	0.175	Arrington, 1978
	cat		F			3	0.175	Templeton, 1968
	cat		M			3	0.175	Arrington, 1972
	cat		M			3	0.175	Arrington, 1978
	cat		M			3	0.175	Templeton, 1968
	dog	beagle	F			11.5	0.40	Arrington, 1972
	dog	beagle	F			14.5	0.40	Templeton, 1968
	dog	beagle	M			15.5	0.40	Arrington, 1972
	dog	beagle	M			15.5	0.40	Templeton, 1968
	dog		M&F	8	adult	24	0.36	Brown et al., 1984
	dog		N	1		5.82	1.266	Cowgill, 1928
	rabbit	Dutch	M&F	24	(42-49)	0.881	0.0496	Arrington et al., 1974
	rabbit	Dutch	M&F	24	(78-85)	1.4	0.0496	Arrington et al., 1974
	rabbit	Dutch	F	6	+185	2.32	0.063	Cizek, 1961
	rabbit	Dutch	F	6	+164	2.3	0.064	Cizek, 1961
	rabbit	Dutch	F	6	+70	2.13	0.071	Cizek, 1961
	rabbit	Dutch	F	6	+143	2.29	0.072	Cizek, 1961
	rabbit	Dutch	F	6	+112	2.28	0.073	Cizek, 1961
	rabbit	Dutch	F	6	+91	2.19	0.078	Cizek, 1961
	rabbit	Dutch	F	12	+183	2.571	0.0802	Cizek, 1961
	rabbit	Dutch	F	12		2.571	0.0802	Cizek, 1961
	rabbit	Dutch	F	12	+0	2.165	0.0833	Cizek, 1961
	rabbit	Dutch	F	6	+35	1.96	0.084	Cizek, 1961
	rabbit	Dutch	F	6	+49	2.07	0.084	Cizek, 1961
	rabbit	Dutch	F	6	+21	1.89	0.088	Cizek, 1961
	rabbit	Dutch	F	6	+7	1.79	0.09	Cizek, 1961
	rabbit	Dutch	M	6	+175	2.2	0.059	Cizek, 1961
	rabbit	Dutch	M	6	+133	2.19	0.063	Cizek, 1961

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Other laboratory mammals (cont.)	rabbit	Dutch	M	6	+154	2.23	0.063	Cizek, 1961
	rabbit	Dutch	M	12	+183	2.02	0.0632	Cizek, 1961
	rabbit	Dutch	M	6	+91	2.23	0.069	Cizek, 1961
	rabbit	Dutch	M	6	+112	2.27	0.075	Cizek, 1961
	rabbit	Dutch	M	6	+70	2.22	0.077	Cizek, 1961
	rabbit	Dutch	M	6	+35	2.09	0.078	Cizek, 1961
	rabbit	Dutch	M	6	+49	2.16	0.078	Cizek, 1961
	rabbit	Dutch	M	12	+0	1.799	0.0792	Cizek, 1961
	rabbit	Dutch	M	6	+21	1.95	0.084	Cizek, 1961
	rabbit	Dutch	M	6	+7	1.91	0.087	Cizek, 1961
	rabbit	New Zealand white	F			5	0.15	Templeton, 1968
	rabbit	New Zealand white	M			4.5	0.15	Templeton, 1968
	rabbit		F			5	0.15	Arrington, 1972
	rabbit		M			4.5	0.15	Arrington, 1972
	rabbit		M			4.5	0.15	Arrington, 1978
	rabbit		N		~42	1	0.115	Davidson and Spreadbury, 1975
	rabbit		N		53	1.5	0.143	Davidson and Spreadbury, 1975
	rabbit		N		~63	2	0.168	Davidson and Spreadbury, 1975
Livestock	cattle	HO,H,TL	M	12		313	8.20	Becker et al., 1985
	cattle	Holstein	F	7		3619	131	Atkeson and Warren, 1934
	cattle	Holstein	F	7		3330	133.70	Atkeson and Warren, 1934
	cattle	Holstein	F	7		3330	185	Atkeson and Warren, 1934
	cattle	Holstein	F	7		3605	29.10	Atkeson and Warren, 1934
	cattle	several	M	many	(98-126)	94	3.04	Taylor et al., 1986
	cattle	several	M	many	(126-154)	111	4.14	Taylor et al., 1986
	cattle	several	M	many	(154-162)	133	5.29	Taylor et al., 1986
	cattle	several	M	many	(162-210)	159	6.25	Taylor et al., 1986
	cattle	several	M	many	(210-238)	184	6.94	Taylor et al., 1986
	cattle	several	M	many	(238-266)	210	7.32	Taylor et al., 1986
	cattle	several	M	many	(266-294)	233	7.64	Taylor et al., 1986
	cattle	several	M	many	(229-322)	256	8	Taylor et al., 1986
	cattle	several	M	many	(322-350)	278	8.25	Taylor et al., 1986
	cattle	several	M	many	(350-378)	299	8.50	Taylor et al., 1986
	cattle	several	M	many	(378-406)	319	8.64	Taylor et al., 1986
	cattle	several	M	many	(406-434)	338	8.86	Taylor et al., 1986
	cattle	several	M	many	(434-462)	358	9	Taylor et al., 1986
	cattle	several	M	many	(462-490)	376	9.04	Taylor et al., 1986

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Livestock (cont.)	cattle		N	20	18	44.11	0.14	Kertz et al., 1984
	cattle		N	20	25	47.2	0.50	Kertz et al., 1984
	cattle		N	20	31	52.65	1.01	Kertz et al., 1984
	cattle		N			27	3.825	Lane-Peter et al., 1967
	cattle		N			36	4.30	Lane-Peter et al., 1967
	cattle		N			45	5.05	Lane-Peter et al., 1967
	cattle		N			55	5.40	Lane-Peter et al., 1967
	chicken	Ross broiler	M	3	7	0.164	0.0157	Prescott et al., 1985
	chicken	Ross broiler	M	3	14	0.334	0.0207	Prescott et al., 1985
	chicken	Ross broiler	M	3	21	0.765	0.0714	Prescott et al., 1985
	chicken	Ross broiler	M	3	28	1.155	0.1057	Prescott et al., 1985
	chicken	Ross broiler	M	3	35	1.539	0.1243	Prescott et al., 1985
	chicken	Ross broiler	M	3	42	1.778	0.1471	Prescott et al., 1985
	chicken	Ross broiler	M	3	49	2.334	0.1629	Prescott et al., 1985
	chicken	Ross broiler	M	3	63	3.254	0.2129	Prescott et al., 1985
	chicken	Ross broiler	M	3	77	3.934	0.2671	Prescott et al., 1985
	chicken	Ross broiler	M	3	91	4.73	0.2429	Prescott et al., 1985
	chicken	Ross broiler	M	3	105	5.46	0.2789	Prescott et al., 1985
	chicken	Ross broiler	M	3	119	5.758	0.2929	Prescott et al., 1985
	chicken	Ross broiler	M	3	140	6.49	0.3048	Prescott et al., 1985
	chicken	Ross broiler	M	2	161	6.5	0.3905	Prescott et al., 1985
	pig	cross-bred	M	24		31.3	1.4415	Asche et al., 1986
	pig	white cross	N	51	28	5.49	0.164	Brooks et al., 1984
	pig	white cross	N	51	28	6.15	0.187	Brooks et al., 1984
	pig	white cross	N	51	35	7.15	0.34	Brooks et al., 1984
	pig	white cross	N	51	35	7.99	0.357	Brooks et al., 1984
	pig	white cross	N	51	42	9.77	0.567	Brooks et al., 1984
	pig	white cross	N	51	42	10.6	0.594	Brooks et al., 1984
	pig	white cross	N	51	42	13.6	0.704	Brooks et al., 1984
	pig	white cross	N	51	49	13.06	0.762	Brooks et al., 1984
	sheep		N		newly weaned	31.5	0.575	Lane-Peter et al., 1967
	sheep		N		growing	45	0.75	Lane-Peter et al., 1967
	sheep		N		growing	63	0.85	Lane-Peter et al., 1967
Wildlife	ferret	domestic	F		adult	0.675	0.168	Moody et al., 1985
	ferret	domestic	M		adult	2.025	0.168	Moody et al., 1985
	hyena		F	1		71	2.44	Green et al., 1984
	hyena		F	1		58	4.88	Green et al., 1984
	hyena		M	1		38	4.05	Green et al., 1984

TABLE 6-1 (cont.)

Group	Species	Strain	Sex	No. of Animals	Age (days)	Weight (kg)	Food (kg/day)	Reference
Wildlife (cont.)	koala		M&F			9.2	0.5105	Nagy and Martin, 1985
	lion		F	1		149	6.12	Green et al., 1984
	lion		M	1		193	5.06	Green et al., 1984
	lion		M	1		91	6.53	Green et al., 1984
	marmot	yellow-bellied	F	9	+14	3.81	0.0799	Zatzman et al., 1984
	marmot	yellow-bellied	F	9	+28	3.86	0.1012	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+175	5.32	0.0198	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+168	5.33	0.0329	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+154	5.29	0.057	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+140	5.46	0.057	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+126	5.5	0.0816	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+112	5.45	0.0928	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+98	5.39	0.1049	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+42	4.62	0.1086	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+56	4.76	0.1178	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+70	4.95	0.122	Zatzman et al., 1984
	marmot	yellow-bellied	M	9	+84	5.19	0.122	Zatzman et al., 1984
	mink		M	4		1.613	0.042	Eriksson et al., 1984
	nutria		N		adult	8	1.35	Lane-Peter et al., 1967
	shrew	common	N			0.008	0.0008	Chmiel and Harrison, 1981
	vole	bank	N	10-15		0.0227	0.00192	Drozdz, 1968
	vole	bank	N	10-15		0.0231	0.00226	Drozdz, 1968
	vole	bank	N	10-15		0.0229	0.0034	Drozdz, 1968
	vole	bank	N			0.02	0.0055	Chmiel and Harrison, 1981
	vole	bank	N	0-15		0.0224	0.00183	Drozdz, 1968
	vole	common	N	0-15		0.0226	0.00424	Drozdz, 1968
	vole	common	N	0-15		0.0218	0.0025	Drozdz, 1968
Other	kestrel	Eurasian	N	1	~1200	0.179	0.01	Campbell and Koplin, 1986
	owl	screech	N	1	~300	0.169	0.0086	Campbell and Koplin, 1986
	turkey	Amerine, Nichola	M	40,40	294,329	13.4	0.372	Parker et al., 1972

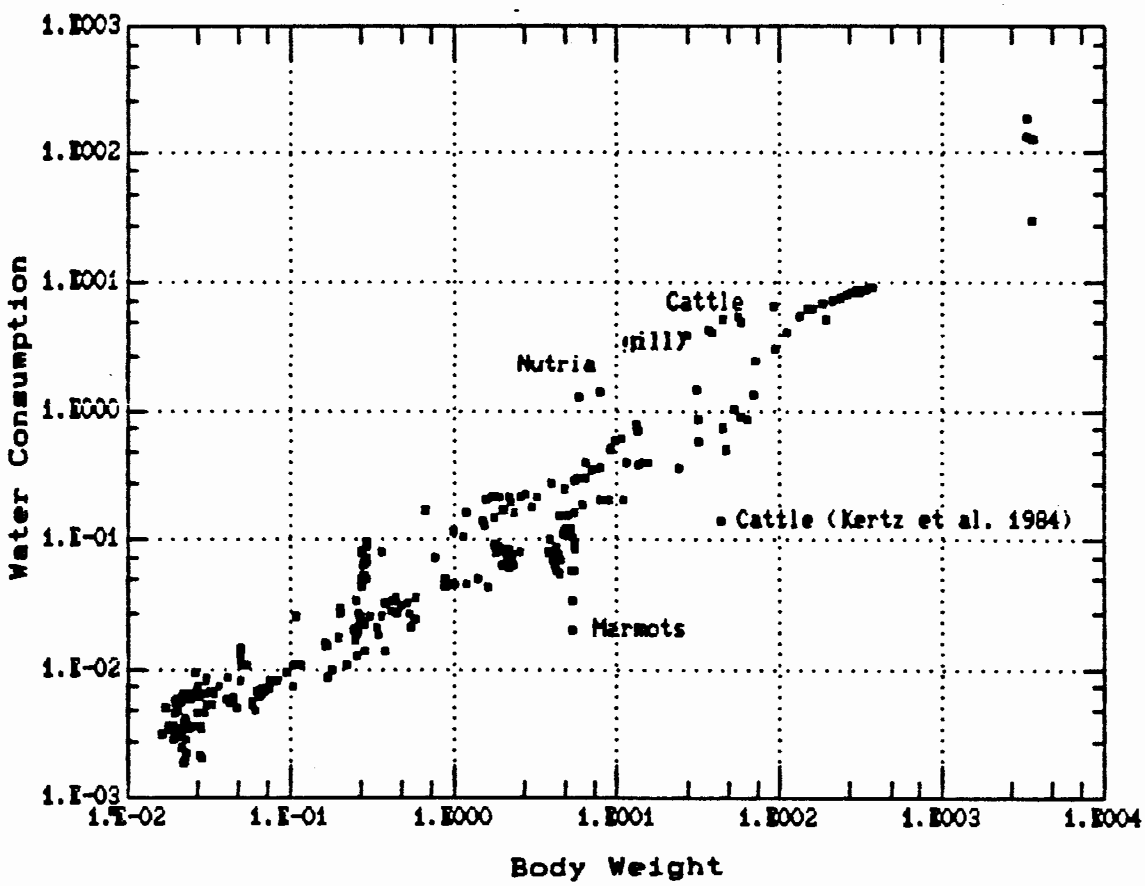


FIGURE 6-1

Plot of Food Consumption (kg/day) vs.
Body Weight (kg) for All Species

(See Table 6-1 for points and references)

