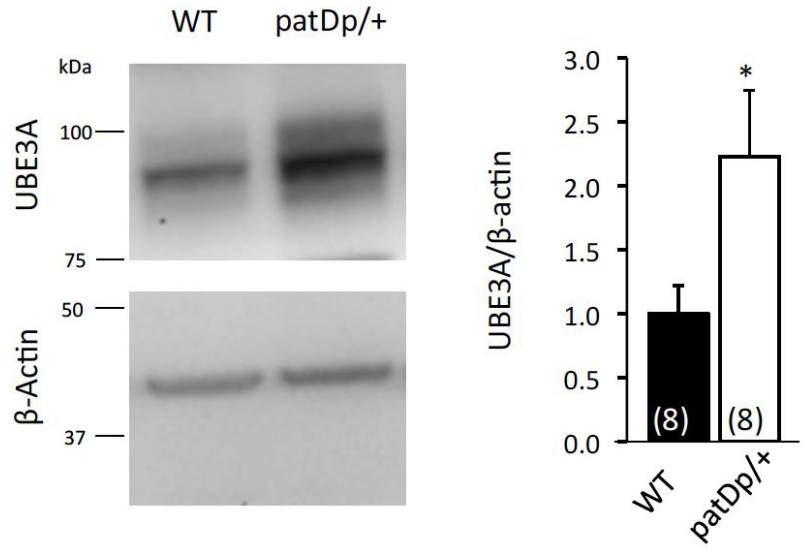
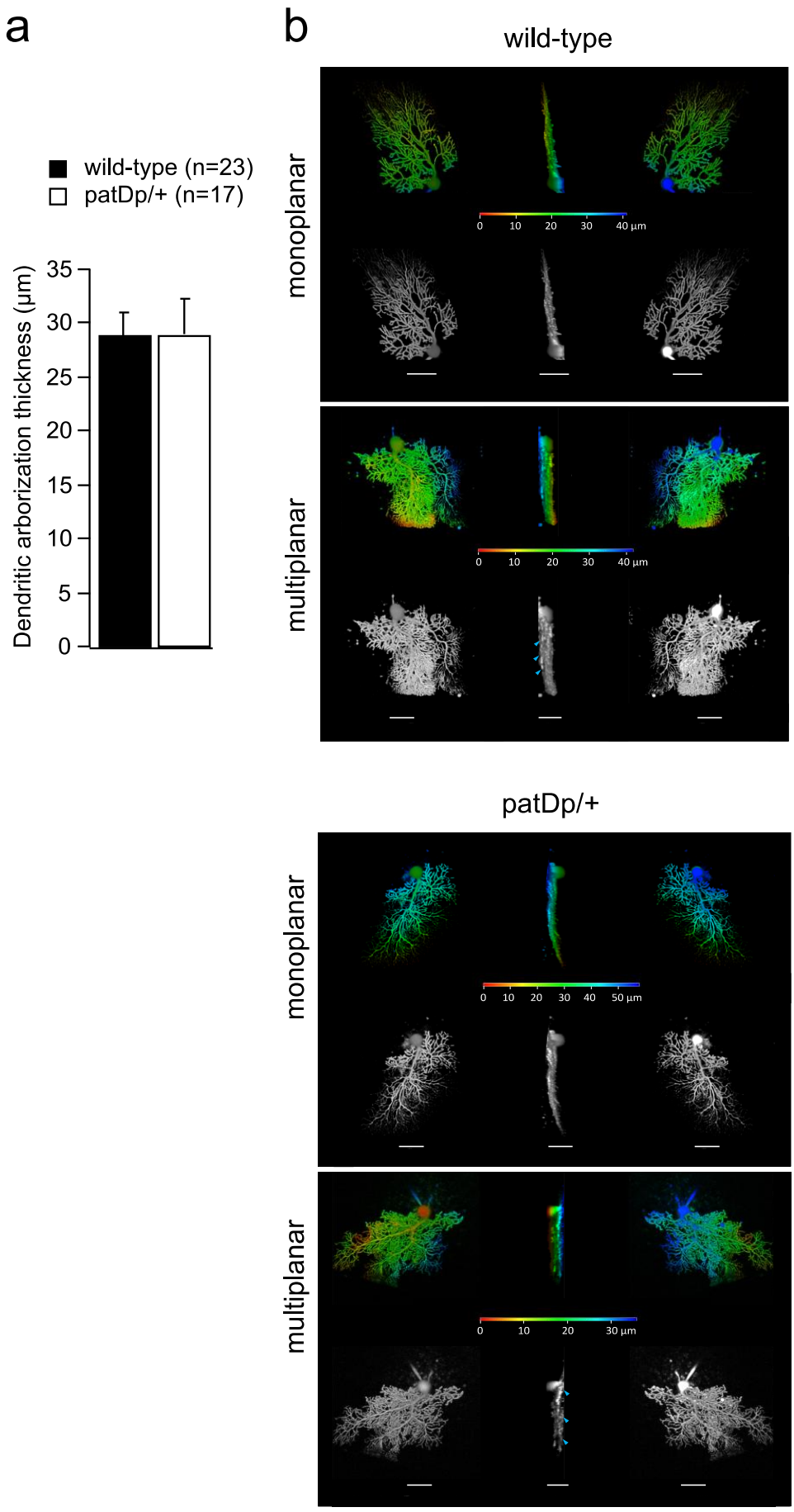
