Vitamin and Mineral Research

Because most pet foods are formulated from deficient feed ingredients, nearly every other manufacturer adds chemically-synthesized forms of vitamins and minerals in order to reach nutritional profiles established by the Association of American Feed Control Officials, or AAFCO. The potential toxicity from these unnatural forms of vitamins and minerals has been known for decades. The National Research Council, and its Committee on Animal Nutrition, has written and published two books on this topic: Vitamin Tolerance of Animals and Mineral Tolerance of Domestic Animals. Both books reveal research data on the adverse effects of chemically-synthesized vitamins and minerals on animals. Below are portions of the research data gathered by the National Research Council.

Nature's Logic has specially formulated dry, canned, and frozen diets, treats and supplements without adding any of these potentially toxic forms of vitamins and minerals. The vitamins and minerals found in all Nature's Logic products are those found naturally in the special whole food ingredients making up our formulas. Cats and dogs in the wild never consume chemically- synthesized vitamins and minerals. Nature's Logic is a pet food that reflects the true natural foods best suited for our pets.

Chemically Synthesized Vitamin Research

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Vitamin A Research							
Cats, 31	Weanling	3,5000,000 IU/kg diet	Retinyl palmitate	10 mon	Gavage	Loss of appetite; irritability; lethargy; exophthalmus[1]; cervical spondylosis[2]	Seawright et al., 1967
Cats, 3	Weanling	15,000,000 IU/kg diet	Retinyl palmitate	29 wk	Oral	Proliferative gingivitis; incisor exfoliation; thin mandibles	Seawright and Hrdlicka, 1974
Dogs, 5	2 mo	75,000 U/kg diet	Retinyl acetyl	67 d	Oral	Bone changes	Maddock et al., 1949
Rabbits	Young, 1kg	400 IU/g BW	Retinyl palmitate	5 d	Gavage	Depleted cartilage matrix; hair loss	Thomas et al, 1960

[1]Abnormal protrusion of the eyeball.

[2]Degenerative joint disease affecting the cervical vertebrae, intervertebral disks and surrounding ligaments and connective tissue, sometimes with pain or paresthesia radiating down the arms as a result of pressure on the nerve root.

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Vitamin B6 Research							
Dogs, 3	Pups	20 mg/kg BW		75	Oral	Growth unaffected; no adverse effects on blood parameters; histology normal[3]	Unna and Antopol, 1940
Dogs, Beagles 5/treatments	7-8 mo (8 kg)	50 mg/kg BW/d	PN HCl	107 d	Oral	No clinical effects; reduction of myelin[1] in nerves; increased PN[2] concentration in blood and cerebral cortex	Phillips et al., 1978
Dogs, Beagles Male/Female 10-13/group	13-15 mo	50 increasing to 150 mg/kg BW/d	PN-HCl	100 d	Oral	Anorexia within 2 wk; ataxia[4] with 4 wk	Hoover and Carlton, 1981
Dogs, Beagles 5/treatments	7-8 mo (8 kg)	200 mg/kg BW/d	PN-HCl	107 d	Oral	Ataxia[4], muscle weakness, and loss of balance after 40-75 d; reduction of myelinin nerves; increased PN concentration in blood and organs	Phillips et al., 1978
Dogs, Beagles 5/treatments	7-8 mo (8 kg)	250 mg/kg BW/d	PN-HCl	1 wk	Oral	Incoordination; ataxia[4]	Phillips et al., 1980
Dogs, Beagles Male/Female 2/group	7-11 mo	300 mg/kg BW/d	PN-HCl	78 d	Oral	Development of swaying gait within 9 d; neuronal degeneration of ganglia[5]	Krinke et al., 1980
Dogs, Beagles 2/treatments	12 mo (11kg)	3 g/d	PN-HCl	8-26 d	Oral	Unsteady gait; weakness; apathy; neurologic impairment; lesions of sensory neurons	Schaeppi and Krinke, 1982
Dogs, males/females,	Adult (-10kg) 4 total	1-5 g/kg BW/d	PN or PN-HCl	1-4 d	Oral	Vomiting after dosing; ataxia[4] after 2 d. Sacrificed or died at 8-14 d; degeneration of posterior columns of spine found.	Antopol and Tarlov, 1942
Humans, 7	20-43	2-6 g/d	PN-HCl	40 m	Oral	Ataxia; sensory and nervous system dysfunction; 4 humans severely disabled.	Schaumburg et al., 1980
Vitamin C (Ascorbic Acid) Research							
Dogs, 8		1 g/d		46 d	Oral	Aggravation of hypertrophic[1] osteodystrophy[2]	Teare et al., 1979
Dogs, 67		1-2.5 g/d		3-6 d	IV	No effect	Leveque, 1969
Dogs, 1	5 mo	0.5-3.0 g/d		14 d	IV	Improvement of osteodystrophy[2]	Vaananen and Wekman, 1979
Dogs, 12		2 g/d		3-6 d	IV	No effect	Belfield, 1967
Dogs, 1	4 mo	3 g/d		12 d	IV	Improvement of osteodystrophy[2]	Vaananen and Wekman, 1979
Dogs, 3		9 g/d		3 d	IV	No effect	Leveque, 1969
Horses, 2	390 & 533 kg	5 g/d		1 d	IM	No effect	Loscher et al., 1984
Horses, 4	440-600 kg	10 g/d		1 d	SC	No effect	Loscher et al., 1984
Horses, 20	300-400 kg	5-10 g/d		1d	IV	No effect	Loscher et al., 1984
Horses, 10	276-609 kg	10-20 g/d		1 d	Drinking water	No effect	Loscher et al., 1984
Guinea pigs, 6	350g	0.2 g/d		112 d	Oral	Liver congestion	Ohno and Myoga, 1981
Guinea pigs	250-300 g	0.3 g/d		4 d	Oral	Decreased MFO activity; altered phospholipid levels	Sutton et al., 1982
Guinea pigs, 5	Weanlings (<250 g)	0.15-0.5 mg/kg		70 d	Oral	Depressed 7-a- Hydroxylase activity	Peterson et al., 1983

