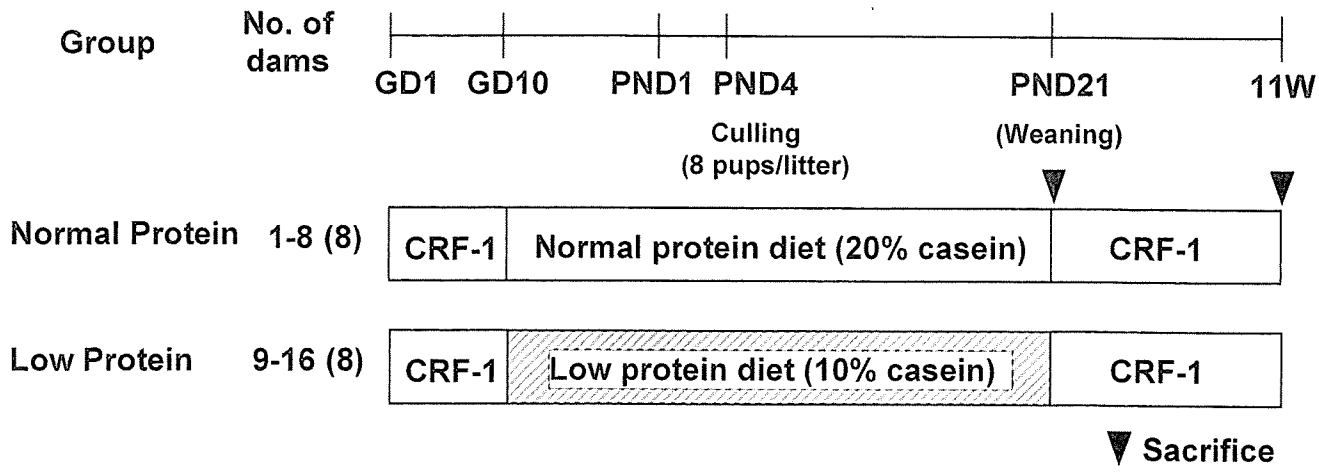


Fig. 1.
Maternal protein restriction study using synthetic low protein diet in SD:IGS rats to examine the effect on neuronal development.

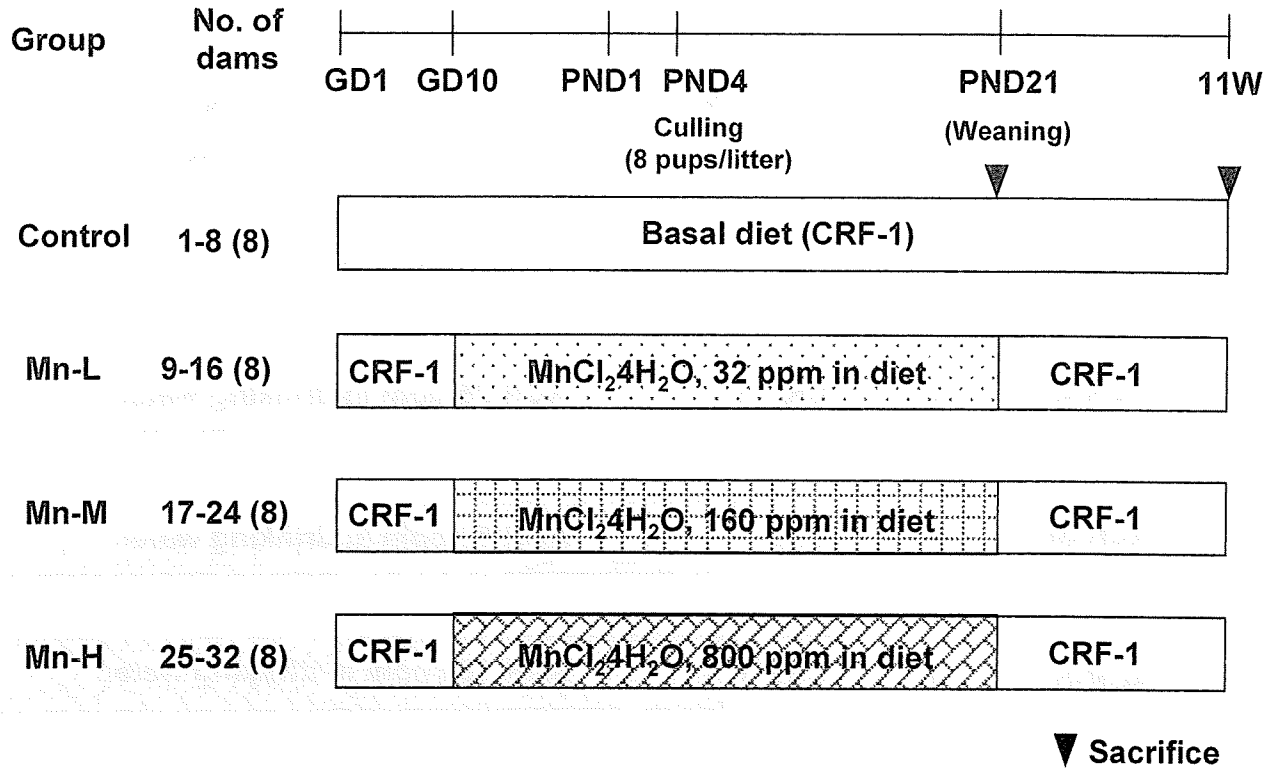


Fig. 2.
Developmental exposure study of $MnCl_2 \cdot 4H_2O$ in SD:IGS rats to examine the effect on neuronal development.

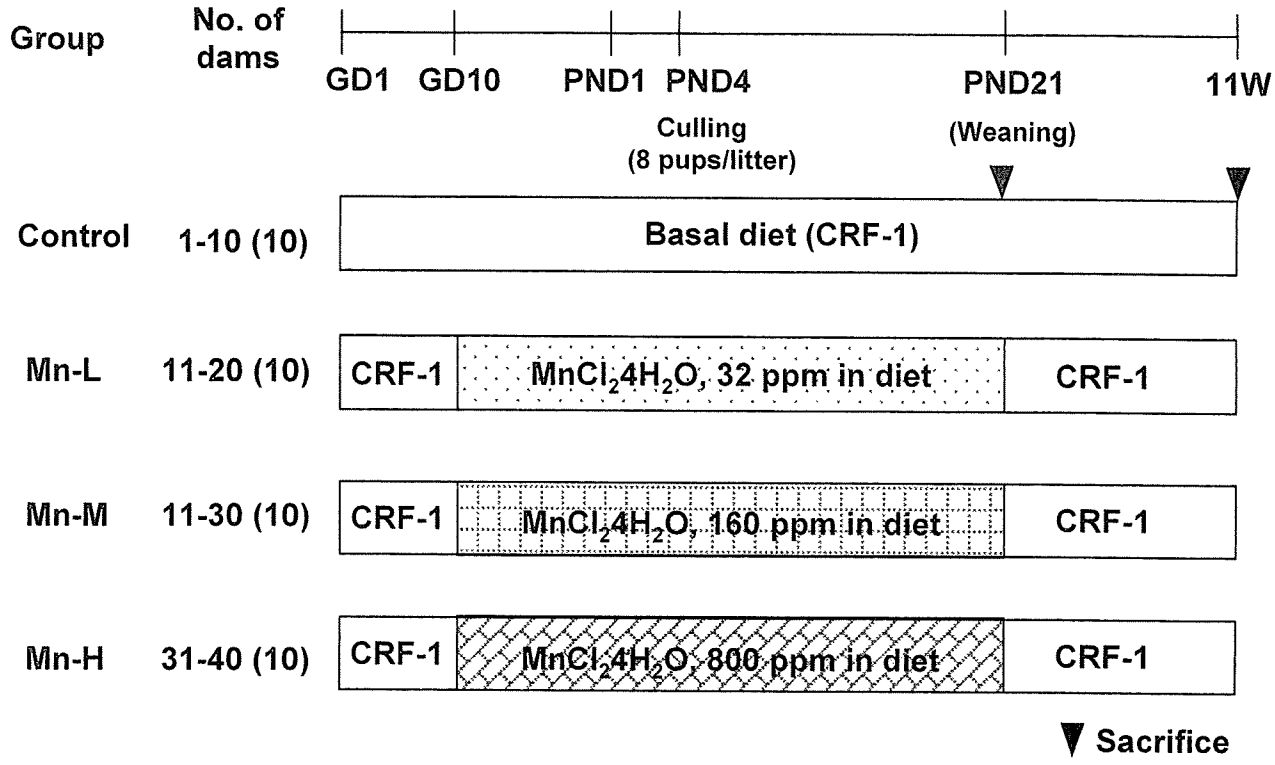


Fig. 3.
Developmental exposure study of $MnCl_2 \cdot 4H_2O$ in ICR mice to examine the effect on neuronal development.