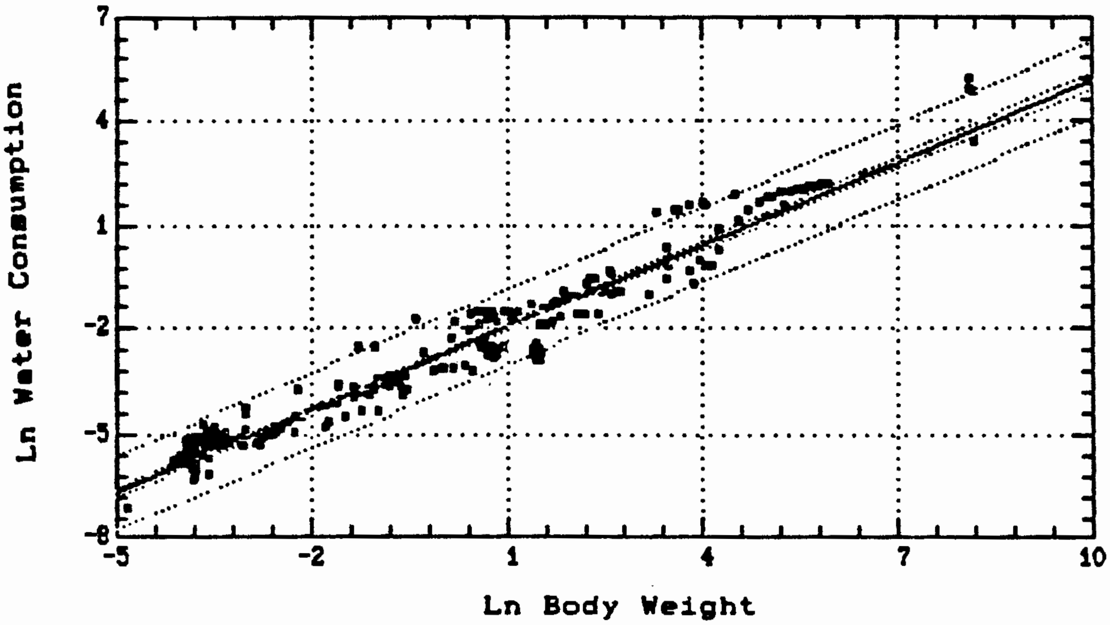
study, or in cattle from other studies. The Nutria (Lane-Peter et al., 1967) and one dog studied by Cowgill (1928) also are eliminated from subsequent statistical analyses as atypical. Although not apparent in Figure 6-1, the food consumption values for hamsters, reported by Arrington (1968) and Templeton (1968), vary markedly from other reports. The only other data excluded from the analyses are data on pregnant and lactating rats reported by Shirley (1984). The effect of these exclusions can be seen by comparing Figure 6-10 with Figure 6-11.

With these exclusions, the general allometric relationship of food consumption to body weight is illustrated in Figure 6-2. This and similar relationships for subgroups of animals and species are summarized in Table 6-2 and Figures 6-3 to 6-14. The allometric equation for all species combined is as follows:

$$F = 0.065\ W^{0.7919} \qquad r^2 = 0.95 \qquad (6\text{-}1)$$

where W is body weight and F is daily food consumption, both in kilograms. The slope function of this equation is similar to those for both inhalation rates (0.7579) (see Eq. 4-1) and drinking rates (0.7872) (see Eq. 5-1). This similarity is most likely related to the slope function for metabolic rate estimated at 0.76 (Benedict, 1938).

The negative correlations for both dogs and cats are probably artifacts of different diets. This is clearly the case for cats for which two primary studies, Waterhouse and Carver (1966) and Taton et al. (1984), are available. In the study by Taton et al. (1984), cats received a dry diet, and in the study by Waterhouse and Carver (1966) cats received a canned, moist diet. The cats in the study by Taton et al. (1984) were larger but consumed substantially less food than the cats in the study by Waterhouse and Carver (1966), which resulted in a negative slope (see Figure 4-12). In each



B0: -2.736 SE: 0.033886 T: -80.742
B1: 0.7919 SE: 0.011209 T: 70.65
CORR: 0.97512 MSE: 0.29743 DF: 258

FIGURE 6-2

Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for All Species, Except Marmots

TABLE 6-2

Species and Group Specific Allometric Relationships for Food Consumption in kg/day (F) to Body Weight in kg (W)

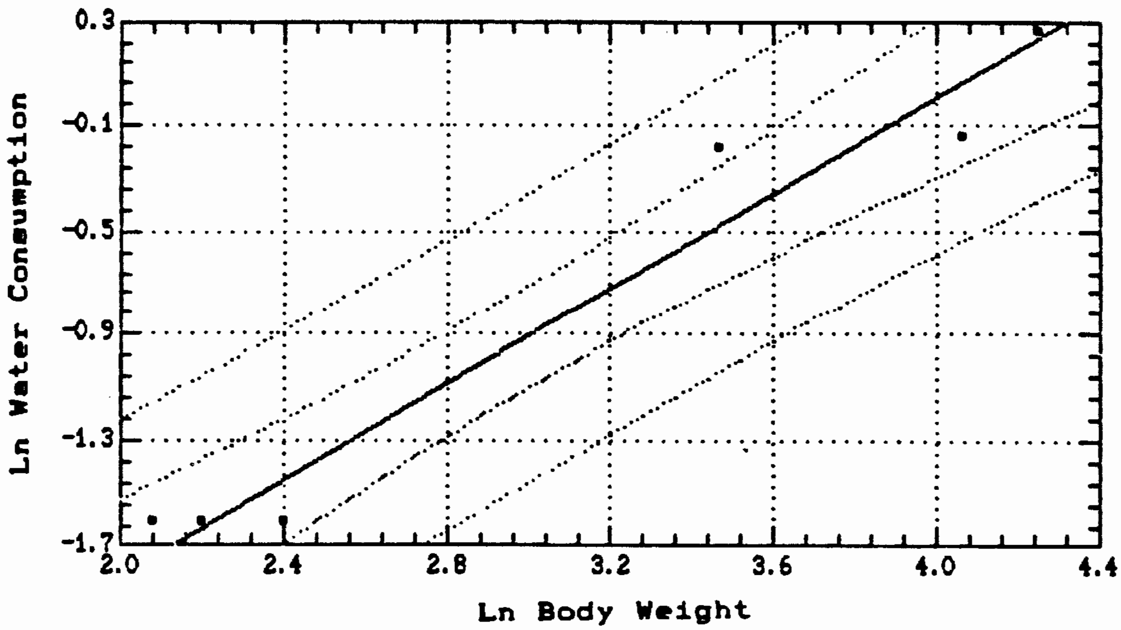
Animal Group	Allometric Equation	r^2	Figure
All species combined	$F = 0.065\ W^{0.7919}$	0.95	6-2
Primates	$F^a = 0.026\ W^{0.9142}$	0.95	6-3
Laboratory mammals	$F = 0.056\ W^{0.6611}$	0.87	6-4
Laboratory rodents	$F^b = 0.060\ W^{0.6917}$	0.82	6-5
Gerbils	$F = 0.112\ W^{1.0583}$	0.80	6-6
Guinea Pigs	$F = 0.041\ W^{0.3308}$	0.75	6-7
Hamsters	$F = 0.082\ W^{0.9285}$	0.96	6-8
Mice	$F^c = 0.064\ W^{0.7242}$	0.27	6-9
Rats	$F^c = 0.040\ W^{0.4790}$	0.40	6-11
Cats	$F^c = 0.215\ W^{-0.581}$	-0.22	6-12
Dogs	$F^c = 5.13\ W^{-0.918}$	-0.81	NA
Rabbits	$F = 0.041\ W^{0.7898}$	0.73	6-13
Chickens	$F = 0.075\ W^{0.8449}$	0.97	6-14

[a]Not recommended for calculating values. Use equation for all species combined.

[b]Not recommended for calculating values. Included for comparison only.

[c]Not recommended for calculating values. Use equation for laboratory mammals.

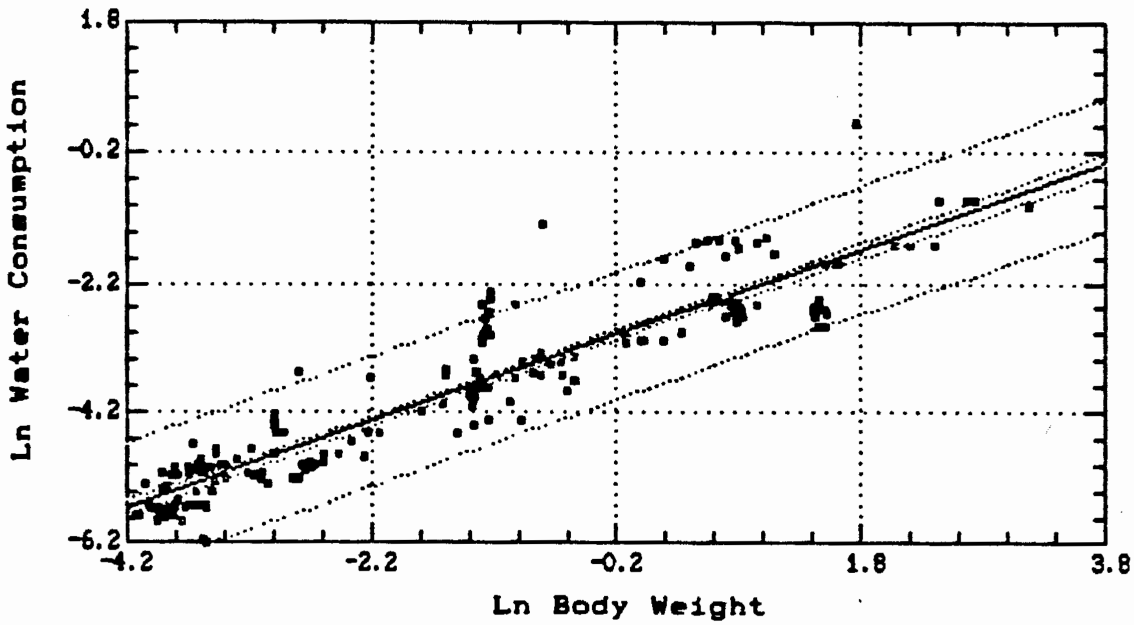
NA = Not applicable



B0: -3.6488 SE: 0.27537 T: -13.251
B1: 0.91415 SE: 0.088875 T: 10.286
CORR: 0.97718 MSE: 0.040392 DF: 5

FIGURE 6-3

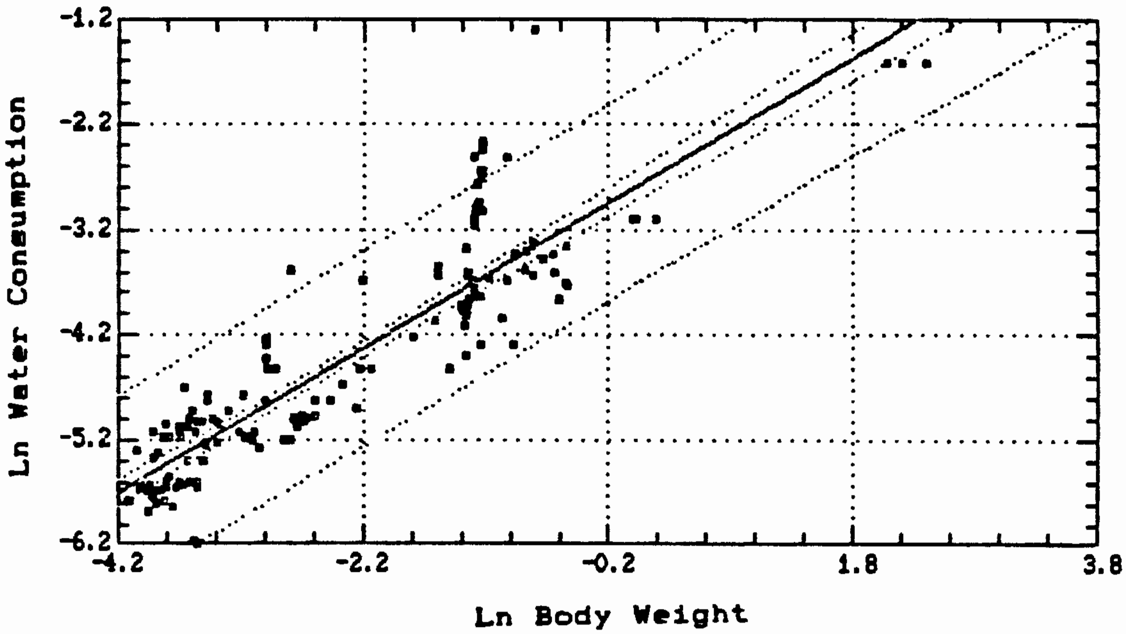
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Primates