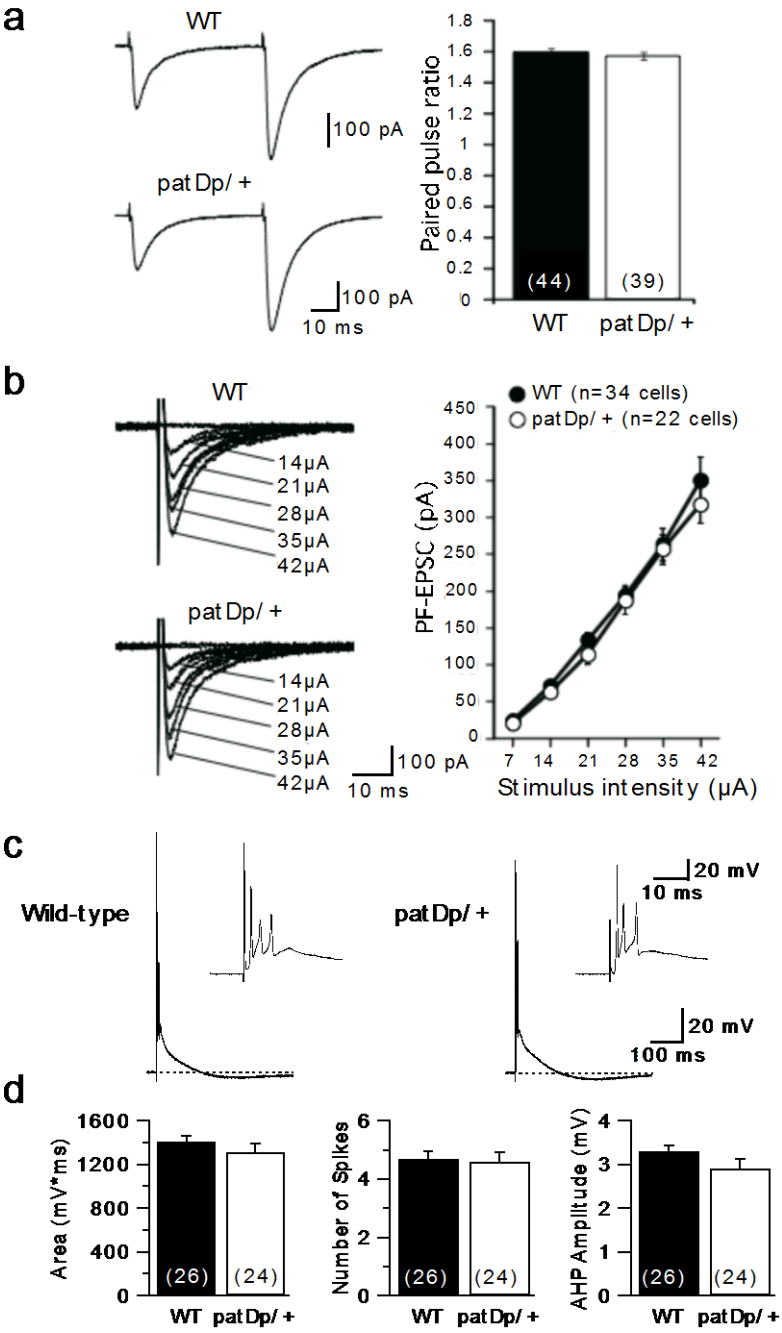
Supplementary Information