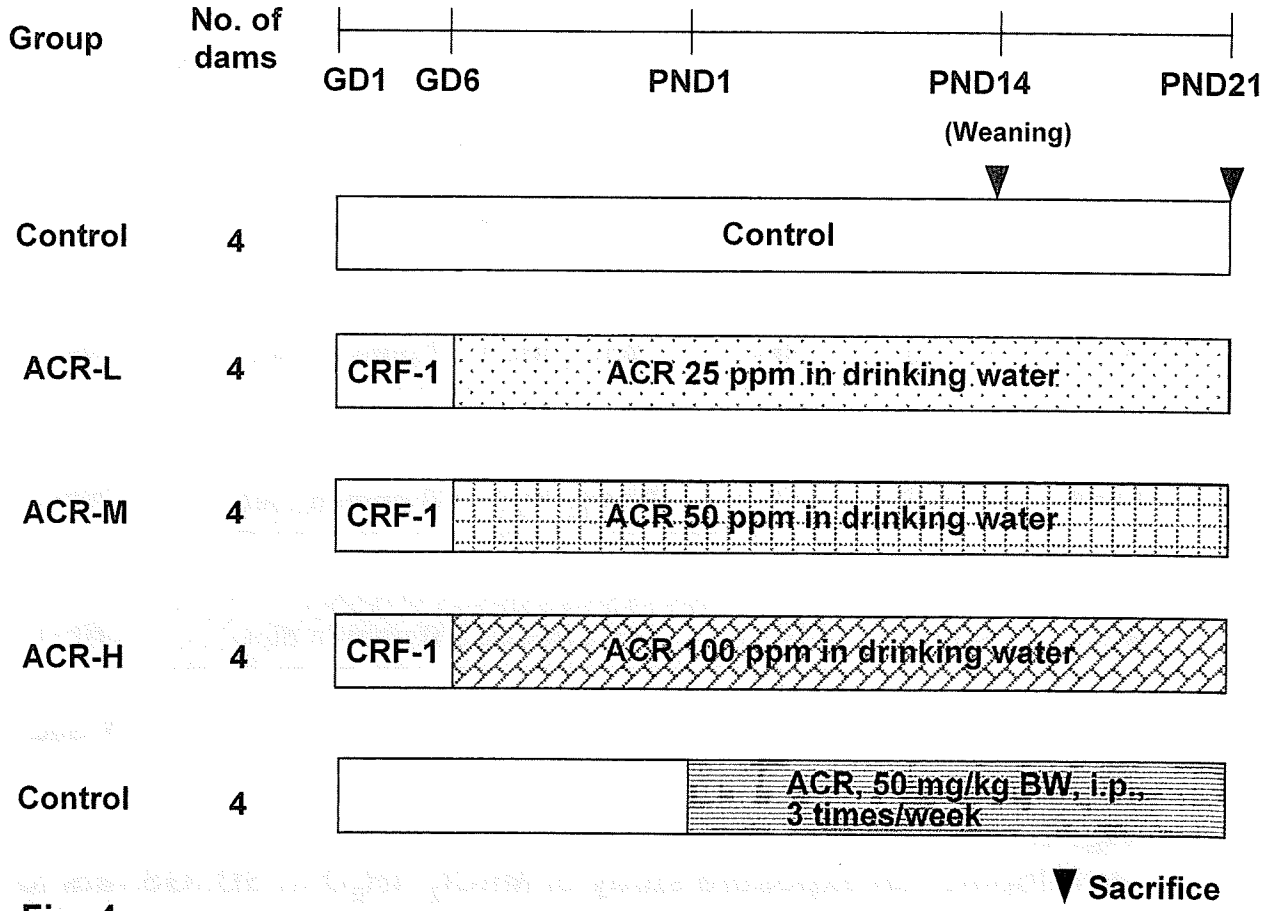


Fig. 4.
Developmental exposure study of acrylamide in SD:IGS rats to examine the effect on neuronal development.

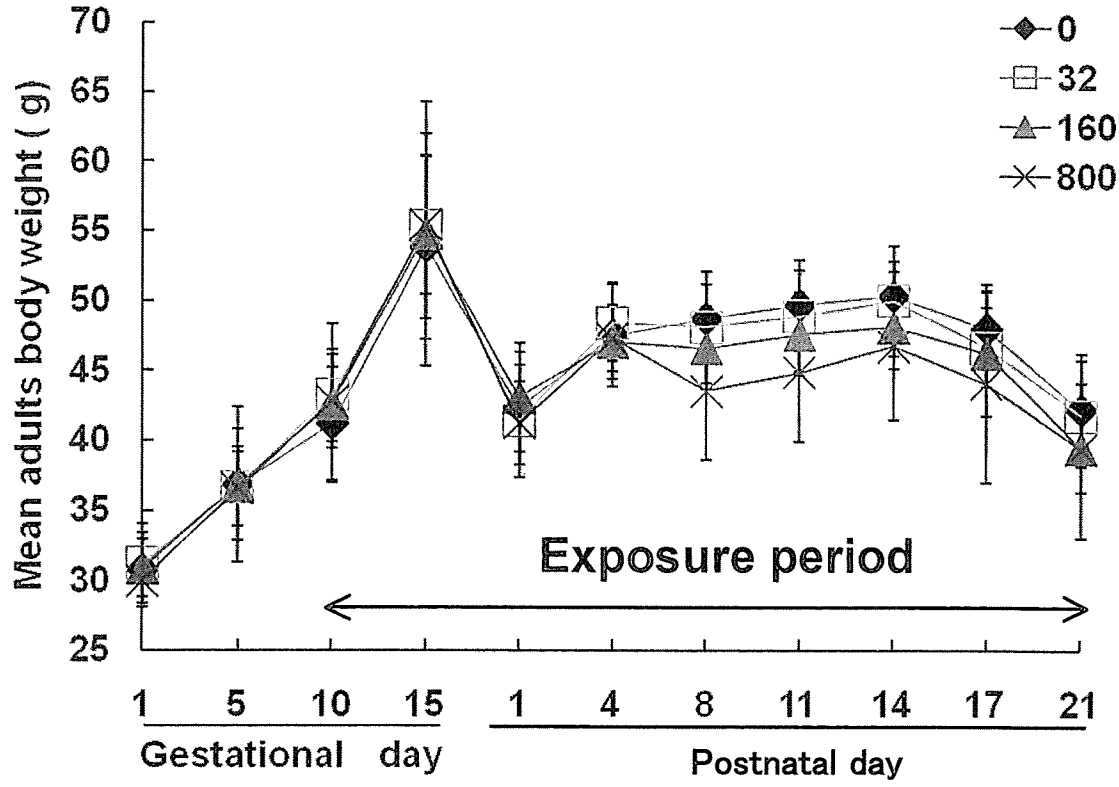


Fig. 5. Body weight of dams exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in ICR mice.

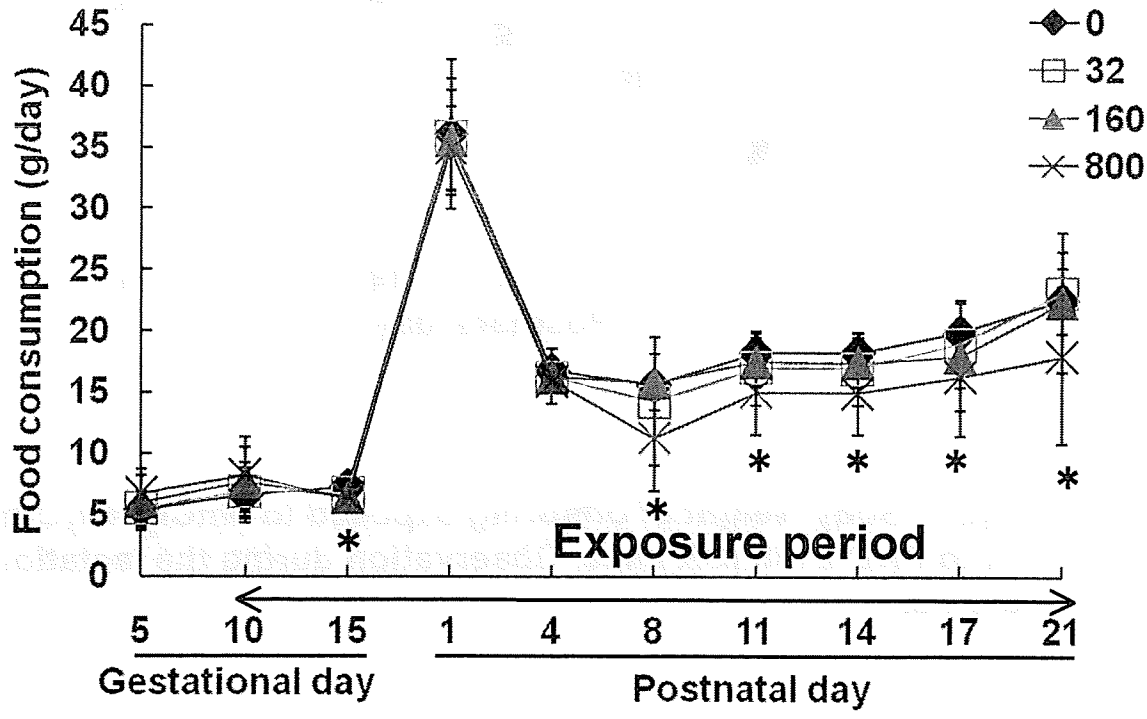
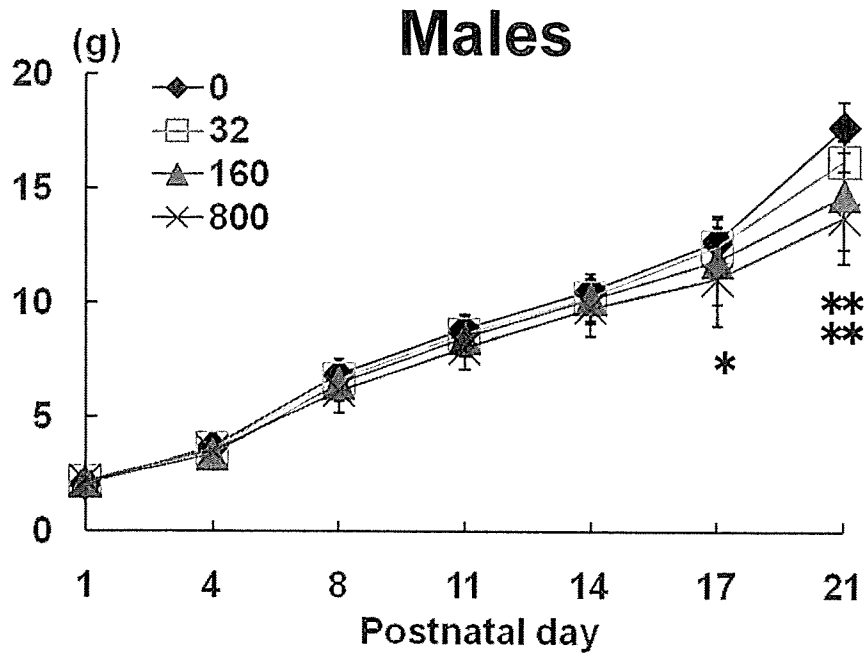


Fig. 6. Food consumption of dams exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in ICR mice.



