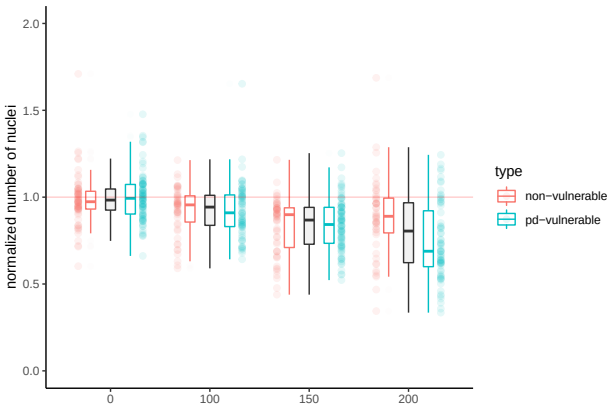
analysis-manuscript

PD-vulnerable neurons are more vulnerable to hydrogen peroxide than pd-resilient neurons

Nuclei (DAPI) count



Supplimentary Tables n.n

Kurskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  dapi_normalized by hydrogen_peroxide
Kruskal-Wallis chi-squared = 91.227, df = 3, p-value < 2.2e-16
```

Dunn test

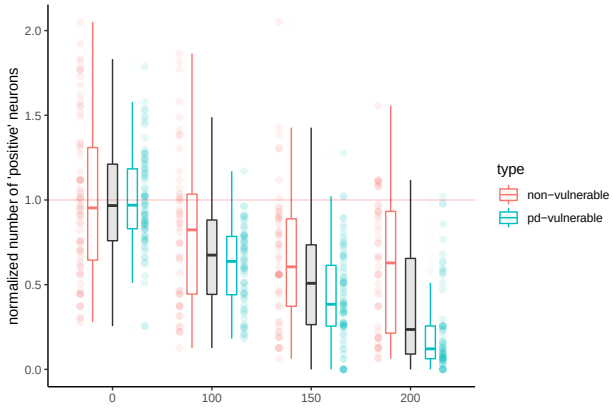
```
  Comparison         Z      P.unadj        P.adj
1    0 - 100 3.4001879 6.733956e-04 4.040373e-03
2    0 - 150 7.8043915 5.978932e-15 3.587359e-14
3  100 - 150 3.9718484 7.131711e-05 4.279026e-04
4    0 - 200 8.1835348 2.756366e-16 1.653819e-15
5  100 - 200 4.5069337 6.577117e-06 3.946270e-05
6  150 - 200 0.7245953 4.687004e-01 1.000000e+00
```

PairwiseTtest

```
# A tibble: 4 x 10
  hydrogen_peroxide .y.     group1  group2     n1    n2       p p.signif   p.adj
```

```
* <fct>             <chr>   <chr>   <chr>   <int> <int>   <dbl> <chr>      <dbl>
1 0                 dapi_n~ non-vu~ pd-vul~    71    86 1   e+0 ns       1   e+0
2 100               dapi_n~ non-vu~ pd-vul~    50    77 9.77e-1 ns       9.77e-1
3 150               dapi_n~ non-vu~ pd-vul~    55    92 8.3 e-1 ns       8.3 e-1
4 200               dapi_n~ non-vu~ pd-vul~    48    72 9.18e-4 ***      9.18e-4
# ... with 1 more variable: p.adj.signif <chr>
```

Neuron count



Supplimentary Table n.n

Kurskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  neuron_normalized by hydrogen_peroxide
Kruskal-Wallis chi-squared = 164.32, df = 3, p-value < 2.2e-16
```

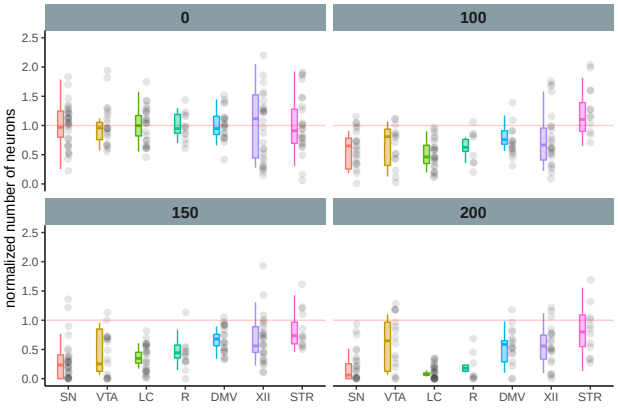
Dunn test

```
  Comparison         Z      P.unadj        P.adj
1    0 - 100  5.867938 4.412478e-09 2.647487e-08
2    0 - 150  9.779527 1.378532e-22 8.271193e-22
3  100 - 150  3.408957 6.521186e-04 3.912712e-03
4    0 - 200 11.754230 6.717025e-32 4.030215e-31
5  100 - 200  5.563542 2.643538e-08 1.586123e-07
6  150 - 200  2.386850 1.699342e-02 1.019605e-01
```