Supplementary Figure 1: UBE3A expression levels are upregulated in the cerebellum of 3-13 month-old patDp/+ mice. Western blot analysis of whole protein extracts obtained from the cerebellum, and subsequent densitometric quantification of UBE3A expression levels (expressed as normalized to the expression levels of β-actin, and relative to wild-type expression levels) shows a ~2-fold enhanced expression of UBE3A in patDp/+ mice (n=8) as compared to wild-type controls (n=8; unpaired Student's t test; *indicates $p<0.05$). Error bars indicate mean ± SEM.


a
b
wild-type (n=23)
patDp/+ (n=17)
Dendritic arborization thickness (µm)
35
30
25
20
15
10
5
0
wild-type
monoplanar
multiplanar
0 10 20 30 40 µm
0 10 20 30 40 µm
patDp/+
monoplanar
multiplanar
0 10 20 30 40 50 µm
0 10 20 30 µm

Supplementary Figure 2: Planar organization of Purkinje cell dendrites. (**a**) Bar graph showing the thickness (coronal axis) of dendrites of wild-type (n=23) and patDp/+ Purkinje cells (n=17; unpaired Student's t test; $p>0.05$). Error bars indicate mean ± SEM. (**b**) Typical examples of 3D-reconstructed Purkinje cells: wild-type Purkinje cells (upper panels) with a monoplanar dendrite and with a multiplanar dendrite, patDp/+ Purkinje cells (lower panels) with a monoplanar dendrite and with a multiplanar dendrite. On each panel the pseudo-color code shows the relative position of dendritic regions along the z-axis as indicated. Below, we show reconstructed Purkinje cells without pseudo-color coding for better contrast. Projections on the left and right show the front and back view of dendrites in the sagittal plane. The middle projection shows the coronal view that was used for thickness measures. The arrowheads point toward a second dendritic plane. Scale bars are 50μm.


a
WT
100 pA
patDp/+
100 pA
10 ms
Paired pulse ratio
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
(44)
(39)
WT
patDp/+
b
WT
14μA
21μA
28μA
35μA
42μA
patDp/+
14μA
21μA
28μA
35μA
42μA
100 pA
10 ms
WT (n=34 cells)
patDp/+ (n=22 cells)
PF-EPSC (pA)
450
400
350
300
250
200
150
100
50
0
7
14
21
28
35
42
Stimulus intensity (μA)
c
Wild-type
patDp/+
20 mV
10 ms
20 mV
100 ms
d
Area (mV*ms)
1600
1200
800
400
0
(26)
(24)
WT
patDp/+
Number of Spikes
6
4
2
0
(26)
(24)
WT
patDp/+
AHP Amplitude (mV)
4
3
2
1
0
(26)
(24)
WT
patDp/+