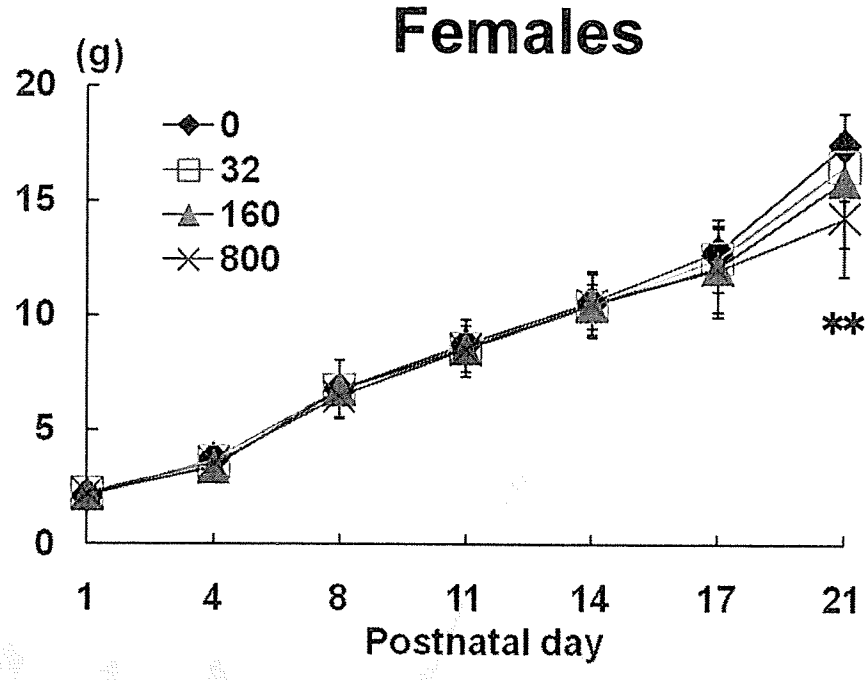


Fig. 7. Body weight of offspring exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in ICR mice. Observation during the lactation period.

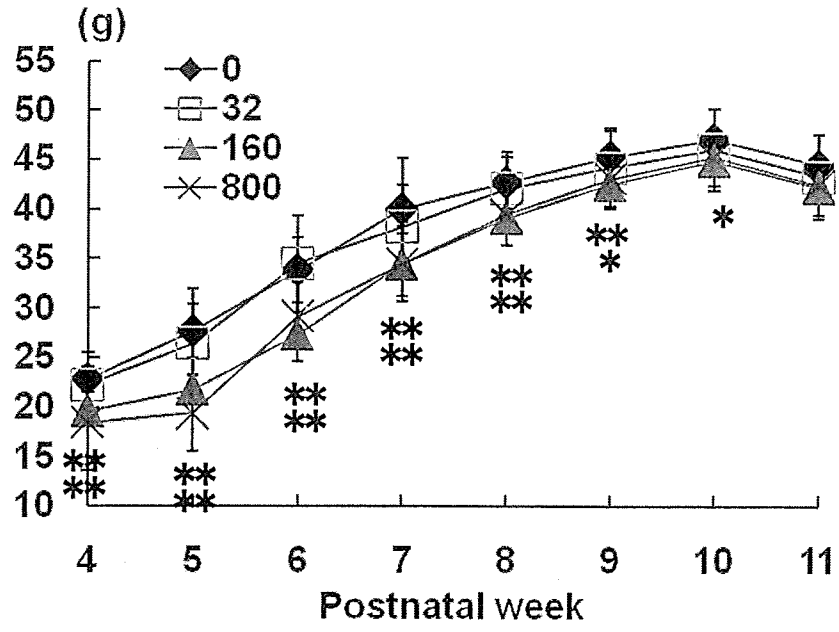


Fig. 8. Body weight of male offspring exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in ICR mice. Observation after the lactation period.

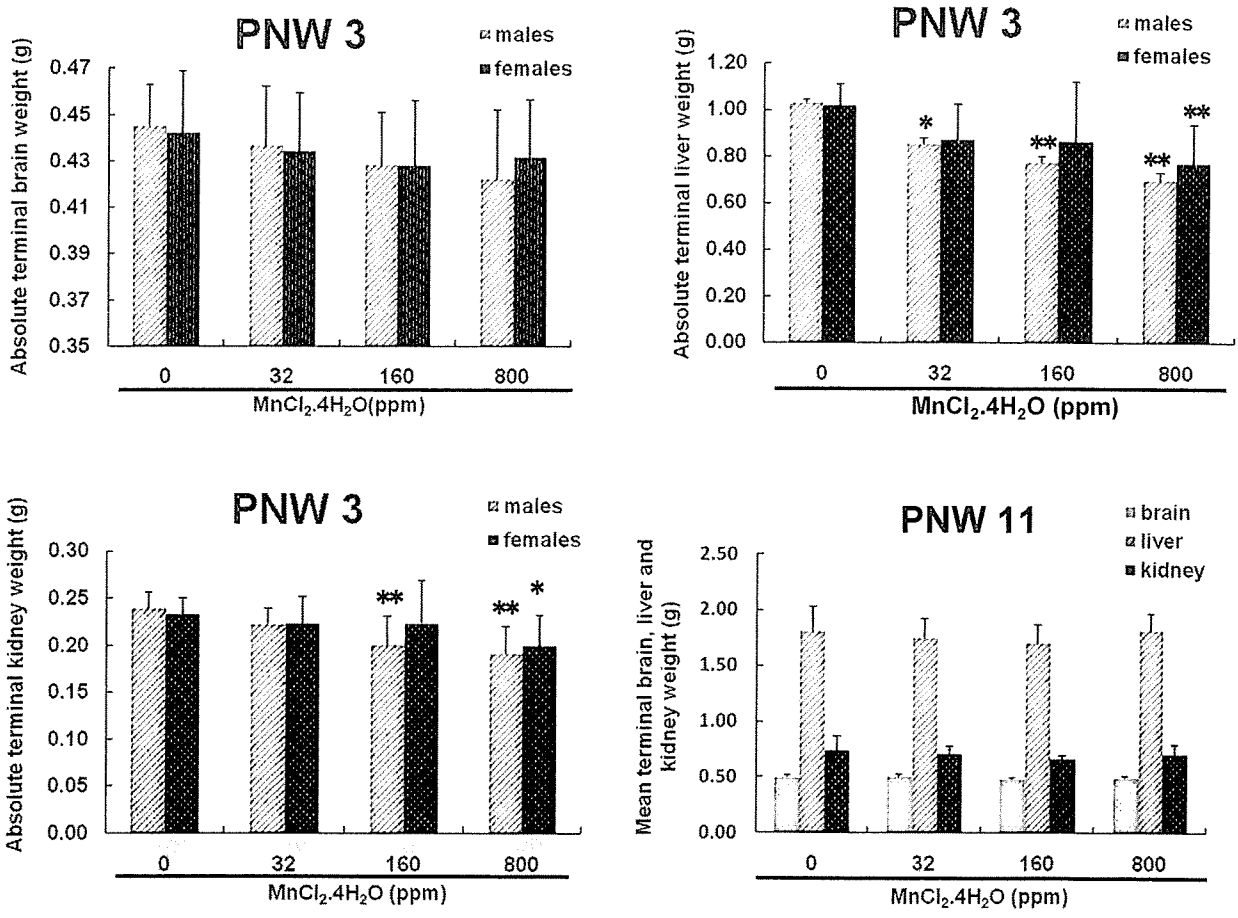


Fig. 9. Organ weights of male offspring exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in ICR mice. Observation at PND 21 and PNW 11.

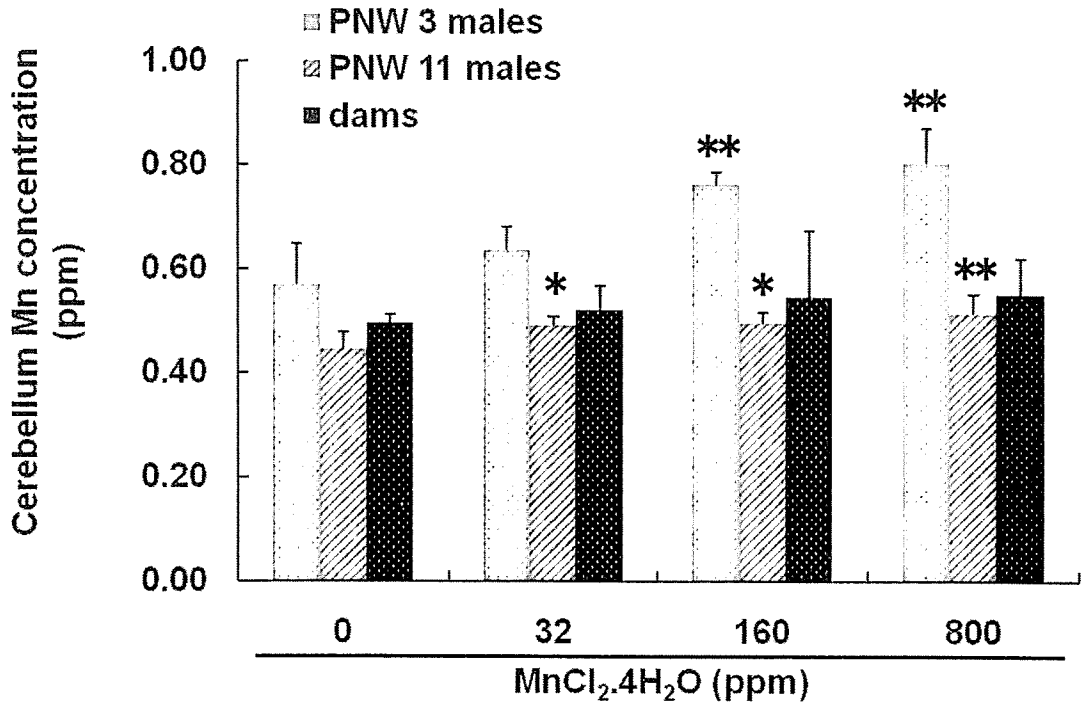


Fig. 10. Manganese concentrations in the cerebellum of male offspring and dams exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