PairwiseTtest

```
# A tibble: 4 x 10
  hydrogen_peroxide .y.     group1  group2     n1    n2       p p.signif   p.adj
* <fct>             <chr>   <chr>   <chr>   <int> <int>   <dbl> <chr>      <dbl>
1 0                 neuron~ non-vu~ pd-vul~    71    86 1   e+0 ns       1   e+0
2 100               neuron~ non-vu~ pd-vul~    50    77 1.13e-3 **       1.13e-3
3 150               neuron~ non-vu~ pd-vul~    55    92 7.42e-5 ****     7.42e-5
4 200               neuron~ non-vu~ pd-vul~    48    72 6.43e-9 ****     6.43e-9
# ... with 1 more variable: p.adj.signif <chr>
```

Differential vulnerability of neurons to hydrogen peroxide



Supplimentary Table n.n

Kruskal-Wallis and Dunn test for each

0 micromollar

```
    Kruskal-Wallis rank sum test

data:  neuron_normalized by neuron
Kruskal-Wallis chi-squared = 0.43515, df = 6, p-value = 0.9985
```

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	0.04600991	0.9633024	1
2	DMV - R	-0.01706684	0.9863833	1
3	LC - R	-0.05702708	0.9545236	1
4	DMV - SN	0.05968455	0.9524069	1
5	LC - SN	0.01204718	0.9903880	1
6	R - SN	0.06868787	0.9452381	1
7	DMV - STR	0.38805723	0.6979737	1
8	LC - STR	0.35874226	0.7197879	1
9	R - STR	0.34993891	0.7263845	1
10	SN - STR	0.36610036	0.7142902	1
11	DMV - VTA	0.39298245	0.6943324	1
12	LC - VTA	0.36444688	0.7155243	1
13	R - VTA	0.35739962	0.7207927	1
14	SN - VTA	0.37080616	0.7107819	1
15	STR - VTA	0.02239956	0.9821292	1
16	DMV - XII	0.34198331	0.7323635	1
17	LC - XII	0.30997827	0.7565775	1
18	R - XII	0.30876417	0.7575009	1
19	SN - XII	0.31538169	0.7524719	1
20	STR - XII	-0.05916447	0.9528211	1
21	VTA - XII	-0.07924845	0.9368350	1

100 micromollar

```
    Kruskal-Wallis rank sum test

data:  neuron_normalized by neuron
Kruskal-Wallis chi-squared = 27.496, df = 6, p-value = 0.0001169
```

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	3.05767631	2.230604e-03	4.684268e-02
2	DMV - R	1.34734970	1.778676e-01	1.000000e+00
3	LC - R	-0.98822521	3.230424e-01	1.000000e+00
4	DMV - SN	2.10964597	3.488886e-02	7.326661e-01
5	LC - SN	-0.95978913	3.371614e-01	1.000000e+00
6	R - SN	0.28076187	7.788930e-01	1.000000e+00
7	DMV - STR	-1.83772941	6.610229e-02	1.000000e+00
8	LC - STR	-4.77623845	1.786046e-06	3.750697e-05
9	R - STR	-2.81576290	4.866157e-03	1.021893e-01
10	SN - STR	-3.87390539	1.071050e-04	2.249205e-03
11	DMV - VTA	1.13666428	2.556787e-01	1.000000e+00
12	LC - VTA	-1.75714226	7.889356e-02	1.000000e+00
13	R - VTA	-0.39951133	6.895165e-01	1.000000e+00
14	SN - VTA	-0.86242974	3.884511e-01	1.000000e+00
15	STR - VTA	2.86680545	4.146378e-03	8.707394e-02
16	DMV - XII	1.29462100	1.954510e-01	1.000000e+00
17	LC - XII	-1.93767522	5.266286e-02	1.000000e+00
18	R - XII	-0.39459214	6.931439e-01	1.000000e+00
19	SN - XII	-0.92310331	3.559534e-01	1.000000e+00
20	STR - XII	3.15425423	1.609088e-03	3.379086e-02
21	VTA - XII	0.03899101	9.688976e-01	1.000000e+00

150 micromollar

```
    Kruskal-Wallis rank sum test

data:  neuron_normalized by neuron
Kruskal-Wallis chi-squared = 43.006, df = 6, p-value = 1.163e-07
```