Supplementary Figure 3: Synaptic responses in patDp/+ and wild-type slices. (**a**) Left: Typical PF-EPSCs recorded from wild-type (top) and patDp/+ (bottom) Purkinje cells. The paired-pulse ratio (PPR) was determined by applying two pulses with a 50ms interval. Right: Bar graph shows the PPR recorded from wild-type (n=44) and patDp/+ (n=39) Purkinje cells. There was no significant difference in PPR values between the two groups (Mann-Whitney U test; $p>0.05$). (**b**) Input-output curves. Left: typical traces of PF-EPSCs in response to stepwise increases in stimulus intensity recorded from wild-type (top) and patDp/+ (bottom) Purkinje cells. Right: There is no significant difference in input-output curves between wild-type (n=34 cells from 4 mice) and patDp/+ (n=22 cells from 4 mice) Purkinje cells (two-way repeated measure ANOVA; $p>0.05$). (**c**) Typical complex spikes recorded from wild-type (left) and patDp/+ (right) Purkinje cells. The inserts show the same traces at an expanded time scale. (**d**) There was no significant difference in the following parameters between complex spikes recorded from wild-type (n=26) and patDp/+ (n=24) Purkinje cells: area under the curve (left; measured from stimulus onset to onset of the afterhyperpolarization, AHP; Mann-Whitney U test; $p>0.05$), number of spike / spikelet components (Mann-Whitney U test; $p>0.05$), and AHP amplitude (Mann-Whitney U test; $p>0.05$). Error bars are mean $\pm$ SEM.

Supplementary Table 1: **Gait parameters in wild-type and patDp/+ mice**. Mean ± SEM and p-values (non-paired Student's t-tests) of selected DigiGait parameters for forelimbs and hindlimbs.

	Forelimbs			Hindlimbs		
	wild-type (n=14)	patDp/+ (n=10)	p-value	wild-type (n=14)	patDp/+ (n=10)	p-value
Stance Width (cm)	1.56 ± 0.04	1.69 ± 0.04	0.03	2.34 ± 0.04	2.41 ± 0.04	0.19
Stride Length (cm)	5.52 ± 0.07	6.14 ± 0.07	0.00000293	5.57 ± 0.09	6.11 ± 0.07	0.0001
Stride Frequency (stride/s)	3.71 ± 0.05	3.32 ± 0.04	0.00000239	3.66 ± 0.06	3.33 ± 0.04	0.0002
Propulsion Duration (s)	0.093 ± 0.002	0.115 ± 0.002	0.00000005	0.107 ± 0.002	0.125 ± 0.005	0.001

Supplementary Table 2: **Kinetic parameters of unconditioned and conditioned responses in wild-type and patDp/+ mice**. Mean ± SEM and p-values (non-paired Student's t-tests) for unconditioned (top) and conditioned response (bottom) start time, 10-90% rise time, and peak time, respectively. Note that all time values were calculated relative to the CS onset at t=0ms in the conditioning experiments. The US is delivered at t=250ms.

	Unconditioned Response		
	wild-type (n=11)	patDp/+ (n=10)	p-value
Start Time (ms)	280.8 ± 7.4	295.9 ± 8.4	0.19
10-90% rise time (ms)	72.9 ± 6.3	67.3 ± 4.7	0.50
Peak time (ms)	353.6 ± 8.8	363.6 ± 7.1	0.40

	Conditioned Response		
	wild-type (n=11)	patDp/+ (n=10)	p-value
Start Time (ms)	136.5 ± 5.2	129.6 ± 8.4	0.49
10-90% rise time (ms)	112.4 ± 12.1	117.2 ± 12.6	0.79
Peak time (ms)	298.7 ± 12.4	281.4 ± 13.0	0.34
Response Amplitude (%)	46.6 ± 9.8	43.1 ± 3.8	0.47

Supplementary Table 3: CF elimination in developing and adult patDp/+ and wild-type Purkinje cells. Counts of discrete CF-EPSC steps in individual Purkinje cells in slices obtained from P10-12 wild-type and patDp/+ mice (top) and P63-70 wild-type and patDp/+ mice (bottom). The number of CF-EPSC steps indicates the number of CF inputs per Purkinje cell.