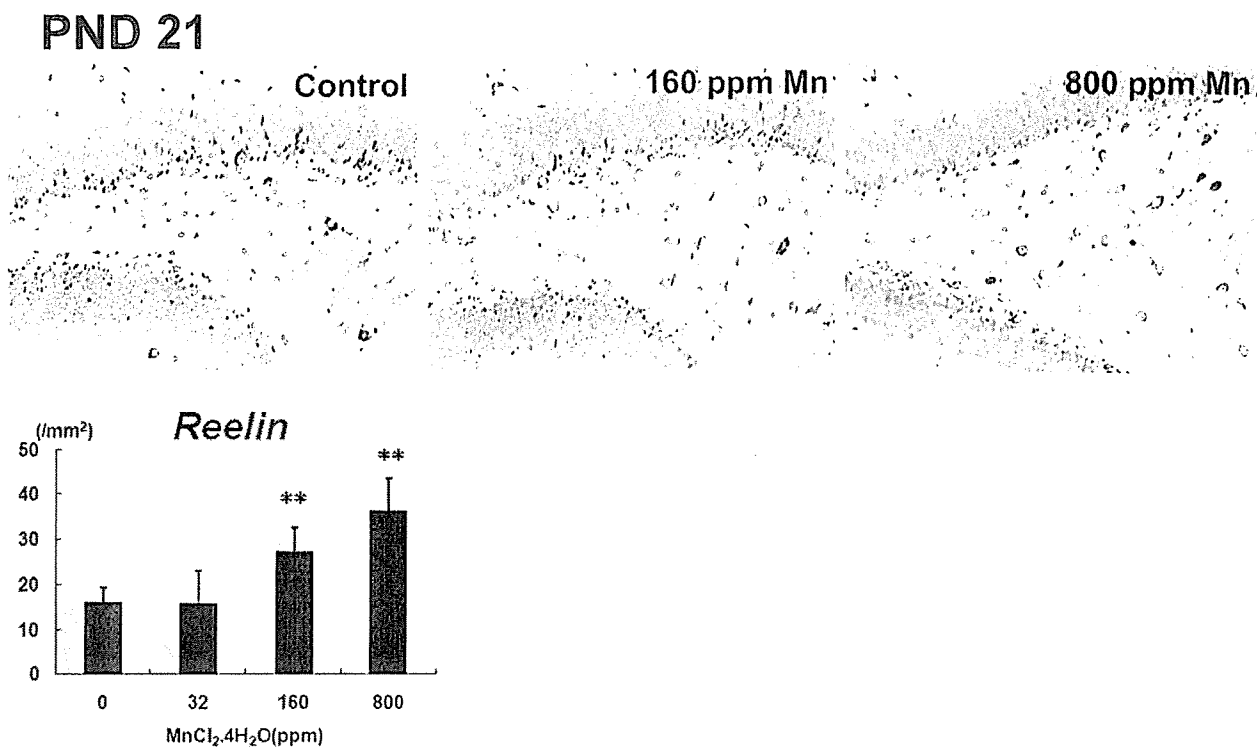


Fig. 11. Distribution of Reelin-immunoreactive cells in the hilus of the hippocampal dentate gyrus in male offspring at PND 21 and PNW 11 after maternal exposure to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

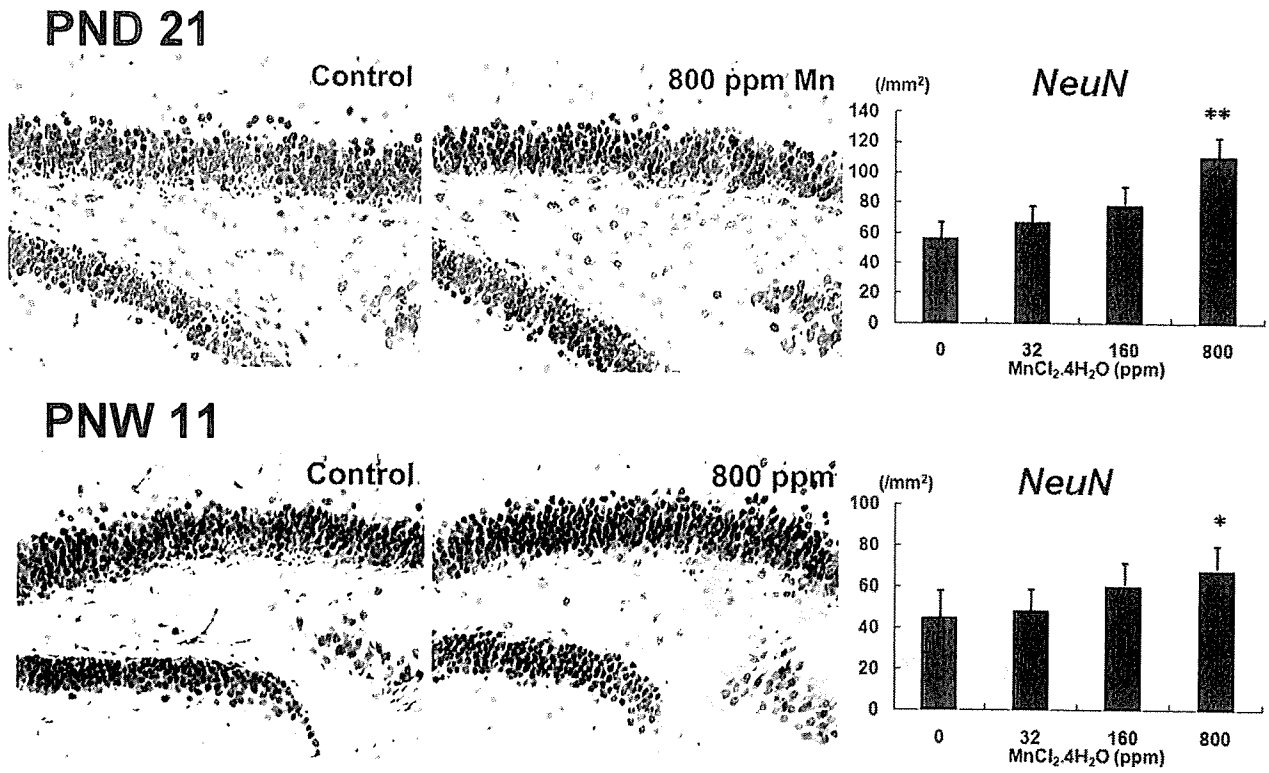


Fig. 12. Distribution of NeuN-immunoreactive cells in the hilus of the hippocampal dentate gyrus in male offspring at PND 21 and PNW 11 after maternal exposure to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

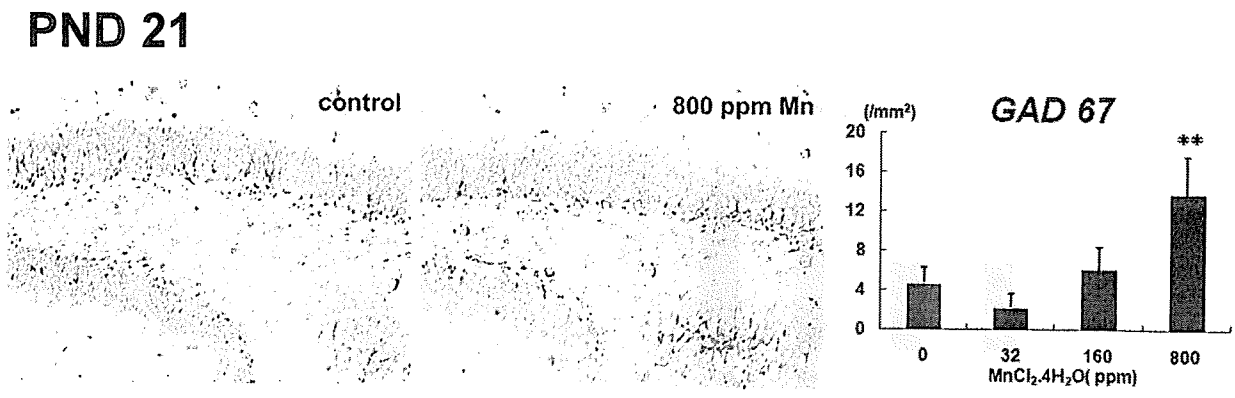


Fig. 13. Distribution of GAD67-immunoreactive cells in the hilus of the hippocampal dentate gyrus in male offspring at PND 21 after maternal exposure to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

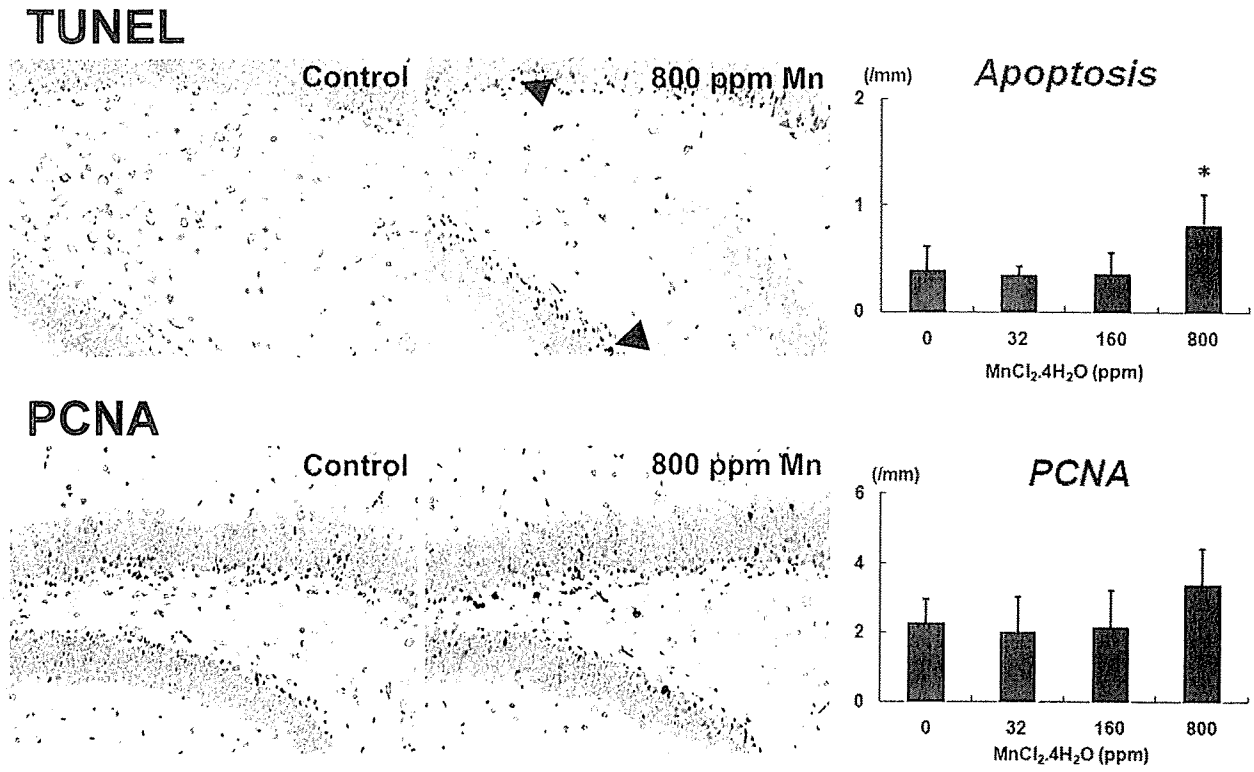


Fig. 14. Distribution of apoptotic cells and proliferating cells in the dentate subgranular zone of male offspring at PND 21 after maternal exposure to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

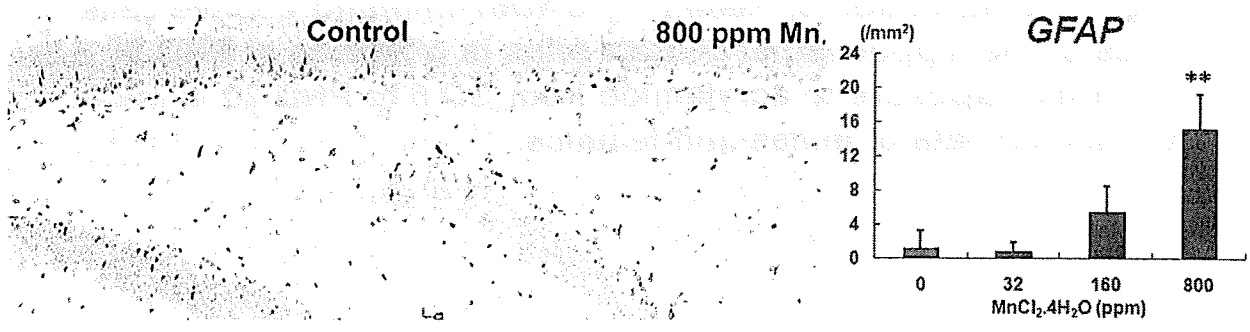


Fig. 15. Distribution of GFAP-positive cells in the hippocampal dentate hilus of male offspring at PND 21 after maternal exposure to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in mice.