B0: -2.8899 SE: 0.039751 T: -72.699
B1: 0.66106 SE: 0.016814 T: 39.315
CORR: 0.9351 MSE: 0.25136 DF: 222

FIGURE 6-4

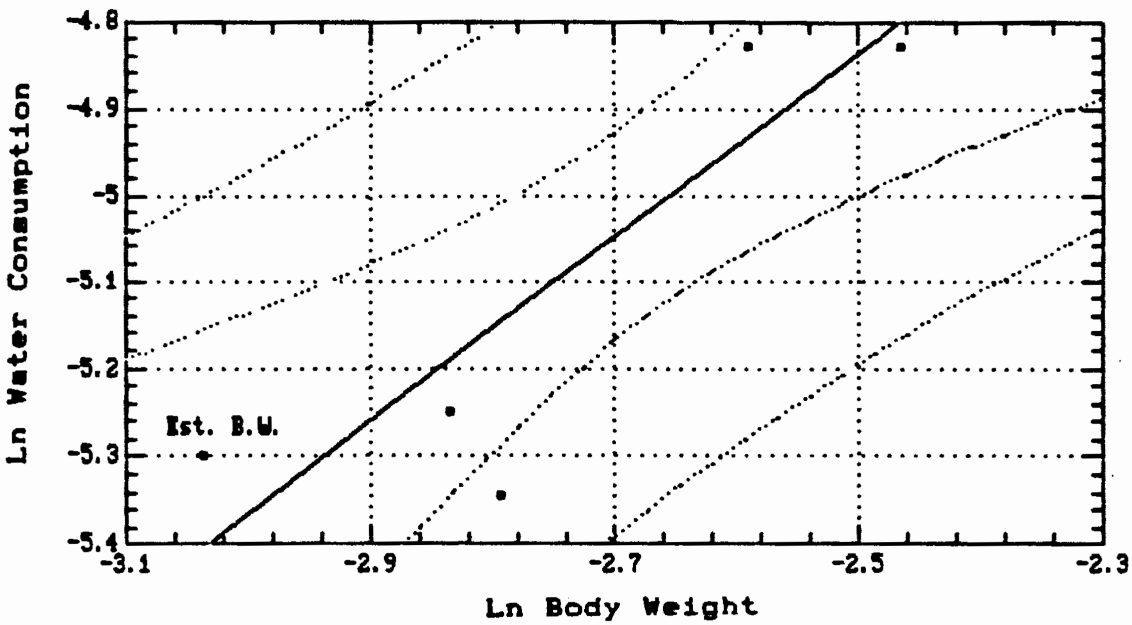
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Laboratory Mammals (Gerbils, Guinea Pigs, Hamsters, Mice, Rats, Cats, Dogs and Rabbits).



B0: -2.809 SE: 0.072298 T: -38.853
B1: 0.6917 SE: 0.026617 T: 25.987
CORR: 0.90293 MSE: 0.21881 DF: 153

FIGURE 6-5

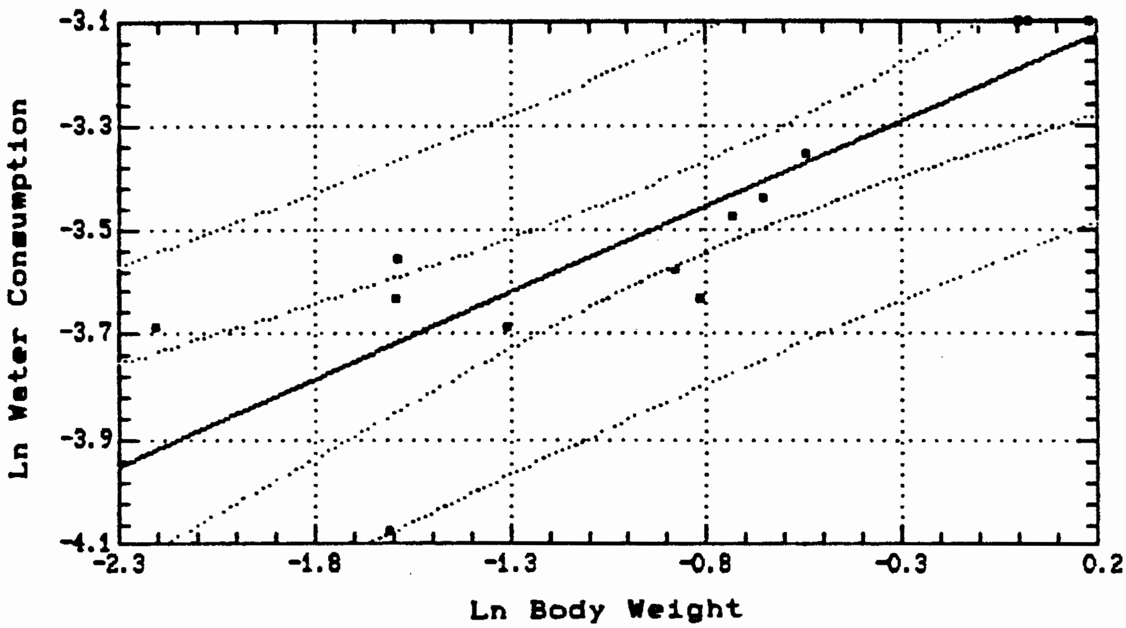
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Laboratory Rodents (Gerbils, Guinea Pigs, Hamsters, Mice and Rats)



B0: -2.1909 SE: 0.63865 T: -3.4305
B1: 1.0583 SE: 0.23747 T: 4.4566
CORR: 0.8938 MSE: 0.015361 DF: 5

FIGURE 6-6

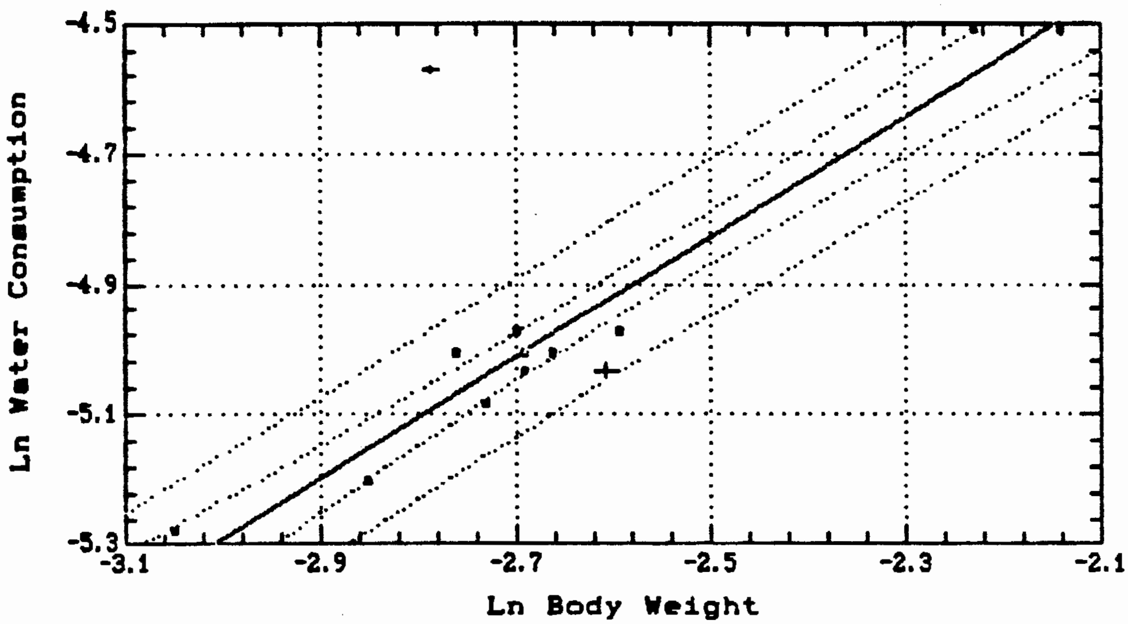
Allometric Relationship of Food Consumption (kg/day)
to Body Weight (kg) for Gerbils



B0: -3.1929 SE: 0.060604 T: -52.685
B1: 0.33077 SE: 0.054986 T: 6.0155
CORR: 0.86658 MSE: 0.02263 DF: 12

FIGURE 6-7

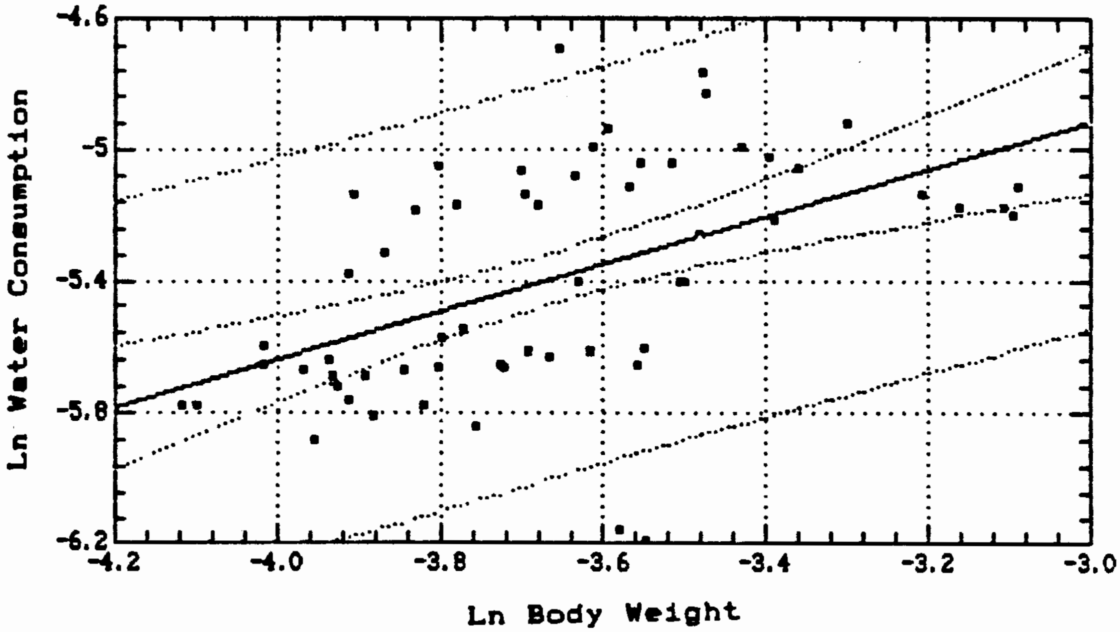
Allometric Relationship of Food Consumption (kg/day)
to Body Weight (kg) for Guinea Pigs



B0: -2.5069 SE: 0.16645 T: -15.061
B1: 0.9285 SE: 0.062665 T: 14.817
CORR: 0.98011 MSE: 2.5965E-3 DF: 9

FIGURE 6-8

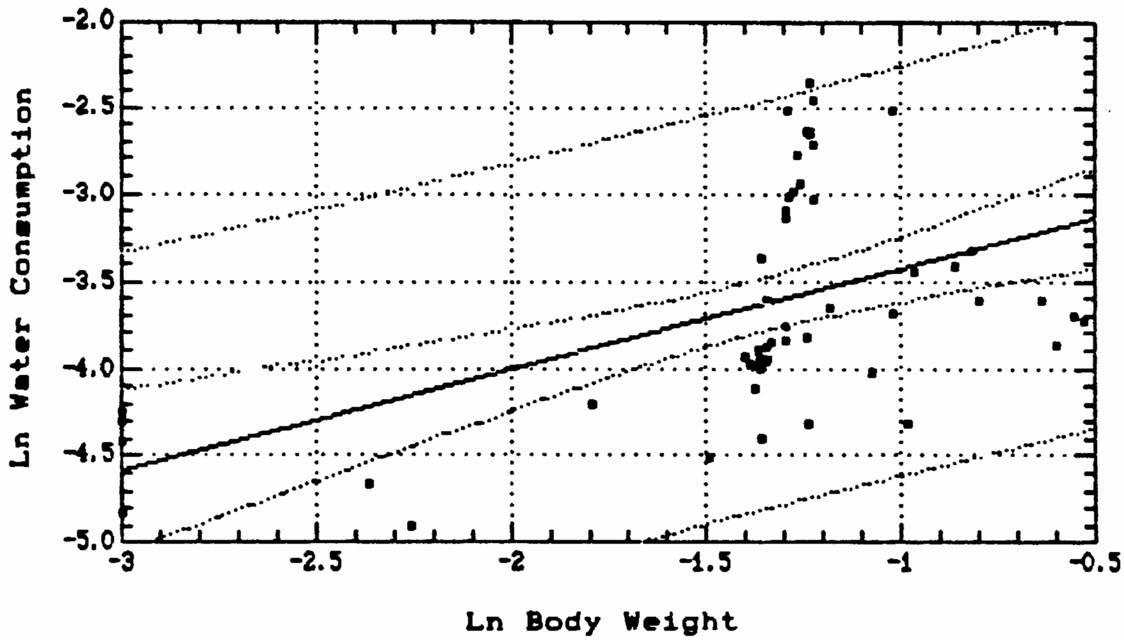
Allometric Relationship of Food Consumption (kg/day)
to Body Weight (kg) for Hamsters