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	3.40923177	6.514611e-04	1.368068e-02
2	DMV - R	1.86033898	6.283758e-02	1.000000e+00
3	LC - R	-0.99814183	3.182106e-01	1.000000e+00
4	DMV - SN	4.59262928	4.376962e-06	9.191620e-05
5	LC - SN	1.12299366	2.614402e-01	1.000000e+00
6	R - SN	1.92817745	5.383306e-02	1.000000e+00
7	DMV - STR	-0.91146407	3.620509e-01	1.000000e+00
8	LC - STR	-3.86084771	1.129943e-04	2.372881e-03
9	R - STR	-2.47917602	1.316863e-02	2.765412e-01
10	SN - STR	-4.86157808	1.164536e-06	2.445526e-05
11	DMV - VTA	2.09242381	3.640062e-02	7.644130e-01
12	LC - VTA	-1.07866488	2.807371e-01	1.000000e+00
13	R - VTA	0.02906247	9.768148e-01	1.000000e+00
14	SN - VTA	-2.12809949	3.332884e-02	6.999055e-01
15	STR - VTA	2.71346613	6.658337e-03	1.398251e-01
16	DMV - XII	0.52063882	6.026184e-01	1.000000e+00
17	LC - XII	-3.09940140	1.939121e-03	4.072154e-02

```
18    R - XII -1.50275652 1.329018e-01 1.000000e+00
19   SN - XII -4.36835989 1.251831e-05 2.628845e-04
20  STR - XII  1.39737195 1.623017e-01 1.000000e+00
21  VTA - XII -1.71656602 8.605850e-02 1.000000e+00
```

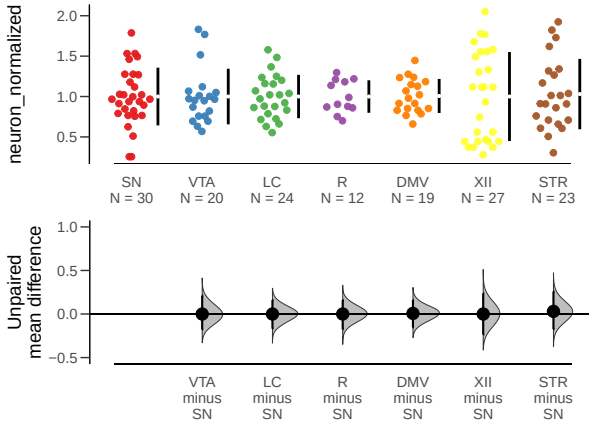
200 micromollar

```
    Kruskal-Wallis rank sum test

data:  neuron_normalized by neuron
Kruskal-Wallis chi-squared = 55.538, df = 6, p-value = 3.608e-10
```

```
   Comparison           Z      P.unadj        P.adj
1    DMV - LC  4.63069760 3.644358e-06 7.653152e-05
2     DMV - R  1.77727430 7.552312e-02 1.000000e+00
3      LC - R -1.77580383 7.576526e-02 1.000000e+00
4    DMV - SN  3.66003770 2.521781e-04 5.295741e-03
5     LC - SN -0.88166475 3.779581e-01 1.000000e+00
6      R - SN  1.09490499 2.735583e-01 1.000000e+00
7   DMV - STR -0.93784904 3.483220e-01 1.000000e+00
8    LC - STR -5.24022196 1.603836e-07 3.368055e-06
9     R - STR -2.47073125 1.348371e-02 2.831579e-01
10   SN - STR -4.34278531 1.406876e-05 2.954440e-04
11  DMV - VTA  0.27340288 7.845435e-01 1.000000e+00
12   LC - VTA -4.33119975 1.482991e-05 3.114281e-04
13    R - VTA -1.55404178 1.201745e-01 1.000000e+00
14   SN - VTA -3.37184576 7.466625e-04 1.567991e-02
15  STR - VTA  1.19097093 2.336650e-01 1.000000e+00
16  DMV - XII -0.06428897 9.487401e-01 1.000000e+00
17   LC - XII -5.00756106 5.512407e-07 1.157605e-05
18    R - XII -1.89119953 5.859771e-02 1.000000e+00
19   SN - XII -3.95024497 7.807125e-05 1.639496e-03
20  STR - XII  0.92177281 3.566471e-01 1.000000e+00
21  VTA - XII -0.35248092 7.244776e-01 1.000000e+00
```