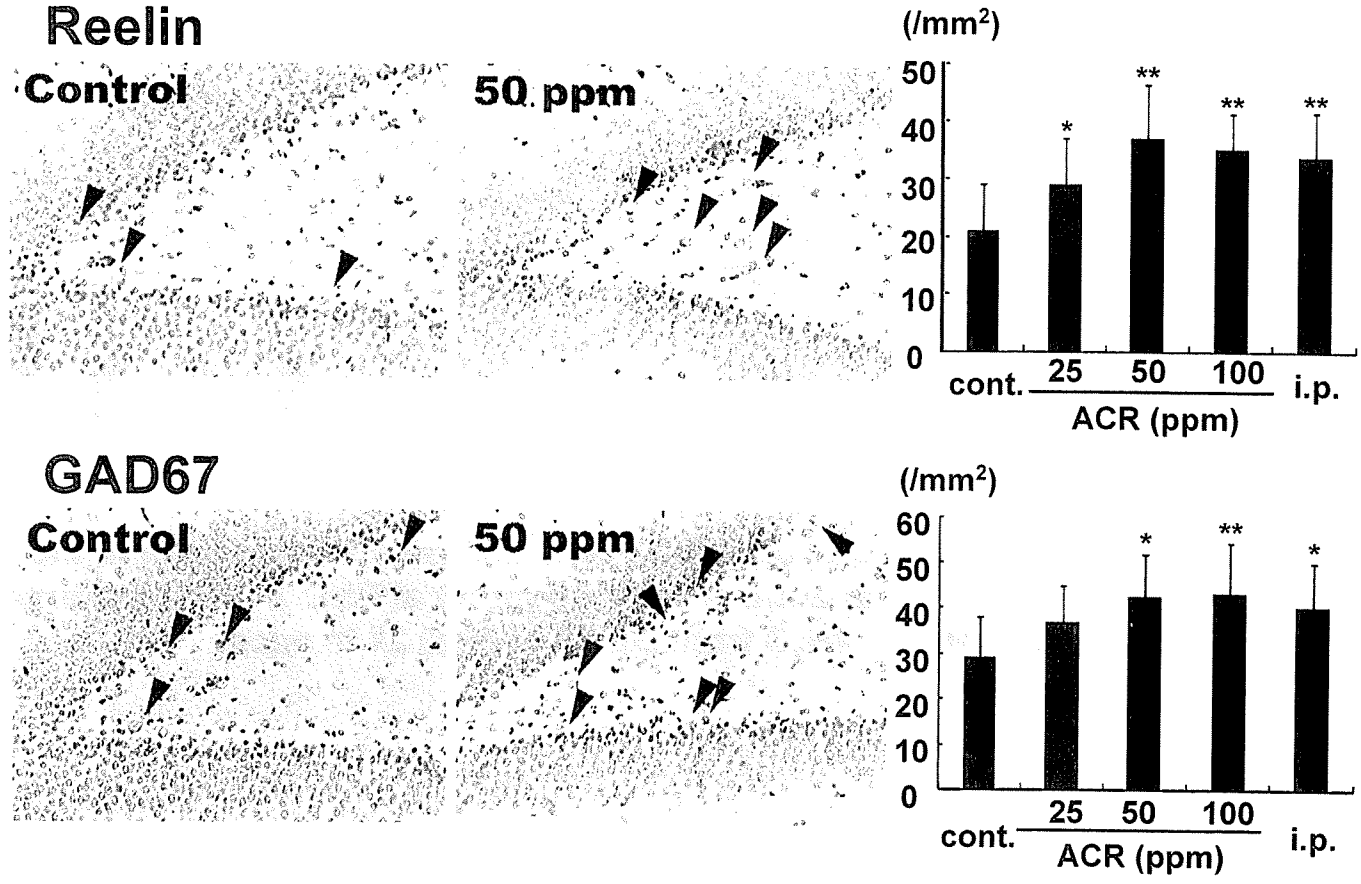


Fig. 16. Distribution of Reelin- or GAD67-immunoreactive cells in the hilus of the hippocampal dentate hilus in offspring at PND 20 after maternal exposure to acrylamide from GD 6 to PND 20 in mice. Combined data of males and females.

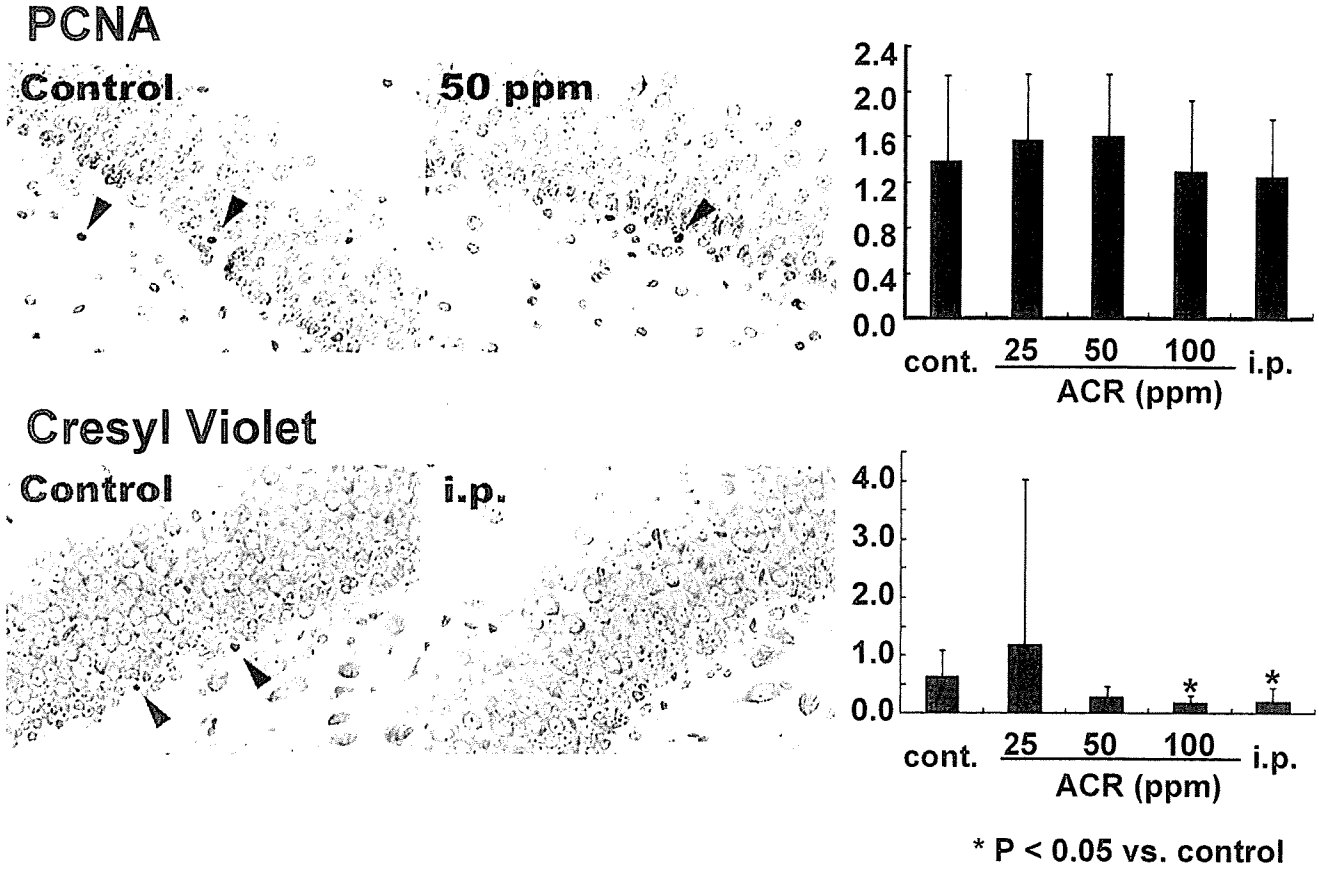


Fig. 17. Distribution of proliferating cells and apoptotic cells in the dentate subgranular zone of offspring at PND 20 after maternal exposure to acrylamide from GD 6 to PND 20 in mice. Combined data of males and females.

Table 1. Body weights of dams fed either a normal or low protein diet from GD 10 to PND 21 in rats.

	Normal protein	Low protein
Casein level	20%	10%
No. of dams examined	8	8
Body weight (g)		
GD 10	287.4 ± 16.1 [a]	293.1 ± 23.5
GD 11	297.8 ± 16.4	299.5 ± 20.0
GD 12	303.8 ± 17.2	304.0 ± 20.9
GD 13	309.8 ± 18.9	308.5 ± 21.8
GD 14	317.4 ± 17.9	318.8 ± 22.5
GD 15	323.4 ± 18.0	324.0 ± 21.7
GD 16	335.1 ± 17.2	336.5 ± 22.4
GD 17	348.3 ± 18.6	348.1 ± 22.6
GD 18	362.0 ± 19.1	360.9 ± 24.6
GD 19	378.0 ± 19.7	374.5 ± 26.8
GD 20	393.3 ± 21.0	384.3 ± 26.8
PND 0	318.0 ± 27.9	309.5 ± 19.7
PND 4	317.3 ± 22.4	297.6 ± 28.2
PND 7	330.1 ± 20.9	303.8 ± 29.5
PND 11	333.1 ± 16.0	294.8 ± 33.1*
PND 14	327.1 ± 22.5	290.3 ± 36.6*
PND 17	322.5 ± 22.3	283.6 ± 35.7*
PND 21	307.4 ± 18.3	266.5 ± 38.4*

[a] Mean±SD.