B0: -2.7418 SE: 0.56827 T: -4.8249
B1: 0.72423 SE: 0.15466 T: 4.6828
CORR: 0.52379 MSE: 0.089148 DF: 58

FIGURE 6-9

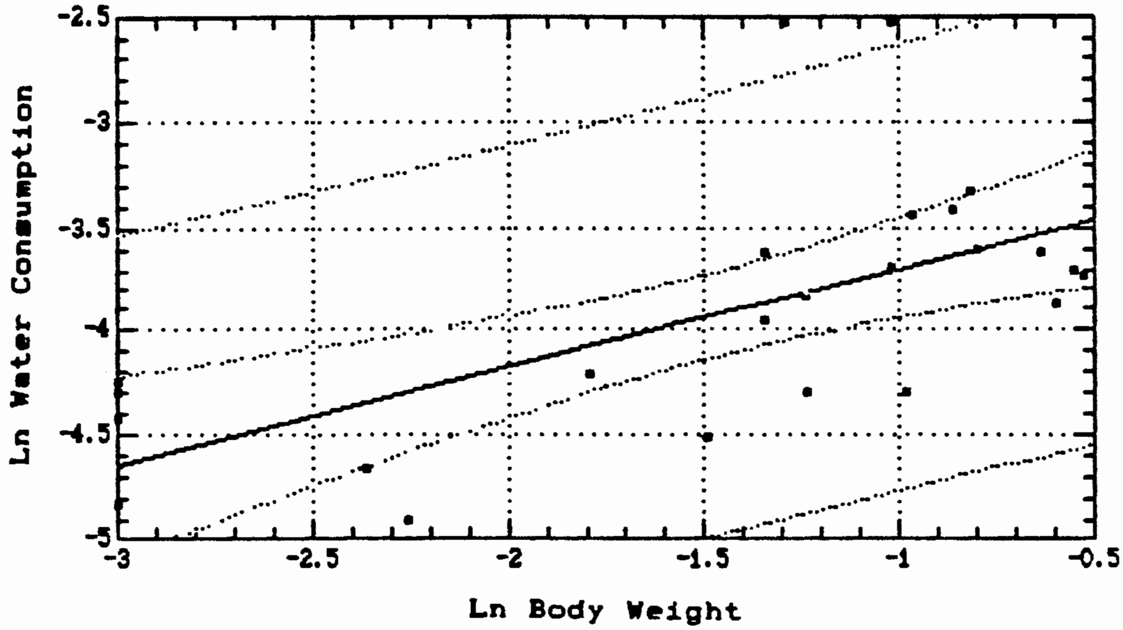
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Mice



B0: -2.8561 SE: 0.20583 T: -13.876
B1: 0.57843 SE: 0.13754 T: 4.2056
CORR: 0.50022 MSE: 0.33354 DF: 53

FIGURE 6-10

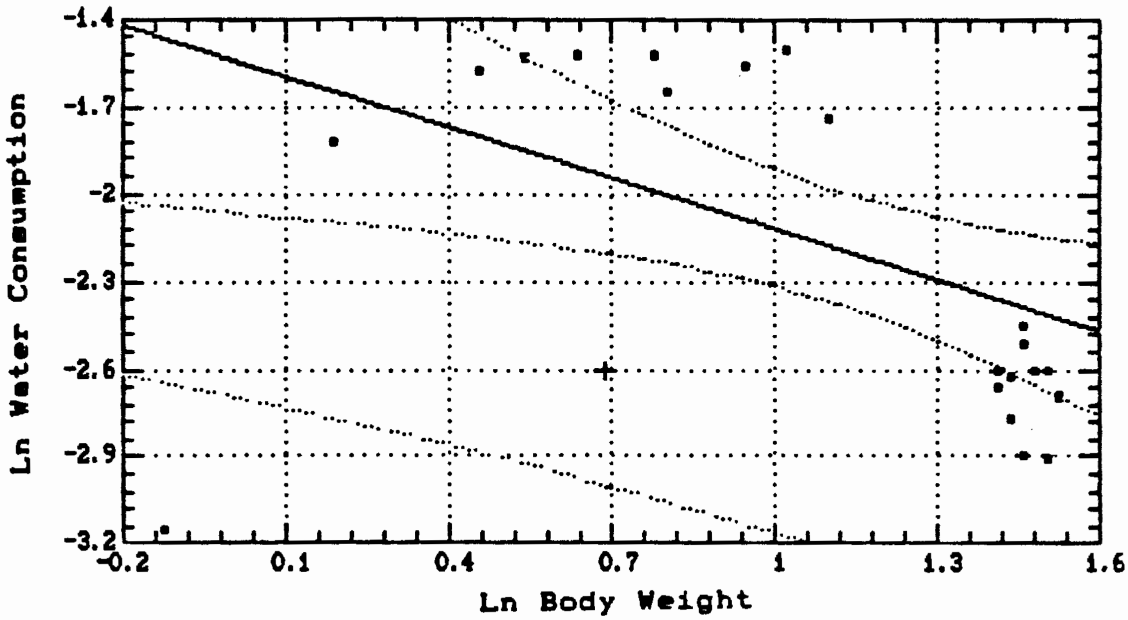
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Rats, Including Pregnant and Lactating Animals



B0: -3.2218 SE: 0.20874 T: -15.434
B1: 0.47897 SE: 0.1223 T: 3.9162
CORR: 0.63249 MSE: 0.25313 DF: 23

FIGURE 6-11

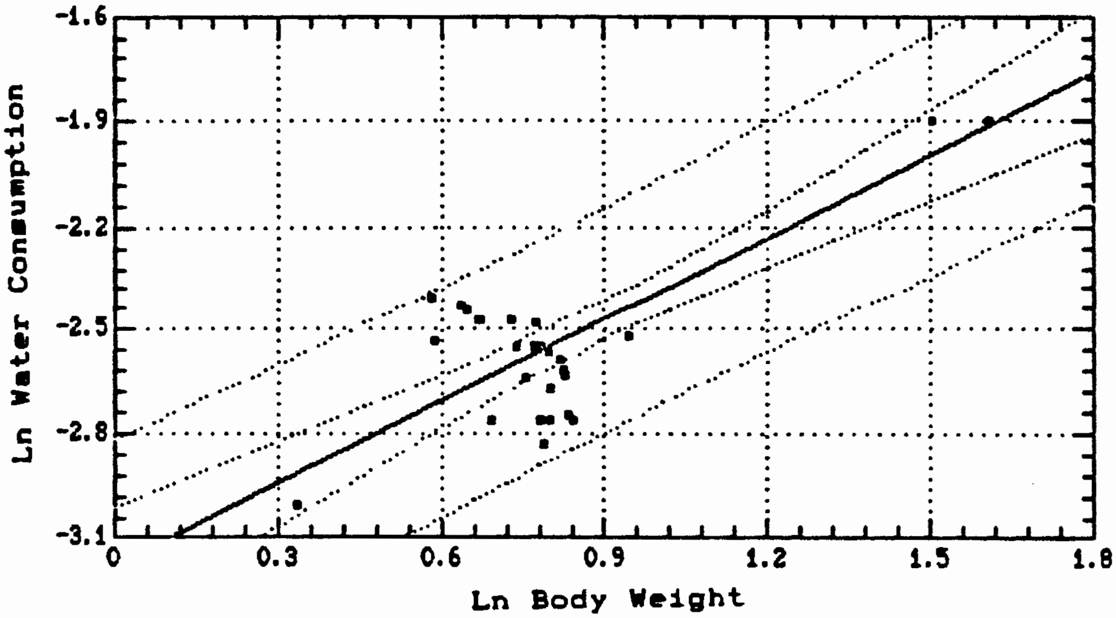
Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Rats, Excluding Pregnant and Lactating Animals



B0: -1.5356 SE: 0.25803 T: -5.9514
B1: -0.58062 SE: 0.21704 T: -2.6751
CORR: -0.46458 MSE: 0.25019 DF: 26

FIGURE 6-12

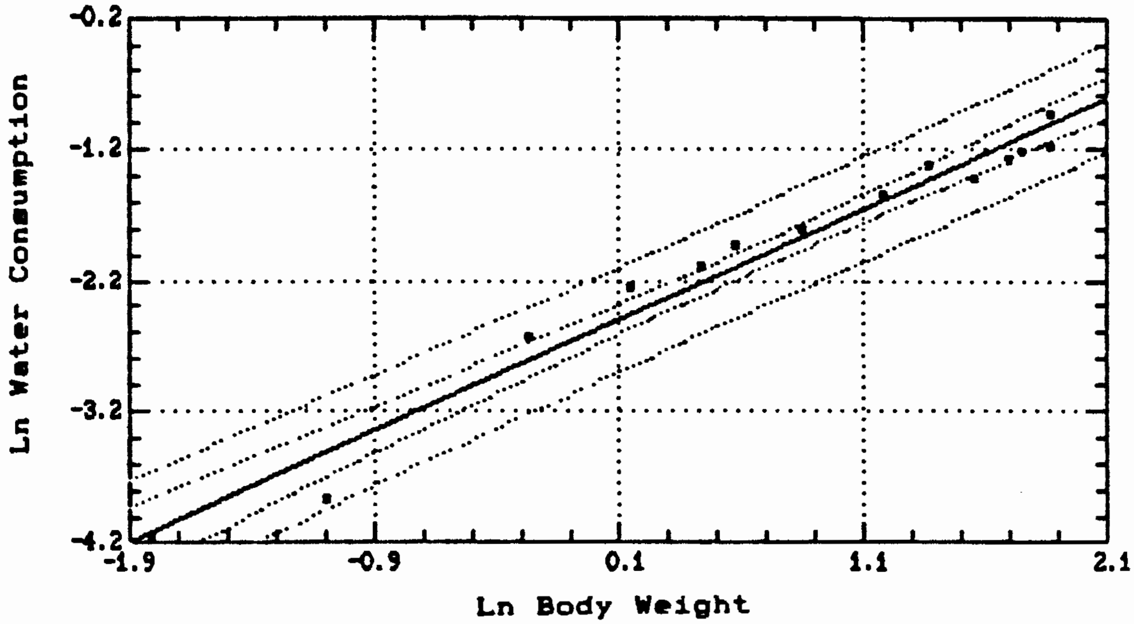
Allometric Relationship of Food Consumption (kg/day)
to Body Weight (kg) for Cats



B0: -3.1835 SE: 0.083168 T: -38.278
B1: 0.78978 SE: 0.089449 T: 8.8294
CORR: 0.85374 MSE: 0.024701 DF: 29

FIGURE 6-13

Allometric Relationship of Food Consumption (kg/day)
to Body Weight (kg) for Rabbits



B0: -2.5857 SE: 0.055963 T: -46.204
B1: 0.8449 SE: 0.042365 T: 19.943
CORR: 0.98525 MSE: 0.030718 DF: 12

FIGURE 6-14

Allometric Relationship of Food Consumption (kg/day) to Body Weight (kg) for Chickens study, both of which were conducted on animals with a relatively small range of weights, no marked correlation is apparent between body weight and food consumption. The narrow range of weights in the available data on dogs (kinds of diets not specified) may also be a factor in the apparent negative correlation for this species.

As with the data on water consumption, the data on the food consumption of rats and mice yield a low correlation coefficient in the allometric model. The equation for mice, nonetheless, is virtually identical to that for all species combined.

The data on primates are limited and do not seem to justify a departure from the standard allometric function given in Equation 6-1.

For the reasons discussed above, the equations given in Table 6-2 for primates, mice, rats, cats and dogs are not recommended for deriving reference values. For these animals, Equation 6-1 should be used. For gerbils, guinea pigs, hamsters, rabbits and chickens, the corresponding equations given in Table 6-2 should be used. This is not to suggest that these species are likely to differ substantially from others in food consumption patterns, but simply that the species-specific equations more accurately reflect the available data on these species.

As with water consumption, consideration should be given to the water content of the diet, as detailed in Chapter 7.