[1]the substance of the cell membrane of Schwann's cells that coils to form the myelin sheath (a tubular structure enclosing some organ or part); it has a high proportion of lipid to protein and serves as an electrical insulator [2]pyridoxine - one of the forms of vitamin B6
[3]that department of anatomy which deals with the minute structure, composition, and function of the tissues [4]failure of muscle coordination; irregularity of muscular action [5]a general term for a group of nerve cell bodies located outside the central nervous system

[1]enlargement or overgrowth of an organ or part due to an increase in size of it constituent cells. [2]defective bone formation

Vitamin D Research

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Dogs, Males 18	Mature	0.5-1.0 mg/kg BW	Vitamin D_2	1-3 wk	Oral	Hypercalcemia[1]; cardiovascular and nephrocalcinosis[2]; increased blood pressure	Spangler et al., 1979
Foxes	2-6 mo	0.125-0.250 mg/kg BW	Vitamin D_3	3 mo	Oral	Anorexia; hypercalcemia[1]; cardiovascular calcinosis[3]; hyaline muscle damage[o]; death in several animals consuming 0.250mg/kg BW	Helgebostad and Nordstoga, 1978
Horses, 1	270-321 kg	1.18mg/kg BW	Vitamin D_2	21 d	Diet	Severe cardiovascular calcinosis[3]; hypercalcemia[1]; hyperphosphatemia[4]	Harrington, 1982
Horses, 2		0.082 mg/kg BW	Vitamin D^3	4 mo	Diet	Kidney and cardiovascular calcinosis[3]; death	Hintz et al., 1973
Horses, 1	231 kg	0.825 mg/kg BW	Vitamin D^2	33 d	Diet	Mild cardiovascular calcinosis[3]; weight loss; hypercalcemia[1]; hyperphosphatemia[4]	Harrington and Page, 1983
Horses, 1	304 kg	0.825 mg/kg BW	Vitamin D^3	33 d	Diet	Severe weight loss; hypercalcemia[1]; hyperphosphatemia[4]; severe cardiovascular	Harrington and Page, 1983
Horses, 1	270-321 kg	0.232 mg/kg BW	Vitamin D^3	21 d	Diet	No effect	Harrington , 1982
Horses, 1	270-321 kg	0.550 mg/kg BW	Vitamin D^2	21 d	Diet	No effect	Harrington, 1982
Rabbits	0.250 mg/kg BW		Vitamin D^3		Diet	cardiovascular calcinosis[3]	Toda et al, 1983

[o] glassy and transparent or nearly so
[1]an excess of calcium in the blood; manifestations include fatigability, muscle weakness, depression, anorexia, nausea and constipation.
[2]a condition characterized by precipitation of calcium phosphate in the tubules of the kidneys, with resultant renal insufficiency.
[3]a condition marked by the deposition of calcium salts in various tissues of the body
[4]an excessive amount of phosphates in the blood; it is usually asymptomatic.