* Significantly different from the normal protein group (*P<0.05).

Abbreviations: GD, gestation day; PND, postnatal day.

Table 2. Food consumption of dams fed either a normal or low protein diet from GD 10 to PND 21 in rats.

	Normal protein	Low protein
Casein level	20%	10%
No. of dams examined	8	8
Food consumption (g/animal/day)		
GD 9-10	24.8 ± 1.8 [a]	26.4 ± 3.0
GD 10-14	30.3 ± 3.5	31.1 ± 1.6
GD 14-17	28.6 ± 2.6	29.5 ± 1.9
GD 17-20	24.8 ± 3.7	23.5 ± 2.7
PND 0-4	32.9 ± 3.7	28.5 ± 4.6
PND 4-7	37.8 ± 3.1	34.1 ± 2.6*
PND 7-11	44.6 ± 2.7	35.8 ± 3.7**
PND 11-14	51.1 ± 2.6	39.0 ± 5.0**
PND 14-17	50.8 ± 4.6	39.8 ± 5.3**
PND 17-21	56.6 ± 5.4	42.0 ± 3.1**
Food consumption (g/kg body weight/day)		
GD 9-10	86.2 ± 5.1	89.9 ± 4.9
GD 10-14	95.2 ± 8.0	97.8 ± 3.8
GD 14-17	82.2 ± 6.2	85.0 ± 6.3
GD 17-20	62.8 ± 7.3	61.2 ± 6.3
PND 0-4	104.3 ± 15.8	96.1 ± 14.8
PND 4-7	114.8 ± 11.9	112.7 ± 6.7
PND 7-11	134.3 ± 11.6	121.6 ± 8.8*
PND 11-14	157.2 ± 16.9	129.5 ± 11.2**
PND 14-17	158.0 ± 18.2	140.2 ± 7.6*
PND 17-21	185.2 ± 24.7	159.4 ± 17.7*

[a] Mean±SD.

*·** Significantly different from the normal protein group (*P<0.05, **P<0.01).

Abbreviations: GD, gestation day; PND, postnatal day.

Table 3. Body weight of offspring after maternal protein restriction during the period from GD 10 to PND 21 in rats.

	Males		Females	
	Normal protein	Low protein	Normal protein	Low protein
Casein level	20%	10%	20%	10%
No. of offspring examined	16	16	16	16
Body weight (g)				
PND 0	6.7 ± 0.6 [a]	6.3 ± 0.4**	6.2 ± 0.4	5.9 ± 0.5*
PND 4	10.9 ± 1.4	9.0 ± 1.1**	10.3 ± 1.5	8.5 ± 1.0**
PND 7	17.6 ± 2.3	13.7 ± 1.9**	16.4 ± 2.6	12.4 ± 1.8**
PND 11	29.0 ± 3.6	21.4 ± 1.6**	27.0 ± 3.7	19.2 ± 2.3**
PND 14	38.4 ± 4.4	26.6 ± 1.5**	36.1 ± 3.9	24.5 ± 2.3**
PND 17	46.5 ± 5.5	31.6 ± 1.9**	43.9 ± 4.5	29.2 ± 2.5**
PND 21	61.4 ± 7.0	40.4 ± 2.4**	58.0 ± 6.1	38.0 ± 3.6**
PNW 4	102.8 ± 10.9	75.4 ± 4.7**	90.1 ± 9.6	70.8 ± 4.1**
PNW 5	174.5 ± 16.3	136.5 ± 8.1**	142.3 ± 12.3	121.4 ± 6.6**
PNW 6	253.0 ± 19.6	203.1 ± 9.6**	181.3 ± 12.4	160.6 ± 8.4**
PNW 7	322.8 ± 21.7	263.2 ± 13.6**	206.2 ± 13.6	187.5 ± 12.1**
PNW 8	382.8 ± 22.1	318.6 ± 15.0**	228.7 ± 14.4	207.2 ± 15.1**
PNW 9	429.4 ± 25.9	358.9 ± 20.5**	255.4 ± 19.1	231.1 ± 18.8**
PNW 10	474.5 ± 28.0	398.3 ± 23.1**	276.8 ± 23.3	247.4 ± 20.4*
PNW 11	508.3 ± 30.6	427.0 ± 26.9**	285.3 ± 22.5	254.9 ± 22.6*

[a] Mean±SD.

*, ** Significantly different from the normal protein group (*P<0.05, **P<0.01).

Abbreviations: PND, postnatal day; PNW, postnatal week.

Table 4. Food consumption of offspring after maternal protein restriction during the period from GD 10 to PND 21 in rats.

	Males		Females	
	Normal protein	Low protein	Normal protein	Low protein
Casein level	20%	10%	20%	10%
No. of offspring examined	16	16	16	16
Food consumption (g/animal/day)				
PNW 5	19.6±1.7	17.1 ± 0.7**	16.6 ± 1.7	15.5 ± 0.9
PNW 6	27.3±2.0	23.4 ± 1.2**	19.9 ± 1.6	19.1 ± 1.1
PNW 7	30.4±2.2	25.9 ± 1.4**	20.2 ± 1.2	19.0 ± 1.2
PNW 8	32.3±1.9	28.0 ± 1.6**	20.6 ± 1.3	19.1 ± 1.4*
PNW 9	31.6±2.0	27.9 ± 1.8**	20.9 ± 1.5	19.2 ± 1.4*
PNW 10	32.1±2.1	27.9 ± 2.0**	22.2 ± 1.9	20.3 ± 1.3*
PNW 11	31.3±2.1	27.4 ± 2.4**	20.7 ± 1.9	18.9 ± 1.5*
Food consumption (g/kg body weight/day)				
PNW 5	141.7±5.1	161.4 ± 9.0**	143.1 ± 8.3	161.1 ± 6.4**
PNW 6	127.6±3.4	137.8 ± 5.7**	122.9 ± 7.8	135.0 ± 4.7**
PNW 7	105.8±5.2	111.0 ± 4.0**	104.3 ± 6.6	109.1 ± 4.3*
PNW 8	91.5±4.6	96.3 ± 4.6**	94.6 ± 4.7	96.6 ± 3.4
PNW 9	77.9±3.9	82.3 ± 4.1**	86.5 ± 3.9	87.7 ± 5.4
PNW 10	71.1±4.0	73.6 ± 3.7	83.3 ± 4.6	84.8 ± 3.2
PNW 11	63.8±3.2	66.3 ± 3.5*	73.6 ± 4.0	75.3 ± 3.9

[a] Mean±SD.

*, ** Significantly different from the normal protein group (*P<0.05, **P<0.01).

Abbreviations: PND, postnatal day; PNW, postnatal week.

Table 5. Organ weights of offspring after maternal protein restriction during the period from GD 10 to PND 21 in rats.

		Males		Females	
		Normal protein	Low protein	Normal protein	Low protein
	Casein level	20%	10%	20%	10%
PND 21					
No. of offspring examined		10	10	10	10
Brain	(g)	1.55 ± 0.06[a]	1.44 ± 0.04**	1.45 ± 0.05	1.33 ± 0.09**
	(g/100g BW)	2.42 ± 0.23	3.68 ± 0.36**	2.53 ± 0.20	4.17 ± 0.80**
Liver	(g)	2.51 ± 0.38	1.64 ± 0.31**	2.39 ± 0.25	1.37 ± 0.41**
	(g/100g BW)	3.87 ± 0.24	4.16 ± 0.35*	4.14 ± 0.21	4.04 ± 0.41
PNW 11					
No. of offspring examined		10	10	10	10
Brain	(g)	2.06 ± 0.06	2.03 ± 0.08	1.90 ± 0.06	1.86 ± 0.08
	(g/100g BW)	0.41 ± 0.02	0.48 ± 0.04**	0.67 ± 0.08	0.73 ± 0.06
Liver	(g)	18.85 ± 2.70	15.33 ± 1.90**	10.06 ± 1.83	9.27 ± 1.45
	(g/100g BW)	3.75 ± 0.31	3.60 ± 0.19	3.47 ± 0.20	3.63 ± 0.24
Kidneys	(g)	3.21 ± 0.47	2.86 ± 0.24*	2.07 ± 0.27	1.85 ± 0.14*
	(g/100g BW)	0.64 ± 0.07	0.67 ± 0.05	0.72 ± 0.06	0.73 ± 0.05
Testes	(g)	3.62 ± 0.30	3.20 ± 0.47*	-	-
	(g/100g BW)	0.72 ± 0.05	0.75 ± 0.09	-	-
Ovaries	(mg)	-	-	95.7 ± 17.5	85.3 ± 14.8
	(mg/100g BW)	-	-	33.3 ± 4.6	33.7 ± 6.0

[a] Mean±SD.
- Not applicable.
*,** Significantly different from the normal protein group (*P<0.05, **P<0.01).
Abbreviations: BW, body weight; PND, postnatal day; PNW, postnatal week.

Table 6. Distribution of immunoreactive cells for Reelin, NeuN, Calb-D-28K, GAD67 and FoxG1 in the in the hilus of the hippocampal dentate gyrus in male rat offspring at PND 21 after maternal protein restriction from GD 10 to PND 21.

	Normal protein	Low protein
Casein level	20%	10%
No. of dams examined	10	10
Reelin (+) cell count (/mm^2)	72.2 ± 16.4[a]	77.9 ± 19.4
NeuN (+) cell count (/mm^2)	250.3 ± 46.8	272.4 ± 72.2
Calb-D-28K (+) cell count (/mm^2)	362.7 ± 53.6	392.7 ± 44.9
GAD67 (+) cell count (/mm^2)	36.7 ± 13.6	36.7 ± 13.2
FoxG1 (+) cell count (/mm^2)	337.4 ± 31.0	375.9 ± 56.5

[a] Mean±SD.

Table 7. Distribution of immunoreactive cells for Reelin, NeuN, Calb-D-28K, GAD67 and FoxG1 in the in the hilus of the hippocampal dentate gyrus in male rat offspring at PNW 11 after maternal protein restriction from GD 10 to PND 21.