7. INTERRELATIONSHIPS BETWEEN FOOD AND WATER CONSUMPTION

As noted in Chapters 5 and 6, the moisture content of the diet is inversely related to the amount of water consumed because of the decreased requirement for free water when consuming diets with a high water content. Water consumption is directly related to the amount of food consumed because of the decreased caloric content of diets with a high moisture content. These relationships have not been extensively quantified, although several studies indicate the importance of this relationship in maintaining water balance (Atkeson and Warren, 1934; Green et al., 1984; Waterhouse and Carver, 1966). In addition to the interdependence of food and water consumption on dietary water, many studies have noted the positive correlation between food and water consumption at constant levels of dietary water in normal animals as well as in physiologically atypical animals (i.e., pregnant, lactating, pre-hibernating). Changes in food consumption patterns, regardless of the basis for the increase or decrease in food consumption, are generally paralleled by corresponding changes in water consumption.

Studies that reported both food consumption and water consumption data are summarized in Table 7-1, and the relationship of food consumption to water consumption is plotted in Figure 7-1. In this figure, more so than in the previous figures on food or water consumption versus body weight, the effect of dietary moisture on food and water consumption is apparent. Most of the points that are labeled and show a general shift to the left (increased food consumption relative to water consumption) are for animals on a high moisture diet. The points for dogs are taken from sources that do not specify the kind of diet used. For the other points, diets of the carnivores [mink, cats in the study by Waterhouse and Carver (1966), ferrets, and

TABLE 7-1

Food and Water Consumption of Various Animal Groups

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Primates	monkey	rhesus	F	8	0.2	0.45	Templeton, 1968
	monkey	rhesus	F	9	0.2	0.45	Arrington, 1972
	monkey	rhesus	M	11	0.2	0.45	Arrington, 1972
	monkey	rhesus	M	11	0.2	0.45	Templeton, 1968
Laboratory rodents	gerbil	Mongolian	M&F	0.06125	0.00477	0.0038	Harriman, 1969a
	gerbil	Mongolian	M&F	0.06125	0.00545	0.00565	McManus, 1972
	gerbil	Mongolian	F	0.075	0.008	0.004	Templeton, 1968
	gerbil	Mongolian	M	0.085	0.008	0.004	Templeton, 1968
	gerbil		F	0.075	0.008	0.004	Arrington, 1972
	gerbil		M	0.085	0.008	0.004	Arrington, 1972
	guinea pig	albino short-hair	M	0.2	0.017	0.04	Hirsch, 1973
	guinea pig	albino short-hair	M	0.11	0.025	0.08	Hirsch, 1973
	guinea pig	albino short-hair	M	0.27	0.025	0.052	Hirsch, 1973
	guinea pig	albino short-hair	M	0.415	0.028	0.115	Hirsch, 1973
	guinea pig	albino short-hair	M	0.48	0.031	0.12	Hirsch, 1973
	guinea pig	albino short-hair	M	0.52	0.032	0.11	Hirsch, 1973
	guinea pig	albino short-hair	M	0.58	0.035	0.151	Hirsch, 1973
	guinea pig		F	1.025	0.045	0.09	Arrington, 1972
	guinea pig		M	1.2	0.045	0.09	Arrington, 1972
	guinea pig		F	1	0.045	0.09	Templeton, 1968
	guinea pig		M	1.2	0.045	0.09	Templeton, 1968
	hamster	Syrian	F	0.0545	0.011	0.009	Templeton, 1968
	hamster	Syrian	F	0.1175	0.011	0.01	Arrington, 1972
	hamster	Syrian	M	0.05125	0.011	0.009	Templeton, 1968
	hamster	Syrian	M	0.1075	0.011	0.01	Arrington, 1972
	mouse	A/J	F	0.0209	0.0049	0.0047	Kutscher, 1974
	mouse	A/J	M	0.0252	0.0057	0.0049	Kutscher, 1974
	mouse	BALB/c	F	0.0201	0.0059	0.0056	Kutscher, 1974
	mouse	BALB/c	M	0.027	0.0068	0.0048	Kutscher, 1974
	mouse	CBA	F	0.0259	0.0092	0.0065	Kutscher, 1974
	mouse	CBA	M	0.031	0.008	0.0071	Kutscher, 1974

TABLE 7-1 (cont.)

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Laboratory rodents (cont.)	mouse	Charles River	M	0.0453	0.0055	0.0043	DeLacey et al., 1975
	mouse	Charles River	M	0.0424	0.00566	0.00479	DeLacey et al., 1975
	mouse	Crl,CD-1,CR,BR	F	0.03075	0.0052	0.0063	Chvedoff et al., 1980
	mouse	Crl,CD-1,CR,BR	F	0.03475	0.00635	0.0076	Chvedoff et al., 1980
	mouse	Crl,CD-1,CR,BR	M	0.04475	0.00565	0.00715	Chvedoff et al., 1980
	mouse	Crl,CD-1,CR,BR	M	0.0405	0.0059	0.0065	Chvedoff et al., 1980
	mouse	Crl,CD-1,CR,BR	M	0.0455	0.006	0.00835	Chvedoff et al., 1980
	mouse	Crl,CD-1,1CR,BR	F	0.03375	0.0054	0.00645	Chvedoff et al., 1980
	mouse	C3H	F	0.0228	0.0057	0.0062	Kutscher, 1974
	mouse	C3H	M	0.0264	0.0062	0.0068	Kutscher, 1974
	mouse	C57	F	0.0223	0.0064	0.0062	Kutscher, 1974
	mouse	C57	M	0.0275	0.0072	0.0066	Kutscher, 1974
	mouse	DBA	F	0.0247	0.0063	0.0079	Kutscher, 1974
	mouse	DBA	M	0.0309	0.0085	0.0078	Kutscher, 1974
	mouse	SWR	F	0.0217	0.0056	0.011	Kutscher, 1974
	mouse	SWR	M	0.0286	0.0065	0.0094	Kutscher, 1974
	mouse	white	F	0.0248	0.0059	0.0107	Chew and Hinegardner, 1957
	mouse	white	F	0.0282	0.006	0.0096	Chew and Hinegardner, 1957
	mouse	white	F	0.0335	0.0066	0.0106	Chew and Hinegardner, 1957
	mouse	white	M	0.0297	0.0065	0.0121	Chew and Hinegardner, 1957
	mouse	white	M	0.0324	0.0068	0.0109	Chew and Hinegardner, 1957
	mouse	white	M	0.0369	0.0073	0.0106	Chew and Hinegardner, 1957
	mouse		F	0.0265	0.0045	0.0055	Arrington, 1972
	mouse		M	0.03	0.0045	0.0055	Arrington, 1972
	rat	albino	M	0.2891	0.0217	0.0354	Moyer, 1966
	rat	Charles River	F	NS	0.02	0.0316	Robinson et al., 1981
	rat	Charles River	F	NS	0.0319	0.0244	Robinson et al., 1981
	rat	Charles River	M	NS	0.0174	0.0269	Robinson et al., 1981
	rat	Charles River	M	NS	0.0174	0.0269	Robinson et al., 1981
	rat	Charles River	M	NS	0.0317	0.0439	Robinson et al., 1981
	rat	F344	F	NS	0.0104	0.015	DePass et al., 1983
	rat	F344	F	NS	0.0105	0.0151	DePass et al., 1983
	rat	F344	M	NS	0.0161	0.0213	DePass et al., 1983
	rat	F344	M	NS	0.0169	0.0214	DePass et al., 1983
	rat	kangaroo	M&F	0.105	0.0074	0.0058	Bailey, 1923

TABLE 7-1 (cont.)

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Laboratory rodents (cont.)	rat	Sprague-Dawley	M	0.05	0.008	0.0136	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	0.05	0.012	0.0242	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	0.05	0.0136	0.0289	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	0.05	0.0143	0.019	Delorme and Wojcik, 1982
	rat	Sprague-Dawley	M	0.38	0.032	0.04	Grunberg et al., 1984
	rat	Sprague-Dawley	M	0.422	0.033	0.041	Grunberg et al., 1984
	rat	Sprague-Dawley	M	0.442	0.036	0.039	Grunberg et al., 1984
	rat	Wistar	F	NS	0.0156	0.0325"	Borzelleca et al., 1964
	rat		F	0.29	0.0135	0.0275	Arrington, 1972
	rat		F	0.26	0.019	0.028	Bruce, 1950
	rat		F	0.36	0.025	0.03	Bruce, 1950
	rat		F	0.26	0.027	0.038	Bruce, 1950
	rat		F	0.275	0.08	0.085	Bruce, 1950
	rat		F	0.36	0.08	0.085	Bruce, 1950
	rat		M	NS	0.0057	0.0117	Granados, 1951
	rat		M	NS	0.0078	0.0239	Granados, 1951
	rat		M	NS	0.008	0.0248	Granados, 1951
	rat		M	NS	0.0081	0.0282	Granados, 1951
	rat		M	NS	0.0082	0.0193	Granados, 1951
	rat		M	NS	0.0097	0.0268	Granados, 1951
	rat		M	NS	0.0104	0.0304	Granados, 1951
	rat		M	0.375	0.0135	0.0275	Arrington, 1972
	rat		NS	0.225	0.011	0.031	Adolph, 1947
Other laboratory mammals	cat	mixed	M	4.5	0.0549	0.1526	Taton et al., 1984
	cat	mixed	M	4.3	0.0555	0.1772	Taton et al., 1984
	cat	mixed	M	4.2	0.063	0.184	Taton et al., 1984
	cat	mixed	M	4.6	0.0676	0.1863	Taton et al., 1984
	cat	mixed	M	4.6	0.0681	0.2199	Taton et al., 1984
	cat	mixed	M	4.6	0.0681	0.2199	Taton et al., 1984
	cat	mixed	M	4.1	0.0697	0.2001	Taton et al., 1984
	cat	mixed	M	4.2	0.0727	0.1877	Taton et al., 1984
	cat	mixed	M	4.5	0.0738	0.207	Taton et al., 1984
	cat	mixed	M	4.4	0.0739	0.1822	Taton et al., 1984
	cat	mixed	M	4.1	0.0742	0.1942	Taton et al., 1984
	cat	mixed	M	4.3	0.0808	0.206	Taton et al., 1984
	cat	mixed	M	4.3	0.0867	0.227	Taton et al., 1984

TABLE 7-1. (cont.)

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Other laboratory mammals (cont.)	cat		M&F	2.034	0.219	0.0067	Waterhouse and Carver, 1966
	cat		M&F	2.9	0.23	0.0168	Waterhouse and Carver, 1966
	cat		F	3	0.175	0.3	Arrington, 1972
	cat		F	3	0.175	0.3	Arrington, 1978
	cat		F	3	0.175	0.3	Templeton, 1968
	cat		M	3	0.175	0.3	Arrington, 1972
	cat		M	3	0.175	0.3	Arrington, 1978
	cat		M	3	0.175	0.3	Templeton, 1968
	dog	beagle	F	11.5	0.4	0.3	Arrington, 1972
	dog	beagle	F	14.5	0.4	0.35	Templeton, 1968
	dog	beagle	M	15.5	0.4	0.3	Arrington, 1972
	dog	beagle	M	15.5	0.4	0.35	Templeton, 1968
	dog		M&F	24	0.36	0.8	Brown et al., 1984
	rabbit	Dutch	F	2.32	0.063	0.174	Cizek, 1961
	rabbit	Dutch	F	2.3	0.064	0.175	Cizek, 1961
	rabbit	Dutch	F	2.13	0.071	0.185	Cizek, 1961
	rabbit	Dutch	F	2.29	0.072	0.185	Cizek, 1961
	rabbit	Dutch	F	2.28	0.073	0.185	Cizek, 1961
	rabbit	Dutch	F	2.19	0.078	0.195	Cizek, 1961
	rabbit	Dutch	F	2.571	0.0802	0.187	Cizek, 1961
	rabbit	Dutch	F	2.571	0.0802	0.187	Cizek, 1961
	rabbit	Dutch	F	2.165	0.0833	0.219	Cizek, 1961
	rabbit	Dutch	F	1.96	0.084	0.226	Cizek, 1961
	rabbit	Dutch	F	2.07	0.084	0.226	Cizek, 1961
	rabbit	Dutch	F	1.89	0.088	0.225	Cizek, 1961
	rabbit	Dutch	F	1.79	0.09	0.22	Cizek, 1961
	rabbit	Dutch	M	2.2	0.059	0.169	Cizek, 1961
	rabbit	Dutch	M	2.19	0.063	0.178	Cizek, 1961
	rabbit	Dutch	M	2.23	0.063	0.17	Cizek, 1961
	rabbit	Dutch	M	2.002	0.0632	0.166	Cizek, 1961
	rabbit	Dutch	M	2.23	0.069	0.19	Cizek, 1961
	rabbit	Dutch	M	2.27	0.075	0.188	Cizek, 1961
	rabbit	Dutch	M	2.22	0.077	0.185	Cizek, 1961
	rabbit	Dutch	M	2.09	0.078	0.225	Cizek, 1961

TABLE 7-1 (cont.)