Vitamin K Research

Dogs, 17	Variable		Menadione bisulfite	Single Dose	IV	LD_{50}[1], 100-150 mg/kg	Richards & Shapiro, 1945
Dogs	15-40 mg/kg		Menadione bisulfite	Daily, 15d	IV	Anemia; no mortality	Richards & Shapiro, 1945
Horses, 11	400 kg	2.1-8.3 mg/kg	Menadione bisulfite	Single dose	IM and IV	Acute renal failure	Rebhun et al., 1984

[1]50% of Animals tested died

Choline Research

Dogs, 2	Mature	10 mg/kg BW 3/d	Choline HCl	90 d	Stomach Tube	Erthrocyte[1] numbers reduced	Davis, 1944b
Dogs, 1	Mature	10 mg/kg BW/d	Choline HCl	d 7	Stomach Tube	Erythrocyte[1] numbers reduced	Davis, 1944b
Dogs, 1	Mature	10 mg/kg BW/d	Choline HCl	d 19	Stomach Tube	Erythrocyte[1] numbers reduced	Davis, 1944b
Dogs, 1	Mature	10 mg/kg BW 3/d	Choline HCl	d 60	Stomach Tube	Erythrocyte[1] numbers reduced	Davis, 1944b
Dogs, 4	Mature	10 mg/kg BW/d	Choline HCl	25 d+ until anemia established	Stomach Tube	Erythrocyte[1] numbers reduced; in 5 dogs, administration of 3 daily doses produced reductions from 30-43%.	Davis, 1944b
Dogs, 4	Mature	10 mg/kg BW/2d	Choline HCl	Until red cell level lowered	Stomach Tube	Erythrocyte[1] numbers reduced; in 5 dogs, administration of 3 daily doses produced reductions from 30-43%.	Davis, 1944b
Dogs, 4	Mature	10 mg/kg BW 3/d	Choline HCl	After red cell levels lowered	Stomach Tube	3 daily doses produced reductions from 30 to 43%	Davis, 1944b
Dogs, 6	1.8 kg	Supplement of 1,500 mg/kg diet	Choline HCl	32-57 d	Diet	Improvement in growth; no adverse effects	McKibbin et al., 1944

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Choline Research Continued							
Dogs, 4	1.5-2.7 kg	Supplement of 2,000 mg/kg diet	Choline HCl	10-50 d	Diet	Improvement in growth and liver function and reduction in liver lipid content; no adverse effects reported	McKibbin et al., 1945
Dogs, 4	Mature	5 g/d	Soybean lecithin 3% Choline	80 d	Diet	After latent period of at least 5 d, erythrocyte numbers gradually reduced; max diminutions of 15-20% reached after 12-25 d of lecithin feeding	Davis, 1944a
Dogs, 2	Mature	8 mg/kg BW/d 0.5 mg/kg BW (for 18D)	Choline HCl administered with atropine	35 d	Stomach Tube	Required additional 10 d after atropine cessation to show comparable depressions	Davis, 1944a
Dogs, 2	Mature	8 mg/kg BW/d	Choline HCl	5 d	Stomach Tube	After 15 d, erythrocyte[1] numbers significantly reduced	Davis, 1944a
Humans with movement disorders, 8	Mature	Up to 20 g/d	Choline HCl	4 wks	Oral	16-20 g associated with peak plasma concentration; rapid disappearance after dosing; some clinical improvement	Hollister et al, 1978
Humans with movement disorders, 8	Mature	5 g/d	Choline HCl	Single Dose	Oral	Plasma concentrations peak at 4 h	Hollister et al, 1978

[1]one of the elements found in peripheral blood.

Niacin Research

Humans, 99		1% in gel	6-Amino-nicotinamide	4 week	Topical	Transient Tachyphylaxis[1] observed in 10 subjects, slight mucocutaneous toxicity observed in 25 subjects	Zackheim 1978
Rabbits		Graded doses	Nicotinamide	Single Dose	IV	LD_{50}[2], 2.5 g/kg BW	Hoffer, 1969

[1]rapidly decreasing response to a drug after administration of a few doses.
[2]50% of animals tested died

Riboflavin Research

Dogs, 3		2 g/kg BW	Riboflavin	Single dose	Oral	No evidence of toxicity; 0.1% of dose recovered in urine during 24 hr	Unna and Greslin, 1942
Dogs, 4	10 wk	25 mg/kg BW/d	Riboflavin	5 mo	Oral	No adverse effect on growth; no toxic signs; histology normal[1]	Unna and Greslin, 1942

[1]That department of anatomy which deals with the minute structure, composition, and function of the tissues.