P10-P12	No. of CF's				
	Age	1	2	3	Total No. of Cells
WT 1	10	3	3	2	8
WT 2	12	2	8	0	10
WT 3	11	6	5	3	14
WT 4	10	7	7	1	15
WT 5	12	2	2	0	4
WT 6	11	1	3	0	4
Total No. of Cells		21	28	6	55
%		38.18	50.91	10.91	

	No. of CF's				
	Age	1	2	3	Total No. of Cells
patDp/+ 1	11	1	5	3	9
patDp/+ 2	11	4	4	4	12
patDp/+ 3	10	2	5	8	15
patDp/+ 4	11	1	6	8	15
patDp/+ 5	11	0	2	0	2
patDp/+ 6	11	1	2	0	3
Total No. of Cells		9	24	23	56
%		16.07	42.86	41.07	

Adult (P63-P70)	No. of CF's				
	Age	1	2	3	Total No. of Cells
WT 1	68	11	1	0	12
WT 2	65	10	1	1	12
WT 3	67	11	4	0	15
WT 4	69	10	3	0	13
WT 5	63	14	3	0	17
Total No. of Cells		56	12	1	69
%		81.16	17.39	1.45	

	No. of CF's				
	Age	1	2	3	Total No. of Cells
patDp/+ 1	69	7	5	0	12
patDp/+ 2	63	10	1	1	12
patDp/+ 3	68	6	3	1	10
patDp/+ 4	70	12	2	0	14
patDp/+ 5	66	8	7	2	17
Total No. of Cells		43	18	4	65
%		66.15	27.69	6.15	

Supplementary Table 4: Age control by analysis of covariance. In order to correct the statistical measures reported in this study for possible age effects, each variable was tested by an analysis of covariance with age as a covariant. Multivariate tests (Wilks test) were applied as needed (total and primary dendritic length; DigiGait parameters). Additional covariants were weight (DigiGait data; Fig. 2) and actin expression levels (Ube3a expression; Suppl. Fig. 1). The table shows the tested parameters (left), the simple group analysis statistics as reported in the Results section (middle), and p values obtained after correction for possible age effects using the Tukey's test (right). *indicates $p<0.05$; **indicates $p<0.01$; ***indicates $p<0.001$.

Age Control by Analysis of Covariance				
Variable	**Group Comparisons (p) WT vs patDp/+**		**Age-Corrected Comparisons (p) WT vs. patDp/+**	
PC Density (Fig. 1d)	0.98	n.s.	0.96	n.s.
Total Dendritic Length (Fig. 1d)	0.43	n.s.	0.35	n.s.
Primary Dendrite Length (Fig. 1d)	0.64	n.s.	0.575	n.s.
Molecular Layer Thickness (Fig. 1d)	0.55	n.s.	0.56	n.s.
Stance Forelimbs (Fig. 2c)	0.030	*	0.029	*
Stance Hindlimbs (Fig. 2c)	0.19	n.s.	0.13	n.s.
Propulsion Forelimbs (Fig. 2d)	0.0000	***	0.0002	***
Propulsion Hindlimbs (Fig. 2d)	0.0010	**	0.0002	***
Stride Length Forelimbs (Fig. 2e)	0.000003	***	0.0002	***
Stride Length Hindlimbs (Fig. 2e)	0.0001	***	0.0004	***
Stride Frequency Forelimbs (Fig. 2f)	0.000002	***	0.0002	***
Stride Frequency Hindlimbs (Fig. 2f)	0.0002	***	0.0007	***
Eyeblink (A9-12; Fig. 3d)	0.010	*	0.0002	***
LTD (Fig. 4)	0.0011	**	0.0003	***
LTP (Fig. 5)	0.28	n.s.	0.16	n.s.
LTD after LTP (Fig. 6)	0.89	n.s.	0.86	n.s.
UBE3A Expression (Supp. Fig. 1)	0.047	*	0.0057	**
PC Dendritic Thickness (Supp. Fig. 2)	0.97	n.s.	0.90	n.s.