	Normal protein	Low protein
Casein level	20%	10%
No. of dams examined	10	10
Reelin (+) cell count (/mm^2)	37.6 ± 10.2[a]	39.2 ± 12.6
NeuN (+) cell count (/mm^2)	148.4 ± 19.3	140.1 ± 26.6
Calb-D-28K (+) cell count (/mm^2)	266.1 ± 30.2	227.3 ± 57.8
GAD67 (+) cell count (/mm^2)	22.8 ± 12.3	20.1 ± 12.0
FoxG1 (+) cell count (/mm^2)	227.6 ± 27.4	207.1 ± 27.1

[a] Mean±SD.

Table 8. Distribution of apoptotic cells and proliferating cells in the dentate subgranular zone of male rat offspring at both PND 21 and PNW 11 after maternal protein restriction from GD 10 to PND 21.

	Normal protein	Low protein
Casein level	20%	10%
PND 21		
No. of dams examined	10	10
PCNA (+) cell count (/mm)	2.33 ± 1.08 [a]	2.39 ± 0.99
Apoptotic cell count (/mm)	0.091 ± 0.202	0.140 ± 0.299
PNW 11 No. of dams examined	10	10
PCNA (+) cell count (/mm)	1.25 ± 0.95	1.19 ± 0.60
Apoptotic cell count (/mm)	0.034 ± 0.107	0.000 ± 0.000

[a] Mean±SD.

Table 9. Histopathological examination of the cerebellum of male rat offspring at PND 21 after maternal protein restriction from GD 10 to PND 21.

	Normal protein	Low protein
Casein level	20%	10%
No. of offspring examined	10	10
Cerebellum		
Increase of external granular cells (±/+) [a]	1(1/0)	5(3/2) *

[a] Grade of change: (±), minimal, (+), slight.
* Significantly different from the normal protein group by Mann-Whitney's *U*-test (*P<0.05).

Table 10. Body weight of dams exposed to $MnCl_2 \cdot 4H_2O$ from day 10 of pregnancy to day 21 after delivery in rats.

		$MnCl_2 \cdot 4H_2O$ in diet		
	Control	32 ppm	160 ppm	800 ppm
No. of dams examined	8	8	8	8
Body weight (g)				
GD 10	287.5 ± 22.2 [a]	284.4 ± 23.1	277.0 ± 17.4	276.9 ± 24.6
GD 11	301.1 ± 26.6	296.0 ± 23.6	292.9 ± 20.6	294.0 ± 23.9
GD 12	309.4 ± 25.7	304.4 ± 24.9	301.4 ± 20.9	303.5 ± 25.2
GD 13	313.0 ± 26.6	308.4 ± 23.7	306.3 ± 20.5	309.3 ± 23.2
GD 14	321.5 ± 25.5	316.1 ± 23.2	312.1 ± 22.1	316.0 ± 23.9
GD 15	328.5 ± 27.3	323.6 ± 23.2	320.0 ± 21.2	325.9 ± 24.1
GD 16	340.5 ± 28.2	335.5 ± 24.6	331.1 ± 22.8	337.4 ± 23.9
GD 17	352.0 ± 27.8	349.4 ± 24.7	343.6 ± 22.7	349.0 ± 25.6
GD 18	362.5 ± 27.7	359.3 ± 26.0	356.4 ± 22.3	359.8 ± 26.9
GD 19	378.3 ± 27.0	375.3 ± 26.6	370.4 ± 27.2	377.8 ± 28.2
GD 20	398.4 ± 31.7	394.1 ± 27.6	390.9 ± 25.3	394.9 ± 28.9
PND 0	314.9 ± 22.3	309.0 ± 33.3	310.4 ± 21.1	312.9 ± 24.3
PND 4	338.8 ± 21.1	331.0 ± 25.3	334.1 ± 23.7	333.9 ± 21.3
PND 7	339.9 ± 18.4	329.9 ± 24.6	335.3 ± 21.9	336.9 ± 18.5
PND 11	334.9 ± 19.8	334.8 ± 23.9	343.9 ± 24.5	329.6 ± 14.5
PND 14	343.4 ± 14.4	331.1 ± 17.6	337.0 ± 19.9	332.0 ± 18.5
PND 17	326.5 ± 13.3	324.4 ± 21.9	328.3 ± 17.7	326.8 ± 19.1
PND 21	323.3 ± 21.1	314.9 ± 15.1	316.8 ± 21.6	318.3 ± 14.1

[a] Mean±SD.
Abbreviations: GD, gestation day; PND, postnatal day.

Table 11. Food consumption of dams exposed to $MnCl_2 \cdot 4H_2O$ from day 10 of pregnancy to day 21 after delivery in rats.

	$MnCl_2 \cdot 4H_2O$ in diet			
	Control	32 ppm	160 ppm	800 ppm
No. of dams examined	8	8	8	8
Food consumption (g/animal/day)				
GD 10	21.5±3.0 [a]	22.0 ± 2.7	16.6 ± 5.9	15.8 ± 9.1
GD 14	24.1±2.4	24.4 ± 2.1	24.0 ± 2.0	24.0 ± 2.0
GD 17	24.5±1.8	24.5 ± 1.8	24.1 ± 2.1	24.4 ± 1.7
GD 20	24.4±2.1	24.1 ± 2.2	25.0 ± 1.6	24.4 ± 1.8
PND 4	34.9±2.9	36.5 ± 3.1	36.6 ± 5.3	37.1 ± 3.2
PND 7	40.9±2.0	40.3 ± 2.8	42.4 ± 2.9	42.4 ± 2.8
PND 11	45.1±3.8	47.5 ± 3.3	50.3 ± 3.8*	49.6 ± 3.4*
PND 14	52.6±2.8	50.3 ± 3.0	51.6 ± 3.1	56.4 ± 3.5
PND 17	51.1±2.9	51.5 ± 3.0	55.5 ± 4.0	54.5 ± 4.8
PND 21	66.0±3.2	66.1 ± 3.1	68.0 ± 4.3	70.1 ± 4.5
Food consumption (g/kg body weight/day)				
GD 10	74.7±8.4	77.5 ± 8.0	60.6 ± 22.2	55.2 ± 31.4
GD 14	75.0±3.7	77.2 ± 4.4	76.9 ± 3.4	76.0 ± 4.3
GD 17	69.7±3.5	70.2 ± 2.8	70.2 ± 3.3	70.0 ± 5.5
GD 20	61.3±3.6	61.2 ± 2.7	64.0 ± 3.0	62.4 ± 4.7
PND 4	103.3±11.0	110.7 ± 11.7	109.6 ± 13.8	111.5 ± 11.6
PND 7	120.5±8.2	122.5 ± 10.9	126.5 ± 6.5	125.9 ± 8.1
PND 11	134.9±11.5	142.6 ± 15.2	146.3 ± 8.7	150.7 ± 10.8*
PND 14	153.4±8.8	152.1 ± 11.2	153.6 ± 11.5	170.3 ± 14.7*
PND 17	156.8±11.1	159.3 ± 12.0	169.1 ± 8.1	167.0 ± 13.7
PND 21	205.0±17.3	210.4 ± 13.2	215.3 ± 16.5	220.7 ± 17.0

[a] Mean±SD.

* Significantly different from the control group (*$P<0.05$).

Abbreviations: GD, gestation day; PND, postnatal day.

Table 12. Body weight of offspring exposed maternally to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in rats.

		$MnCl_2 \cdot 4H_2O$ in diet		
	Control	32 ppm	160 ppm	800 ppm
Body weight (g)				
Males				
No. of offspring examined	16	16	16	16
PND 0	6.6 ± 0.5[a]	6.7 ± 0.4	6.8 ± 0.4	6.7 ± 0.6
PND 4	10.6 ± 0.9	10.4 ± 1.0	11.6 ± 0.8	11.0 ± 1.3
PND 7	17.2 ± 1.8	17.2 ± 1.3	18.9 ± 1.4	18.2 ± 1.6
PND 11	26.4 ± 2.5	26.5 ± 1.8	29.0 ± 2.3	28.1 ± 2.6
PND 14	33.6 ± 2.9	33.7 ± 2.3	36.4 ± 3.0	35.7 ± 2.9
PND 17	41.3 ± 3.7	41.4 ± 2.7	44.9 ± 3.7	42.9 ± 2.8
PND 21	58.4 ± 5.4	58.8 ± 2.6	62.1 ± 4.9	60.5 ± 4.1
PNW 4	99.7 ± 7.6	101.1 ± 3.4	104.9 ± 9.8	101.1 ± 7.2
PNW 5	169.2 ± 10.4	170.8 ± 5.6	173.9 ± 15.9	169.4 ± 11.6
PNW 6	244.3 ± 11.0	246.4 ± 7.8	249.9 ± 21.5	244.0 ± 16.0
PNW 7	313.3 ± 12.1	317.6 ± 10.5	317.4 ± 22.7	314.1 ± 22.1
PNW 8	373.9 ± 12.7	378.9 ± 15.8	381.7 ± 31.6	377.6 ± 27.0
PNW 9	417.9 ± 12.0	425.9 ± 17.9	427.8 ± 38.0	423.6 ± 33.7
PNW 10	455.4 ± 11.5	467.7 ± 20.3	468.0 ± 43.7	463.3 ± 38.4
PNW 11	489.0 ± 15.4	501.9 ± 23.9	501.9 ± 47.2	499.2 ± 43.4
Females				
No. of offspring examined	16	16	16	16
PND 0	6.3 ± 0.4	6.3 ± 0.3	6.4 ± 0.5	6.4 ± 0.4
PND 4	10.0 ± 0.7	10.1 ± 0.9	11.0 ± 1.0	10.5 ± 0.8
PND 7	16.7 ± 1.1	16.9 ± 1.5	18.2 ± 1.3	17.4 ± 1.1
PND 11	25.9 ± 1.6	26.3 ± 2.3	28.4 ± 2.1	27.0 ± 2.1
PND 14	32.9 ± 2.0	33.4 ± 2.7	35.4 ± 2.4	34.6 ± 2.3
PND 17	40.4 ± 2.3	40.8 ± 3.0	43.6 ± 2.7	41.9 ± 2.8
PND 21	56.2 ± 3.5	57.3 ± 3.3	60.0 ± 3.4	58.9 ± 4.0
PNW 4	92.5 ± 5.8	91.7 ± 5.7	95.1 ± 6.6	93.6 ± 6.2
PNW 5	146.1 ± 7.6	141.9 ± 6.1	148.3 ± 10.7	144.8 ± 9.1
PNW 6	186.7 ± 8.2	181.3 ± 8.6	189.0 ± 16.3	184.7 ± 12.8
PNW 7	216.0 ± 7.9	211.9 ± 12.4	214.0 ± 16.1	214.8 ± 17.5
PNW 8	238.5 ± 10.3	235.8 ± 12.5	239.9 ± 22.0	238.9 ± 19.1
PNW 9	263.4 ± 13.6	259.3 ± 13.5	261.1 ± 21.3	264.6 ± 19.2
PNW 10	276.1 ± 13.8	274.9 ± 14.0	274.8 ± 22.2	282.6 ± 17.5
PNW 11	290.1 ± 17.0	289.0 ± 12.7	287.0 ± 23.3	294.9 ± 17.7

[a] Mean±SD.