Chemically Synthesized Mineral Research

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Copper Research							
Pony, 5	137-419 kg	19 mg 618 mg 1080 mg 1866 mg	$CuCO_3$	Daily for 6 m	Diet	No effect No ill effect No hemolytic crisis Liver Cu levels, 3,445-4295 ppm	Smith et al, 1975a Smith et al, 1975a Smith et al, 1975a Smith et al, 1975a
Horse, 4	103-185 d	8 ppm	$CuSo_4$	225	Diet	No effect	Cupps and Howell, 1949
Horse		109 ppm				No effect	Cupps and Howell, 1949
Horse - 32	Mature	60 mg/kg	$CuSo_4$	Once	Gavage	Hypercupremia1; hepatic[2] and renal disease; death in 2 wk	Bauer, 1975
Horse		65-99 mg/kg		Divided in 5-9 doses	Gavage	Gastroenteritis[3]; icterus[4]; uremia[5]; hemolytic crisis[6]	Bauer, 1975
Horse		157-222 mg/kg		Repeated Doses	Gavage	Gastroenteritis[3]; icterus[4]; uremia[5]; hemolytic crisis[6]	Bauer, 1975
Rabbits, 3	2 kg	2 mg/kg	$CuSo_4$	Single Dose IV		No effect	Eden & Green 1939
Rabbits, 2	2 kg	2.5 mg/kg				MLD_{50}[7]	Eden & Green 1939
Rabbits	2 kg	.5 mg/kg				Death within minutes	Eden & Green 1939
Rabbit	2 kg	.50 mg/kg			Drench	50% fatal within 6 hours	Eden & Green 1939
Rabbit	Growing	200 ppm	$CuSo_4$ $5H_20$	Daily	Diet	Growth promotion; thinned cecal wall	Cited by King, 1975

[1] an excess of copper in the blood.
[2] pertaining to the liver
[3] an acute inflammation of the lining of the stomach and intestines, characterized by anorexia, nausea, diarrhea, abdominal pain and weakness.
[4] severe jaundice
[5] signs and symptoms of chronic renal failure, including nausea, vomiting, anorexia
[6] disruption of the integrity of the red blood cells causing the release of hemoglobin
[7] 50% fatality with minimum lethal dose

Iodine Research

Horse, 165	Mature	48-55 mg I/mare	Iodized Salt		Diet	3% incidence of goiter[1] in foals	Baker and Lindsey 1968
Horse, 60		56-69 mg I/mare	Kelp	Several m		10% incidence of goiter[1] in foals	Baker and Lindsey 1968
Horse, 60		288-432 mg I/mare	Kelp	Several m		50% incidence of goiter[1] in foals	Baker and Lindsey 1968
Rabbit, 9	Mature	250 ppm	NaI or KI	2 d before parturition	Diet	Only 30% survival in young to 3 d	Arrington et al, 1965
Rabbit, 19	Mature	500 ppm	NaI or KI	5 d before parturition		Only 3% survival in young to 3 d	
Dog, 4	8-16 kg	36 mg/kg	KIO_3	Several months	Oral (milk)	Some dogs vomited	Webster et al., 1966
	10-15 kg	59 mg/kg	KIO_3	Single dose	Capsule	No effect	Webster et al., 1966
Dog, 3		118 mg/kg 148 mg/kg				1 of 3 died within 1 wk All died within 1 wk	Webster et al., 1966 Webster et al., 1966
Guinea Pig, 12	250 g 250 g		KIO_3 KIO_3	28 d 28 d	0.05% KIO_3 soln 0.05% KIO_3 soln	No adverse effect No adverse effect	Webster et al., 1959