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Other laboratory mammals (cont.)	rabbit	Dutch	M	2.16	0.078	0.21	Cizek, 1961
	rabbit	Dutch	M	1.799	0.0792	0.202	Cizek, 1961
	rabbit	Dutch	M	1.95	0.084	0.224	Cizek, 1961
	rabbit	Dutch	M	1.91	0.087	0.255	Cizek, 1961
	rabbit	New Zealand white	F	5	0.15	0.3	Templeton, 1968
	rabbit	New Zealand white	M	4.5	0.15	0.3	Templeton, 1968
	rabbit		F	5	0.15	0.3	Arrington, 1972
	rabbit		M	4.5	0.15	0.3	Arrington, 1972
	rabbit		M	4.5	0.15	0.3	Arrington, 1978
Livestock	cattle	HO,H,TL	M	3136	8.2	43.1	Becker et al., 1985
	cattle	holstein	F	3619	131	162	Atkeson and Warren, 1934
	cattle	holstein	F	3330	133.7	241.6	Atkeson and Warren, 1934
	cattle	holstein	F	3330	185	422	Atkeson and Warren, 1934
	cattle	holstein	F	3605	29.1	205	Atkeson and Warren, 1934
	cattle		NS	44.11	0.14	1	Kertz et al., 1984
	cattle		NS	47.2	0.5	1.18	Kertz et al., 1984
	cattle		NS	52.65	1.01	2.59	Kertz et al., 1984
	pig	white cross	NS	5.49	0.164	0.71	Brooks et al., 1984
	pig	white cross	NS	6.15	0.187	0.74	Brooks et al., 1984
	pig	white cross	NS	7.15	0.34	1.09	Brooks et al., 1984
	pig	white cross	NS	7.99	0.357	1.31	Brooks et al., 1984
	pig	white cross	NS	9.77	0.567	1.63	Brooks et al., 1984
	pig	white cross	NS	10.6	0.594	2.16	Brooks et al., 1984
	pig	white cross	NS	13.6	0.704	2.58	Brooks et al., 1984
	pig	white cross	NS	13.06	0.762	2.15	Brooks et al., 1984
Wildlife	ferret	domestic	F	0.675	0.168	0.0875	Moody et al., 1985
	ferret	domestic	M	2.025	0.168	0.0875	Moody et al., 1985
	lion		F	149	6.12	0.8	Green et al., 1984
	lion		M	193	5.06	3.98	Green et al., 1984
	lion		M	91	6.53	1.07	Green et al., 1984
	marmot	yellow-bellied	F	3.81	0.0799	0.134	Zatzman et al., 1984
	marmot	yellow-bellied	F	3.86	0.1012	0.182	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.32	0.0198	0.034	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.33	0.0329	0.041	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.29	0.057	0.063	Zatzman et al., 1984

TABLE 7-1 (cont.)

Group	Species	Strain	Sex	Weight (kg)	Food (kg/day)	Water (ℓ/day)	Reference
Wildlife (cont.)	marmot	yellow-bellied	M	5.46	0.057	0.089	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.5	0.0816	0.117	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.45	0.0928	0.145	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.39	0.1049	0.187	Zatzman et al., 1984
	marmot	yellow-bellied	M	4.62	0.1086	0.191	Zatzman et al., 1984
	marmot	yellow-bellied	M	4.76	0.1178	0.211	Zatzman et al., 1984
	marmot	yellow-bellied	M	4.95	0.122	0.231	Zatzman et al., 1984
	marmot	yellow-bellied	M	5.19	0.122	0.228	Zatzman et al., 1984
	mink		M	1.613	0.042	0.0063	Eriksson et al., 1984
	mink		M	1.613	0.0465	0.0063	Eriksson et al., 1984
	mink		M	1.613	0.0465	0.0063	Eriksson et al., 1984
Birds	turkey	Amerine, Nichola	M	13.4	0.372	0.605	Parker et al., 1972

NS = Not specified

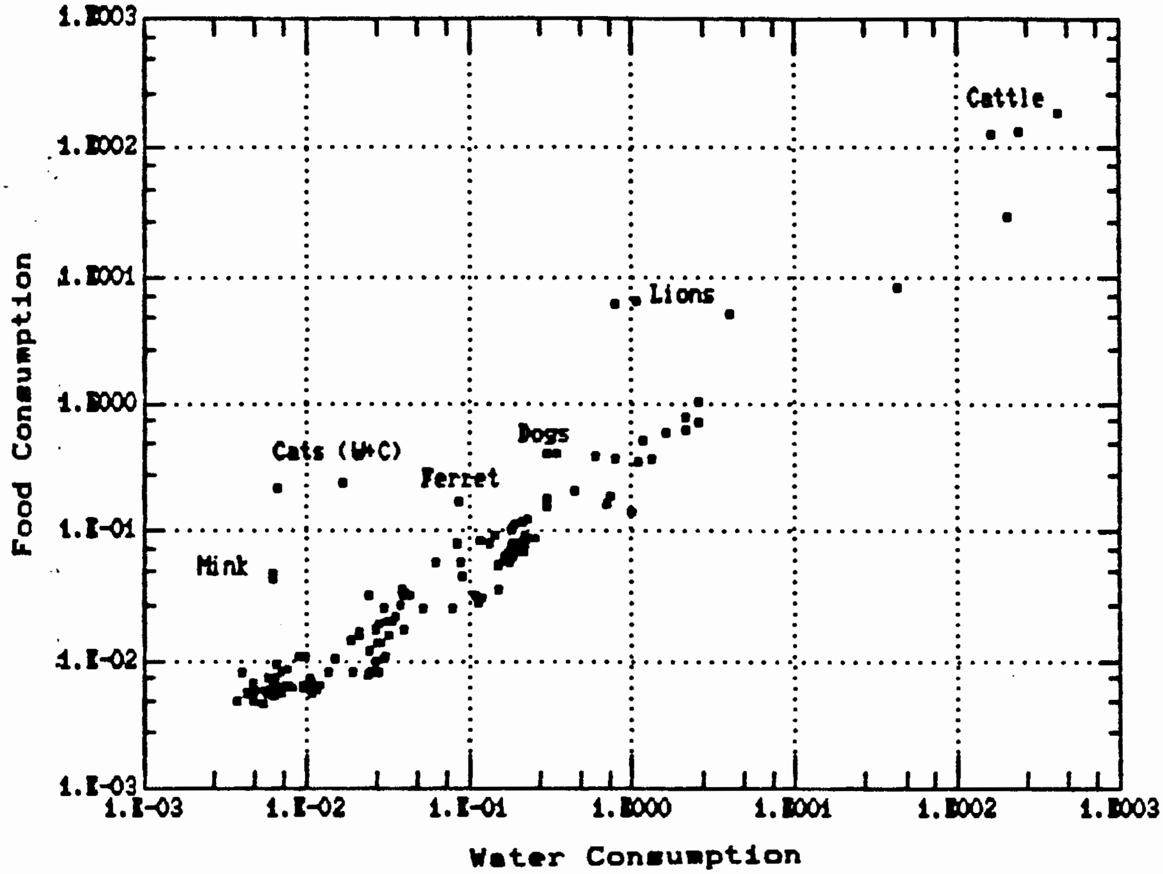


FIGURE 7-1

Plot of Food Consumption (kg/day) vs Water Consumption (ℓ) for All Species [See Table 7-1 for points and references (Outliers are labeled. See text for discussion)].

lions] contained a high content of fresh meat. In the study on cattle, Atkeson and Warren (1934), the labeled points were from three groups of cattle that grazed on succulent vegetation. A fourth group of cattle, the data for which are plotted but not labeled in Figure 7-1, was fed a diet of dry grain. The food-to-water consumption patterns for this group are consistent with the majority of the points in Figure 7-1, which are for animals fed a dry diet, including the data on rabbits (Cizek, 1961), marmots (Zatzman et al., 1984) and cats (Taton et al., 1984).

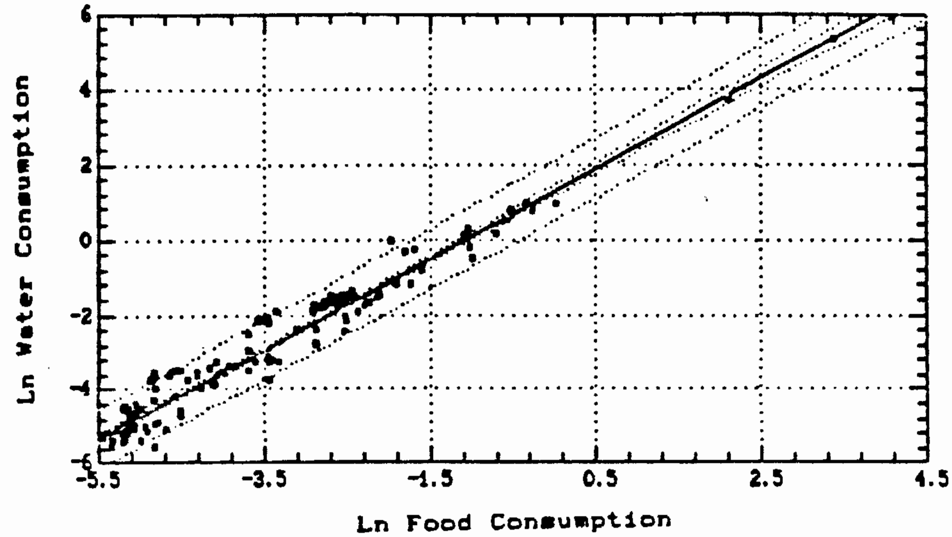
The difference in water and food consumption patterns for animals on dry and moist diets is summarized in Table 7-2 and illustrated in Figures 7-2 to 7-9. When either food or water consumption is known for animals on a wet or dry diet, Equations 7-1 to 7-4 (Table 7-2) should be used to estimate the missing value. [The "a" and "b" designations on these equations and on the corresponding figures are provided for convenience and represent the same data plotted as food vs water ("a") or water vs. food ("b").] Equation 7-3 is recommended for rabbits, dogs and cats only if the animals were fed dry diets. Equation 7-5 (Table 7-2) should be used if moist diets were given. For rodent species, usually given dry diets, Equation 7-4 is recommended. If moist diets are specified for the rodents (as is occasionally the case with hamsters and gerbils), Equation 7-2 should be used. For all other species in which the diets are specified as or can be reasonably assumed to have been dry or moist, Equations 7-1 and 7-2, respectively, are recommended.

If only the body weight is known or assumed, but the type of diet is specified as, or can be reasonably assumed to have been, dry or moist, Equations 7-5 and 7-7 (see Table 7-2), respectively, are recommended for estimating food consumption and Equations 7-6 and 7-8 (see Table 7-2), respectively, are recommended for estimating water consumption.

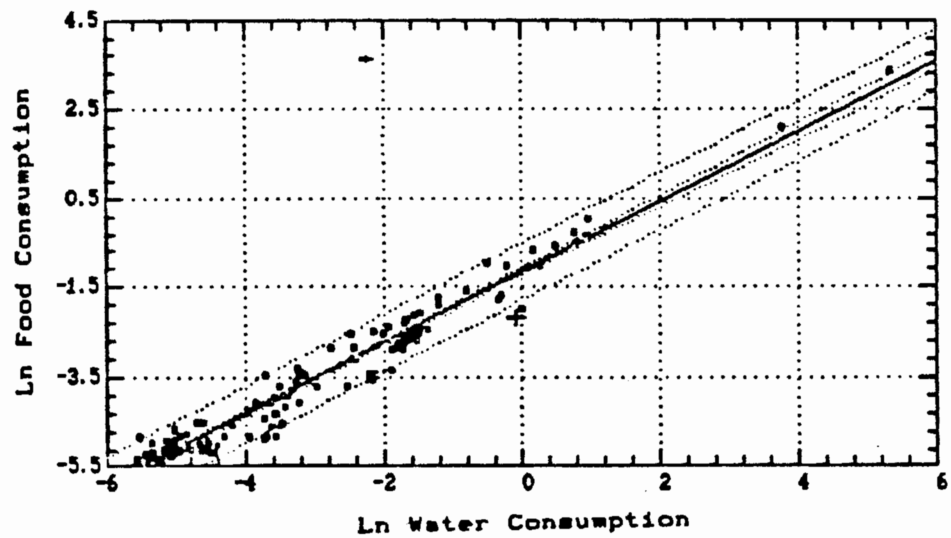
TABLE 7-2

Species and Group Specific Allometric Interrelationships for Food Consumption in kg/day (F), Water in ℓ (C) and Body Weight (W) in kg