Abbreviations: PND, postnatal day; PNW, postnatal week.

Table 13. Food consumption of offspring exposed maternally to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in rats.

	$MnCl_2 \cdot 4H_2O$ in diet			
	Control	32 ppm	160 ppm	800 ppm
Males				
No. of offspring examined	16	16	16	16
Food consumption (g/animal/day)				
PNW 5	18.5±1.1[a]	18.4 ± 1.0	18.8 ± 1.4	18.9 ± 1.2
PNW 6	25.4±0.9	25.3 ± 1.3	25.4 ± 1.6	26.0 ± 1.5
PNW 7	28.3±0.8	28.9 ± 1.6	28.6 ± 1.8	28.9 ± 2.0
PNW 8	29.7±1.0	31.0 ± 2.1	30.1 ± 2.1	30.7 ± 2.7
PNW 9	30.9±1.0	32.0 ± 2.4	31.2 ± 2.5	31.8 ± 3.1
PNW 10	31.0±1.0	32.5 ± 2.5	31.4 ± 2.9	32.1 ± 2.6
PNW 11	29.9±1.2	31.7 ± 2.6	30.8 ± 2.6	31.2 ± 2.9
Food consumption (g/kg body weight/day)				
PNW 5	109.4±3.2	107.9 ± 3.0	108.4 ± 3.4	111.5 ± 4.6
PNW 6	104.2±2.4	102.4 ± 3.5	101.8 ± 4.2	106.6 ± 2.5
PNW 7	90.2±2.4	91.1 ± 3.7	90.1 ± 3.5	92.2 ± 3.1
PNW 8	79.4±1.8	81.8 ± 3.8	78.9 ± 2.9	81.3 ± 3.4
PNW 9	73.9±2.2	75.1 ± 4.0	73.0 ± 2.4	74.9 ± 3.7
PNW 10	68.1±1.4	69.5 ± 3.6	67.1 ± 2.0	69.4 ± 2.6
PNW 11	61.2±1.1	63.1 ± 3.6	61.5 ± 2.1	62.5 ± 2.7
Females				
No. of offspring examined	16	16	16	16
Food consumption (g/animal/day)				
PNW 5	16.2±1.2	15.9 ± 1.0	16.2 ± 0.9	16.3 ± 1.2
PNW 6	19.8±0.8	19.1 ± 1.1	19.7 ± 1.9	19.9 ± 1.1
PNW 7	19.7±0.7	20.1 ± 1.6	19.3 ± 1.5	20.1 ± 1.3
PNW 8	20.2±1.0	20.6 ± 1.3	19.8 ± 1.6	20.6 ± 1.4
PNW 9	21.9±1.3	21.7 ± 1.0	20.9 ± 1.3	21.9 ± 1.5
PNW 10	21.6±1.5	21.9 ± 1.1	21.6 ± 1.6	22.3 ± 1.2
PNW 11	21.1±1.8	20.9 ± 0.9	20.3 ± 1.9	21.1 ± 1.5
Food consumption (g/kg body weight/day)				
PNW 5	110.7±4.2	112.3 ± 5.1	109.3 ± 3.4	112.7 ± 4.2
PNW 6	106.2±3.0	105.5 ± 4.2	104.1 ± 2.8	107.7 ± 2.5
PNW 7	91.2±2.0	94.9 ± 4.7	90.3 ± 3.3	94.0 ± 5.7
PNW 8	84.7±3.6	87.2 ± 3.5	82.4 ± 2.6	86.5 ± 4.8
PNW 9	83.1±3.7	83.7 ± 2.8	80.1 ± 2.9	83.1 ± 4.8
PNW 10	78.3±3.8	79.6 ± 3.3	78.5 ± 2.3	79.0 ± 6.1
PNW 11	72.8±3.4	72.5 ± 3.5	70.8 ± 2.2	71.6 ± 5.7

[a] Mean±SD.

Abbreviations: PNW, postnatal week.

Table 14. Organ weight of offspring exposed maternally to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in rats.

			$MnCl_2 \cdot 4H_2O$ in diet		
		Control	32 ppm	160 ppm	800 ppm
PND 21					
Males					
No. of offspring examined		10	10	10	10
Brain	(g)	1.51 ± 0.05[a]	1.56 ± 0.05	1.48 ± 0.05	1.51 ± 0.04
	(g/100g BW)	2.70 ± 0.30	2.74 ± 0.23	2.54 ± 0.19	2.47 ± 0.17
Liver	(g)	2.15 ± 0.30	2.17 ± 0.19	2.16 ± 0.17	2.21 ± 0.23
	(g/100g BW)	3.79 ± 0.17	3.79 ± 0.17	3.67 ± 0.22	3.59 ± 0.17
Kidneys	(g)	0.64 ± 0.07	0.64 ± 0.06	0.66 ± 0.04	0.66 ± 0.06
	(g/100g BW)	1.13 ± 0.07	1.13 ± 0.04	1.12 ± 0.07	1.08 ± 0.05
Testes	(g)	0.26 ± 0.02	0.24 ± 0.03	0.26 ± 0.02	0.25 ± 0.03
	(g/100g BW)	0.45 ± 0.04	0.42 ± 0.04	0.45 ± 0.04	0.41 ± 0.02
Females					
No. of offspring examined		10	10	10	10
Brain	(g)	1.48 ± 0.05	1.54 ± 0.06	1.50 ± 0.04	1.47 ± 0.04
	(g/100g BW)	2.75 ± 0.24	2.75 ± 0.18	2.56 ± 0.19	2.55 ± 0.25
Liver	(g)	2.06 ± 0.19	2.08 ± 0.18	2.23 ± 0.20	2.10 ± 0.27
	(g/100g BW)	3.82 ± 0.20	3.71 ± 0.15	3.81 ± 0.20	3.60 ± 0.16
Kidneys	(g)	0.63 ± 0.07	0.64 ± 0.05	0.67 ± 0.05	0.67 ± 0.07
	(g/100g BW)	1.17 ± 0.08	1.14 ± 0.06	1.15 ± 0.05	1.14 ± 0.06
Ovaries	(mg)	16.68 ± 1.70	16.94 ± 1.89	17.01 ± 3.52	16.14 ± 2.22
	(mg/100g BW)	30.94 ± 2.41	30.35 ± 4.36	29.30 ± 7.29	27.87 ± 4.08
PNW 11					
Males					
No. of offspring examined		10	10	10	10
Brain	(g)	2.04 ± 0.06	2.07 ± 0.06	2.00 ± 0.07	2.03 ± 0.06
	(g/100g BW)	0.42 ± 0.03	0.42 ± 0.03	0.41 ± 0.04	0.42 ± 0.03
Liver	(g)	18.09 ± 2.16	18.81 ± 2.85	18.11 ± 2.65	17.48 ± 2.14
	(g/100g BW)	3.74 ± 0.28	3.77 ± 0.33	3.69 ± 0.26	3.59 ± 0.24
Kidneys	(g)	3.08 ± 0.35	3.20 ± 0.38	3.18 ± 0.18	3.22 ± 0.29
	(g/100g BW)	0.64 ± 0.05	0.64 ± 0.05	0.65 ± 0.05	0.66 ± 0.03
Testes	(g)	3.46 ± 0.30	3.16 ± 0.21	3.28 ± 0.32	3.36 ± 0.27
	(g/100g BW)	0.72 ± 0.08	0.64 ± 0.05	0.68 ± 0.09	0.69 ± 0.07
Females					
No. of offspring examined		10	10	10	10
Brain	(g)	1.90 ± 0.05	1.90 ± 0.06	1.84 ± 0.05	1.87 ± 0.08
	(g/100g BW)	0.67 ± 0.07	0.66 ± 0.07	0.66 ± 0.07	0.65 ± 0.04
Liver	(g)	9.70 ± 1.43	9.67 ± 1.41	9.25 ± 1.52	9.66 ± 0.55
	(g/100g BW)	3.38 ± 0.27	3.33 ± 0.27	3.28 ± 0.22	3.38 ± 0.15
Kidneys	(g)	1.90 ± 0.14	1.88 ± 0.25	1.81 ± 0.14	1.91 ± 0.13
	(g/100g BW)	0.67 ± 0.05	0.65 ± 0.05	0.65 ± 0.07	0.67 ± 0.05
Ovaries	(mg)	84.18 ± 11.37	81.06 ± 12.56	88.98 ± 17.50	93.70 ± 8.69
	(mg/100g BW)	29.46 ± 3.16	28.06 ± 3.42	31.58 ± 3.91	32.83 ± 3.01

[a] Mean±SD.

Abbreviations: BW, body weight; PND, postnatal day; PNW, postnatal week.

Table 15. Manganese concentrations in the cerebellum of offspring and dams exposed to $MnCl_2 \cdot 4H_2O$ from GD 10 to PND 21 in rats.

	$MnCl_2 \cdot 4H_2O$ in diet			
	Control	32 ppm	160 ppm	800 ppm
Dams				
No. of dams examined	8	8	8	8
manganese concentration (μg Mn/g tissue)	0.468 ± 0.023[a]	0.432 ± 0.045	0.418 ± 0.014	0.433 ± 0.045
Offspring				
PND 21				
No. of offspring examined	6	6	6	6
manganese concentration (μg Mn/g tissue)	0.488 ± 0.022	0.553 ± 0.020	0.641 ± 0.092*	0.610 ± 0.128*
PNW 11				
No. of offspring examined	6	6	6	6
manganese concentration (μg Mn/g tissue)	0.350 ± 0.014	0.387 ± 0.048	0.400 ± 0.033	0.440 ± 0.043

[a] Mean±SD.

* Significantly different from the control group (*P<0.05).

Abbreviations: PND, postnatal day; PNW, postnatal week.