[1] enlargement of thyroid gland

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Iron Research							
Dog, 1	7-12 kg	10 mg/kg 20.1 mg/kg 40.2 mg/kg	$FeSO_4 7H_2 0$	10 d	Capsule	Vomiting Diarrhea Diarrhea	Hoppe et al., 1955a
Dog, 1		150 mg/kg	$FeSO_4$	Single	Gavage	Metabolic acidosis[3]	Reissman and Coleman,1955
Dog, 1		150 mg/kg	Ferrous sulfate			Survived	Franklin et al., 1958
Dog, 10		250 mg/kg	Ferrous sulfate	Single	Tablet	All died	Franklin et al., 1958
Dog, 1	6-14 kg	300 mg/kg	Ferrous sulfate		Tablet	Diarrhea, emesis[1] and gastrointestinal damage	D'Arcy and Howard, 1962
Cat, 2	Adult	5 mg/kg 10 mg/kg 20 mg/kg 40.2 mg/kg	$FeSO_4 7H_2 0$	10 d	Capsule	Occasional emesis[1] Occasional emesis[1] and diarrhea Frequent emesis[1] and diarrhea Frequent emesis[1] and diarrhea	Hoppe et al., 1955a
Cat	Adult	100 mg/kg	$FeSO_4 7H_2 0$	Single	Oral	LD_{50}[2]	Hoppe et al., 1955b
Rabbit, 5	1800 g	275 mg/kg 460 mg/kg	Ferrous sulfate	Single Single	Gavage	Hepatic Congestion Severe hemorrhagic necrosis of liver	Luongo and Bjornson, 1954 Luongo and Bjornson, 1954
Guinea Pig		300 mg/kg 300 mg/kg 200 mg/kg 350 mg/kg	$FeSO_4 7H_2 0$ Ferrous gluconate Ferric chloride Ferric ammonium citrate	Single		LD_{50}[2] LD_{50}[2] LD_{50}[2] LD_{50}[2]	Hoppe et al, 1955b Hoppe et al, 1955b Hoppe et al, 1955b Hoppe et al, 1955b

[1]vomiting
[2]50% of animals tested died
[3]a metabolic derangement of acid-base balance where the blood pH is abnormally low.

Magnesium Research							
Horse 1		0.028 g/kg[c]	$MgSO_4 7H_2O$		IV	Recumbent posture	Bowen et al., 1970
Dog, 8		0.028 g/kg[c]	$MgSO_4 7H_2O$		IV	Recumbent posture	Bowen et al., 1970

[c]values refer to milligrams per kilogram of body weight

Manganese Research							
Rabbit, 2	Young	2.3 mg/d[a]	Manganese Sulfate	500 d	Water[b]	Small decrease in growth; four-fold increase in hair Mn by 100d	Umarji et al., 1969
		24.4 mg/d				Weight loss by 180d with transient paralysis and continuing anesthesia in extremities; increased Mn in hair (10-fold) by 100 d, subsequently declined with weight loss.	Umarji et al., 1969
Guinea pig, 30	350 g	4.37 mg/kg	$MnCl_2$	30 d	Gavage	Six deaths; gastric mucosa; patchy necrosis[1]; decreased mucin and pepsinogen granules; activities for adenosine triphosphatase and glucose-6-phosphatase; intestinal mucosa; patchy necrosis[1]; decreased activities for adenosine triphosphatase and glucose-6-phosphatase; increased acid phosphatase.	

[a] Assumed MnSO4-H20
[b] drinking water
[1] death of cells or tissues through injury or disease, especially in a localized area of the body