Animal Group	Allometric Equation	Equation	Figure
	FOOD AND WATER CONSUMPTION		
Dry diet: All species	$F = 0.31\ C^{0.7923}$	7-1a	7-2
	$C = 3.59\ F^{1.2041}$	7-1b	
Wet diet: All species	$F = 2.09\ C^{0.7389}$	7-2a	7-3
	$C = 0.39\ F^{1.2447}$	7-2b	
Laboratory mammals: (dry diet)	$F = 0.28\ C^{0.7613}$	7-3a	7-4
	$C = 0.31\ F^{1.2226}$	7-3b	
Laboratory rodents: (dry diet)	$F = 0.16\ C^{0.6426}$	7-4a	7-5
	$C = 0.25\ F^{1.2943}$	7-4b	
	BODY WEIGHT TO FOOD OR WATER CONSUMPTION		
Dry diet: All species	$F = 0.049\ W^{0.6087}$	7-5	7-6
	$C = 0.093\ W^{0.7584}$	7-6	7-6
Wet diet: All species	$F = 0.054\ C^{0.9451}$	7-7	7-7
	$C = 0.009\ F^{1.2044}$	7-8	7-7



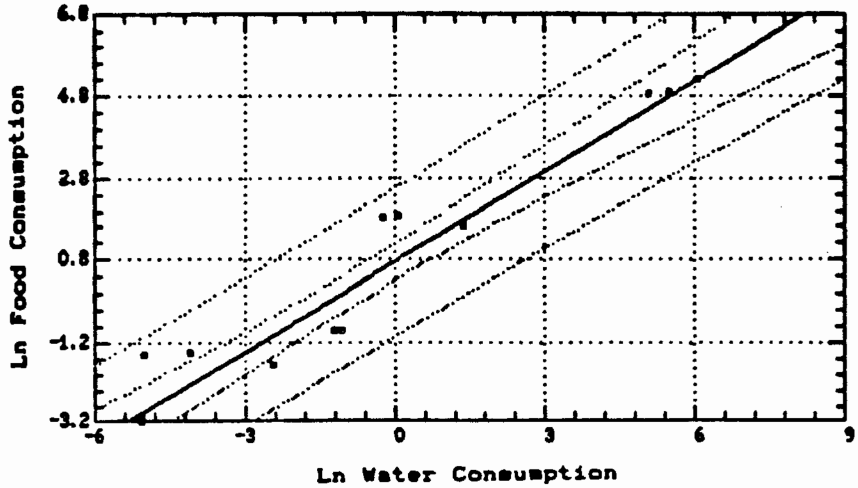
B0: 1.2793 SE: 0.074445 T: 17.185
B1: 1.2041 SE: 0.020635 T: 58.353
CORR: 0.97675 MSE: 0.15937 DF: 164



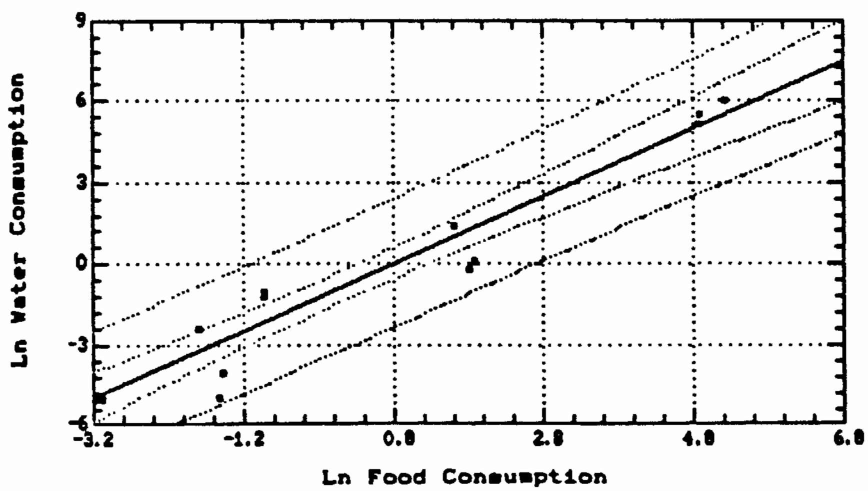
B0: -1.1644 SE: 0.044121 T: -26.391
B1: 0.79233 SE: 0.013578 T: 58.353
CORR: 0.97675 MSE: 0.10487 DF: 164

FIGURE 7-2

Allometric Relationships of Food Consumption (kg/day) to Water Consumption (ℓ/day) for Animals on Dry Diets



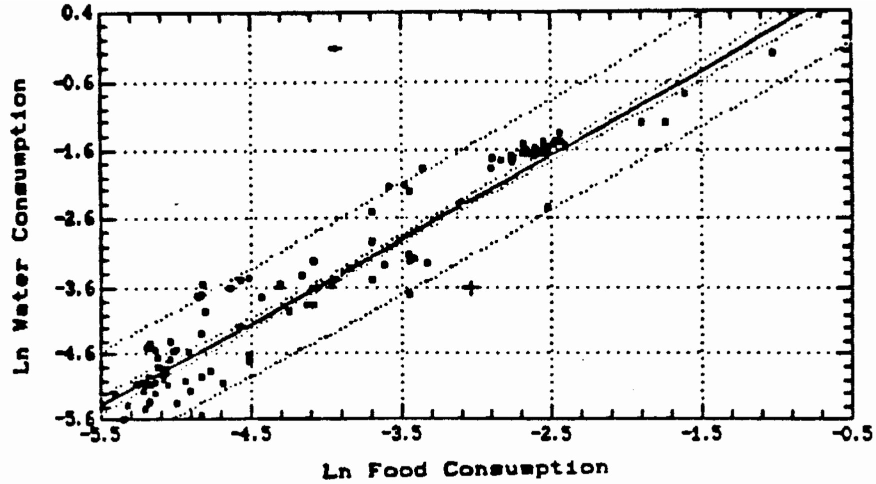
B0: 0.73698 SE: 0.20874 T: 3.5306
B1: 0.73887 SE: 0.058376 T: 12.657
CORR: 0.95897 MSE: 0.6725 DF: 14



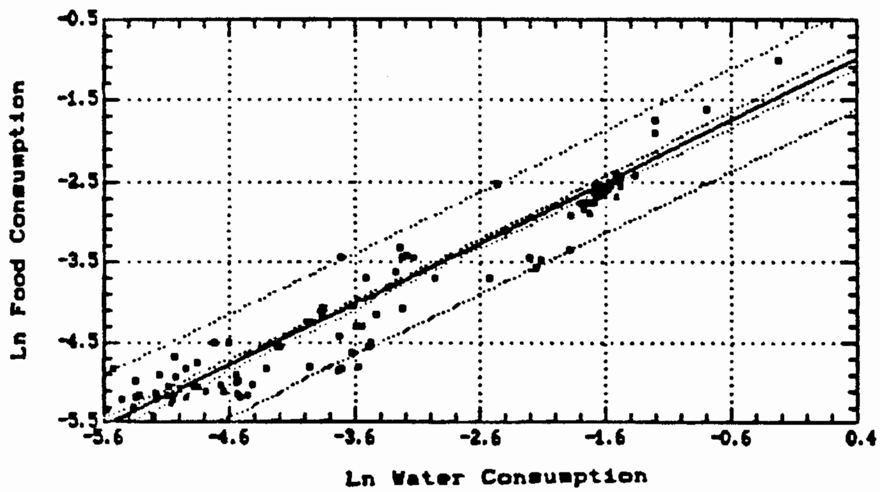
B0: -0.97133 SE: 0.26714 T: -3.6361
B1: 1.2447 SE: 0.098338 T: 12.657
CORR: 0.95897 MSE: 1.1329 DF: 14

FIGURE 7-3

Allometric Relationships of Food Consumption (kg/day) to Water Consumption (ℓ/day) for Animals on Moist Diets



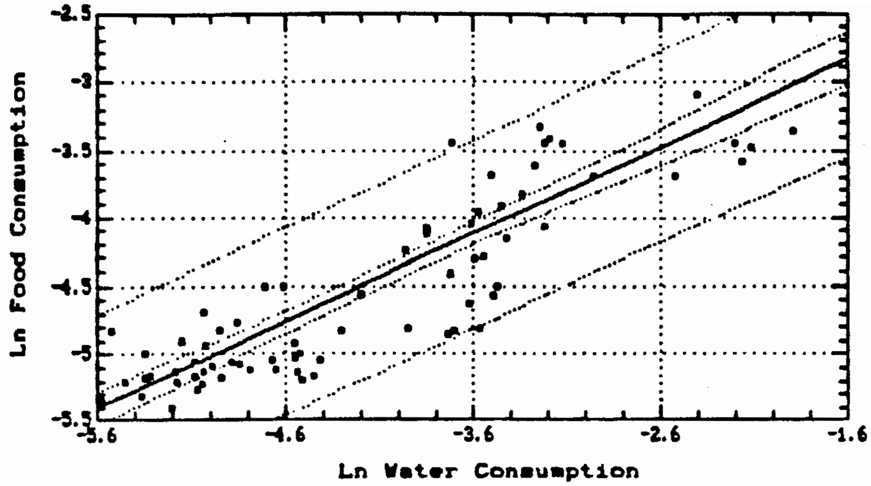
B0: 1.3646 SE: 0.10913 T: 12.505
B1: 1.2226 SE: 0.028486 T: 42.918
CORR: 0.96477 MSE: 0.16366 DF: 137



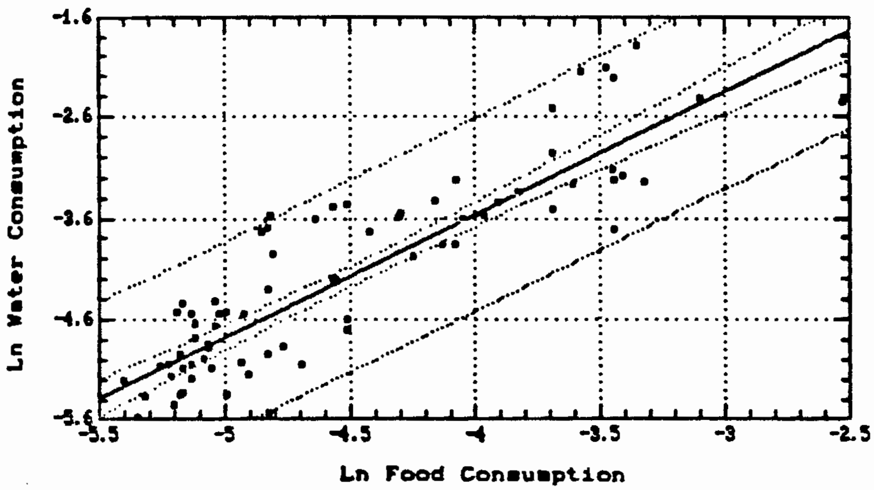
B0: -1.2907 SE: 0.061 T: -21.158
B1: 0.76132 SE: 0.017779 T: 42.918
CORR: 0.96477 MSE: 0.10192 DF: 137

FIGURE 7-4

Allometric Relationships of Food Consumption (kg/day) to Water Consumption (ℓ/day) for Laboratory Mammals (Gerbils, Guinea Pigs, Hamsters, Mice, Rats, Cats, Dogs and Rabbits) on Dry Diets.



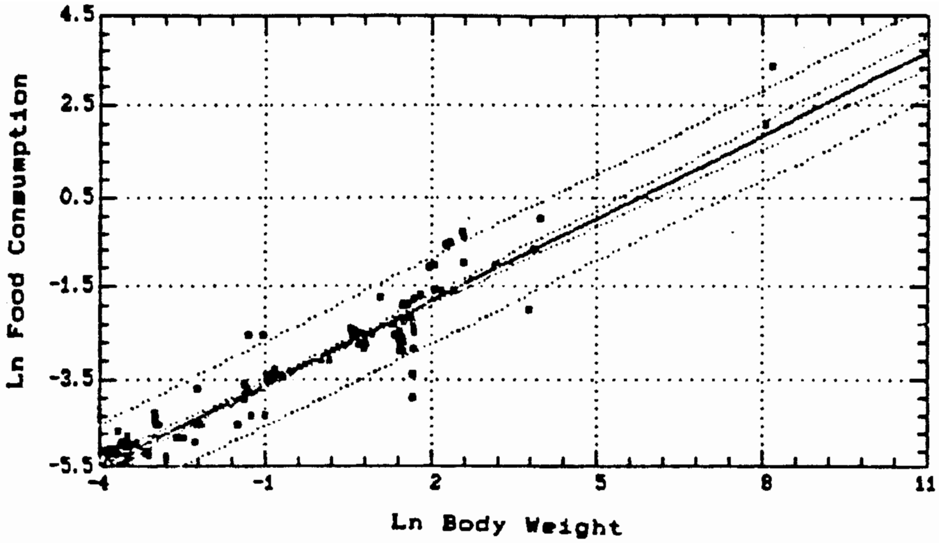
B0: -1.8104 SE: 0.15848 T: -11.423
B1: 0.64256 SE: 0.03743 T: 17.167
CORR: 0.88332 MSE: 0.1188 DF: 83



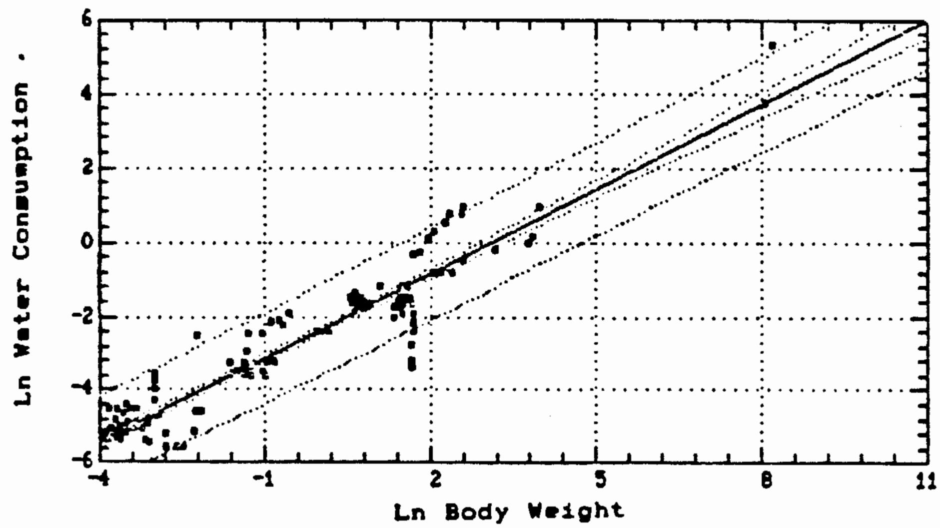
B0: 1.2942 SE: 0.31923 T: 4.054
B1: 1.2143 SE: 0.070734 T: 17.167
CORR: 0.88332 MSE: 0.2245 DF: 83

FIGURE 7-5

Allometric Relationships of Food Consumption (kg/day) to Water Consumption (ℓ/day) for Laboratory Rodents (Gerbils, Guinea Pigs, Hamsters, Mice and Rats) on Dry Diets.



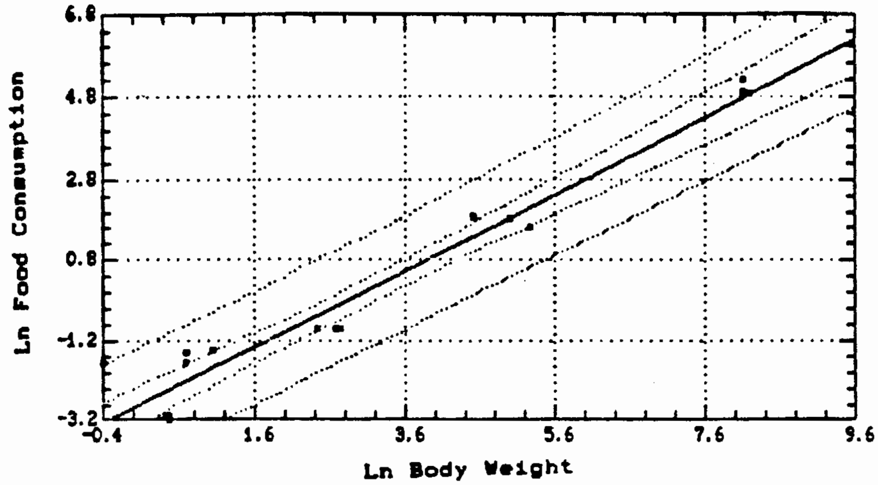
B0: -3.0208 SE: 0.039292 T: -76.88
B1: 0.6087 SE: 0.01638 T: 37.16
CORR: 0.95068 MSE: 0.22802 DF: 147



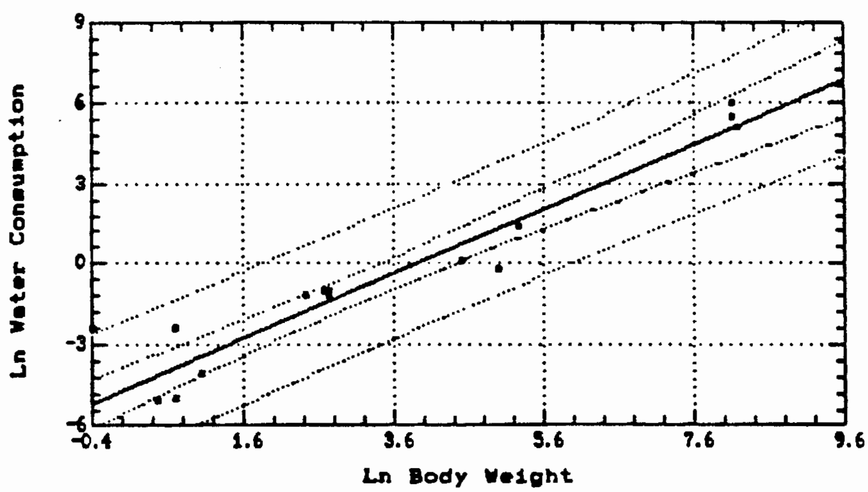
B0: -2.3784 SE: 0.051118 T: -46.529
B1: 0.75842 SE: 0.02131 T: 35.59
CORR: 0.94658 MSE: 0.38593 DF: 147

FIGURE 7-6

Allometric Relationships of Food Consumption (kg/day) and Water Consumption (ℓ/day) to Body Weight (kg) for Animals on Dry Diets



B0: -2.9185 SE: 0.23322 T: -12.514
B1: 0.94514 SE: 0.055249 T: 17.107
CORR: 0.97532 MSE: 0.41428 DF: 15



B0: -4.7081 SE: 0.40404 T: -11.652
B1: 1.2044 SE: 0.095718 T: 12.583
CORR: 0.95575 MSE: 1.2434 DF: 15

FIGURE 7-7

Allometric Relationships of Food Consumption (kg/day) and Water Consumption (ℓ/day) to Body Weight (kg) for Animals on Moist Diets

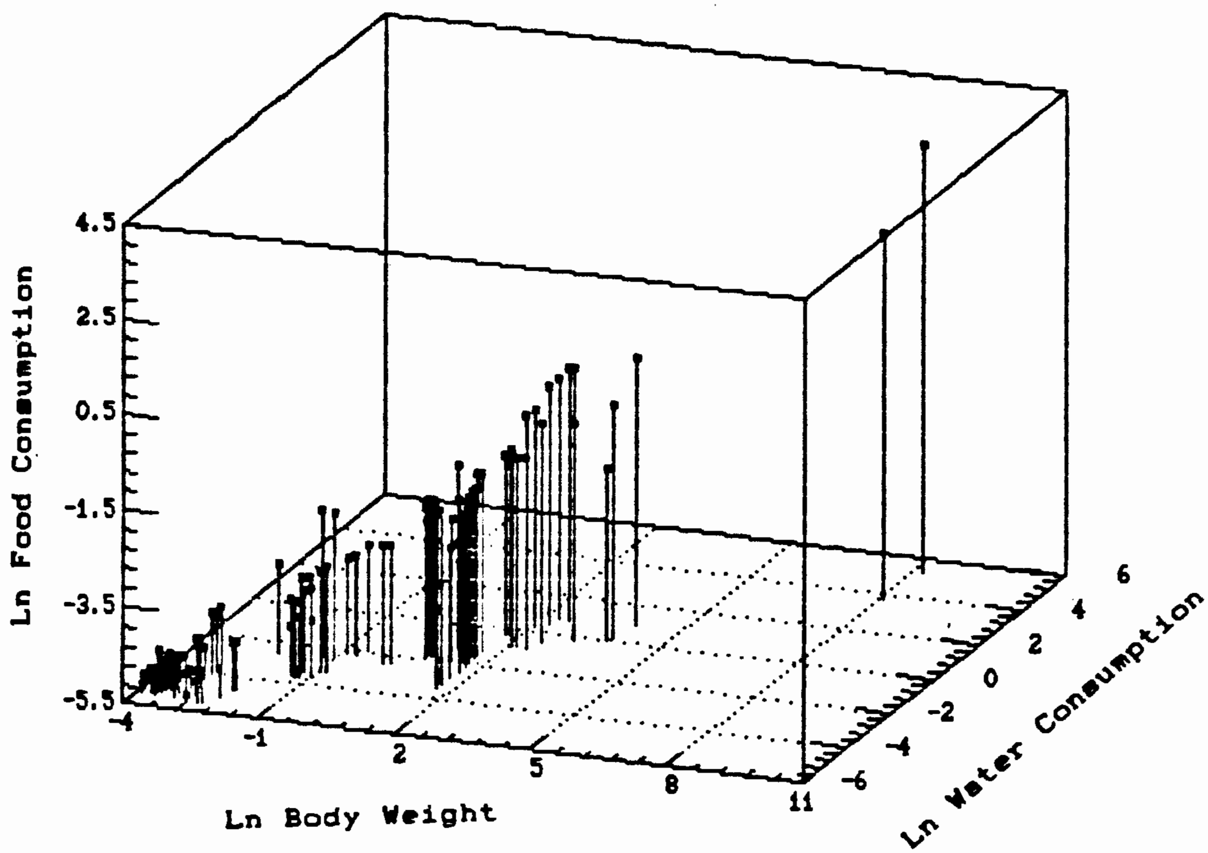


FIGURE 7-8

Plot of Food Consumption (kg/day) vs. Water Consumption (ℓ/day) vs. Body Weight (kg) for Animals on Dry Diets

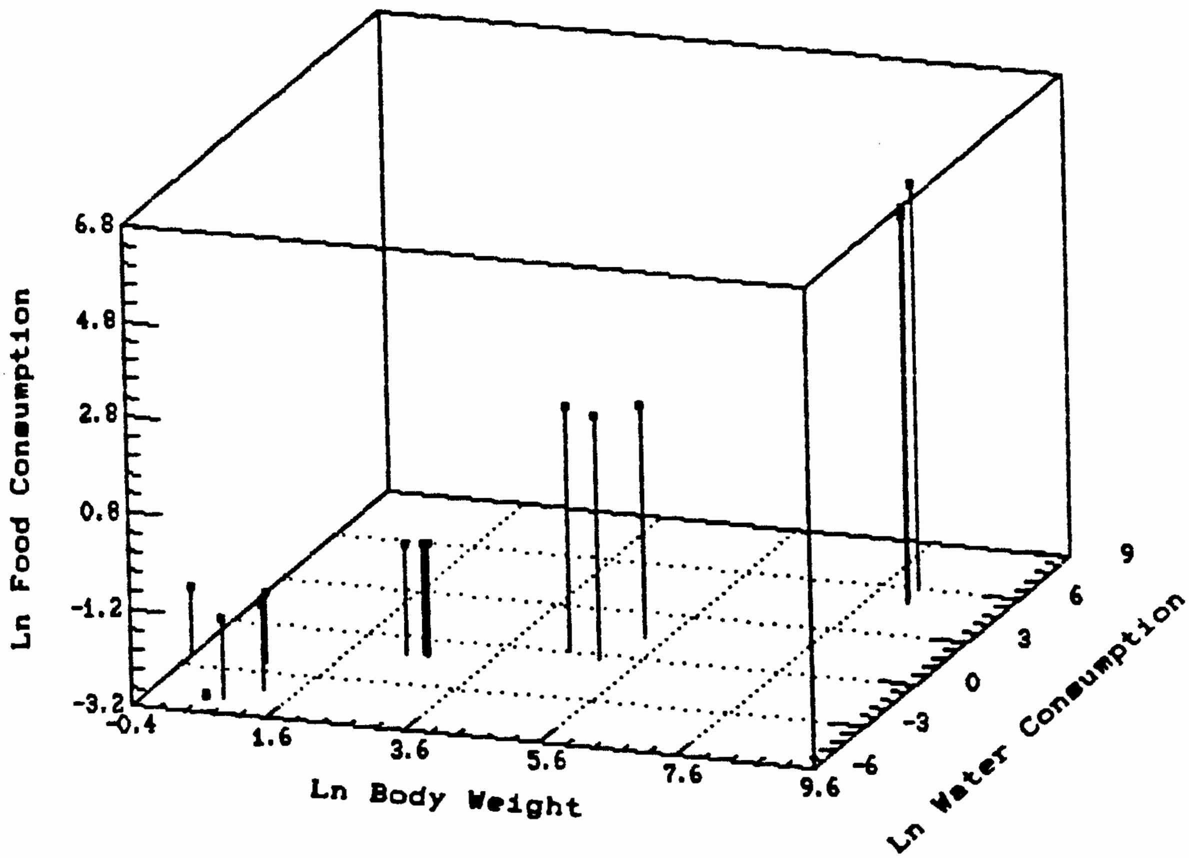


FIGURE 7-9

Plot of Food Consumption (kg/day) vs. Water Consumption (ℓ/day) vs. Body Weight (kg) for Animals on Moist Diets

If the kind of diet is not known and a reasonable assumption cannot be made of the kind of diet, the general equations in Chapters 5 and 6 should be used.

[N.B. At the time the data base containing the information discussed in this report was developed, the significance of moisture content was not appreciated and this factor was not included as a field in the data base. A reanalysis of Chapters 5 and 6, considering the moisture content of the diet, would likely improve Equations 7-5 to 7-8 as well as the allometric equations given in Chapters 5 and 6.]

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