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Phosphorus Research							
Horse	2 yr	1.2% (0.4% Ca)	NaH_2PO_4	56 d	Diet	Decreased calcium absorption, urinary excretion, and retention but increased fecal calcium excretion; more rapid turnover of bone calcium observed due to high dietary P	Schryver et al., 1971
Dog	Adult (12 kg)	0.3, 0.9 and 1.0% (0.3% Ca)		360 d	Diet	Supplementary P induced greater body retention of calcium; there was deposition of calcium in kidney, tendon, and heart; bone formation rates were not changed, but resorption was significantly increased resulting in greater bone porosity and less bone mass	Laflamme and Jowsey, 1972
Dog	Adult (10 kg)	1.2% (0.12% Ca)	K_2HPO_4 NaH_2PO_4 $CaHPO_4$	294 d	Diet	Incisor teeth were loose, and there was evidence of severe bone loss	Krook et al., 1971
Guinea Pig	1 wk 9150-175g)	0.5 and 0.9% (0.8% Ca)	$CaHPO_4$ $KH2PO_4$	150-600 d	Diet	90% of the guinea pigs that consumed the diet that contained 0.9% P and 0.8% Ca developed visible deposits of calcium phosphate; if the P was reduced to 0.5%, the incidence of the deposit was less that 10%; the animals on the high-P diet grew more slowly and the survival period was shortened	Hogan et al., 1950
Guinea Pig	200 g	0.7, 0.9, 1.2 and 1.7%	$CaHPO_4$ KH_2PO_4 NaH_2PO_4	84 d	Diet	Consumption of the high -P diets resulted in slow weight gain, stiff joints, calcium phosphate deposits, and high mortality rate; these signs were most severe on diets that contained 1.7% P and 0.9% Ca	House and Hogan, 1955
Potassium Research							
Dog		0.5-4.5 g/day			Diet	Potassium toxicosis[1] in adrenalectomized[2] dogs	Allers et al., 1936
Dog	9.6-25.0 kg	56-183 mg/kg	KCl	9-53 min	IV	Death when serum K reached 47 to 78 mg/dl	Winkler et al. 1939
[1]any disease of toxic origin [2]to excise one or both adrenal glands							
Selenium Research							
Horse, 2	5-12 yr	24 ppm (2 mo) 48 ppm (13 mo) 96 ppm (2 mo)	Na_2SeO_3	17 mo	Diet (drench for 4 mo)	Emaciation; listlessness; loose hair in mane and tail; softening and scaling of hoof wall; hemorrhagic and cirrhotic liver; death	Miller and Williams, 1940b
Horse, 1	Aged	115 ppm	Na_2SeO_3	5 wk	Diet	Emaciation[1]; listlessness; loose hair in mane and tail; softening and scaling of hoof wall; hemorrhagic and cirrhotic liver; death	
	503 kg	2.7 mg/kg	Na_2SeO_3	Single	Drench	Labored breathing; anorexia for about 1 d; normal thereafter (observed 24 d)	Miller and Williams, 1940a
	658 kg	4.4 mg/kg				Labored breathing; toxic spasms; death in 26 hr	
	651 kg	8.0 mg/kg				Hemorrhagic gastritis; fatty degeneration of liver; death in 18 h	
	440 kg	10.1 mg/kg				Cutaneous[2] muscle spasms; dilation of eyes; profuse sweating, labored breathing; death in 22 h	
	538 kg	12.1 mg/kg				Depressed; weak; trembling; garlic breath; death in 24 h	

Species and No. of Animals	Age or Weight	Administration Amount	Form	Duration	Route	Effect	Reference
Selenium Research Continued							
Dog, 1	60 d	7.2 ppm	Seleniferous corn	189 d	Diet	Decreased feed consumption and gain	Rhian and Moxon, 1943
Dog, 6	150 d	10 ppm	Na_2SeO_3	100-150 d		Decreased food consumption and weight	
Dog, 2	72 d	20 ppm	Seleniferous corn	150 d		Decreased feed consumption and gain	
Dog, 10	Young	20 ppm	Na_2SeO_3	Several Weeks	Diet	Decreased feed consumption and gain; dull-eyed; sluggish; wandered aimlessly	Moxon, 1937
Sodium Chloride Research							
Cat	1-4 group	4,460-8,500 mg/kg body weight			Intravenous	MLD[1]	Cutting et al., 1939
Guinea Pig		2,910 mg/kg body weight			Intravenous	LDL[2]	Amberg and Helmholx, 1915
Zinc Research							
Horse, 3	3-4 wk	25-186 mg/kg[f]	Zinc oxide	38 wk	Diet	Swelling at epiphyseal[1] region of long bones; reduced growth; anemia; increased tissue Zn	Willoughby et al., 1972
Dog, 2	6.5-9.0 kg	400 mg/d	ZnO	3-19 wk	Diet	No adverse effect	Drinker et al., 1927
Dog, 1	9.9 kg	800 mg/d		15 wk		Increased tissue Zn	
Cat, 1	3.1 kg	140-283 mg/d		53 wk		No adverse effects	
Cat, 3	2.9-3.8 kg	252-800 mg/d		16-21 wk		Loss of appetite; fibrous changes in pancreas; increased tissue Zn	
Cat, 15	3.5 kg	400 mg/d[g] 200 mg/d 320 mg/d 240 mg/d	Zinc	Few days 4 wk Few days 12-16 wk	Diet	Refusal to eat or vomiting No adverse effects Refusal to eat or vomiting Weight loss; decreased pancreas weight; fibrotic changes in pancreas; increased liver and pancreas Zn	Scott and Fisher, 1938
Cat, 5	1.7-5.1 kg	16-69 mg/kg	Oysters	24 h	1 meal	No adverse effects	Mannell, 1967

[1]Excessive leanness; a wasted condition of the body.
[2]pertaining to the skin

[1]Minimal lethal dose

[1]expanded articular end of a long bone
[f]the zinc intake was gradually increased between 9 and 20 weeks of the experiment
[g]a single group of 15 cats was fed the four levels of zinc in the sequence shown