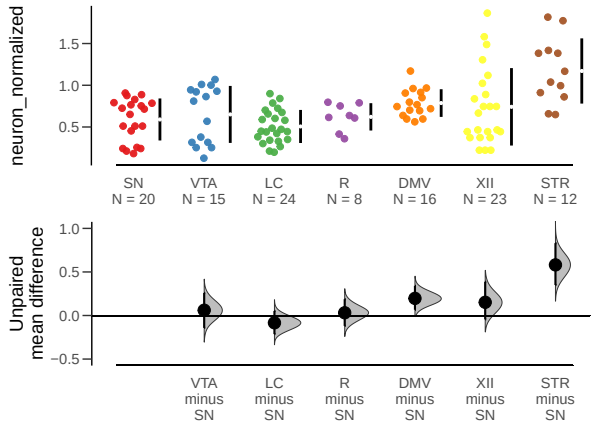
Estimation statistics

0 micromollar



```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 19:59 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  neuron_normalized

Unpaired mean difference of VTA (n = 20) minus SN (n = 30)
 0 [95CI  -0.179; 0.212]

Unpaired mean difference of LC (n = 24) minus SN (n = 30)
 0 [95CI  -0.168; 0.16]

Unpaired mean difference of R (n = 12) minus SN (n = 30)
 -1.11e-16 [95CI  -0.175; 0.16]

Unpaired mean difference of DMV (n = 19) minus SN (n = 30)
 0.00684 [95CI  -0.155; 0.16]

Unpaired mean difference of XII (n = 27) minus SN (n = 30)
 0 [95CI  -0.237; 0.238]

Unpaired mean difference of STR (n = 23) minus SN (n = 30)
 0.0303 [95CI  -0.174; 0.259]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

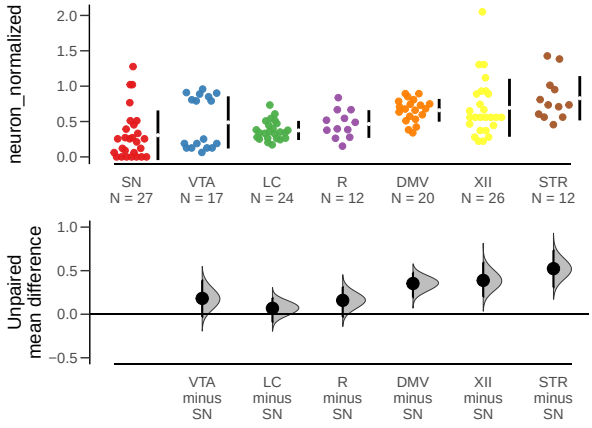
100




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 19:59 pm on Tuesday January 25, 2022.
```

```
Dataset    :  .
X Variable :  neuron
Y Variable :  neuron_normalized

Unpaired mean difference of VTA (n = 15) minus SN (n = 20)
 0.0605 [95CI  -0.142; 0.26]

Unpaired mean difference of LC (n = 24) minus SN (n = 20)
 -0.0838 [95CI  -0.213; 0.0524]

Unpaired mean difference of R (n = 8) minus SN (n = 20)
 0.0314 [95CI  -0.119; 0.187]

Unpaired mean difference of DMV (n = 16) minus SN (n = 20)
 0.197 [95CI  0.0662; 0.34]

Unpaired mean difference of XII (n = 23) minus SN (n = 20)
 0.152 [95CI  -0.0443; 0.388]

Unpaired mean difference of STR (n = 12) minus SN (n = 20)
 0.581 [95CI  0.35; 0.831]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

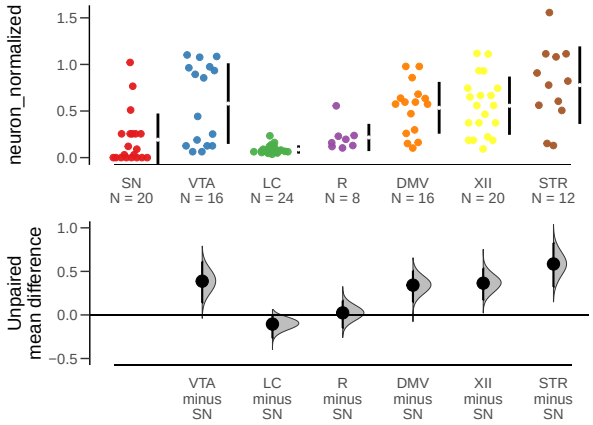
150




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 19:59 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  neuron_normalized

Unpaired mean difference of VTA (n = 17) minus SN (n = 27)
 0.182 [95CI  -0.0308; 0.39]
```

```
Unpaired mean difference of LC (n = 24) minus SN (n = 27)
 0.0681 [95CI  -0.0918; 0.188]

Unpaired mean difference of R (n = 12) minus SN (n = 27)
 0.159 [95CI  -0.0317; 0.311]

Unpaired mean difference of DMV (n = 20) minus SN (n = 27)
 0.353 [95CI  0.192; 0.478]

Unpaired mean difference of XII (n = 26) minus SN (n = 27)
 0.388 [95CI  0.2; 0.595]

Unpaired mean difference of STR (n = 12) minus SN (n = 27)
 0.523 [95CI  0.308; 0.734]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

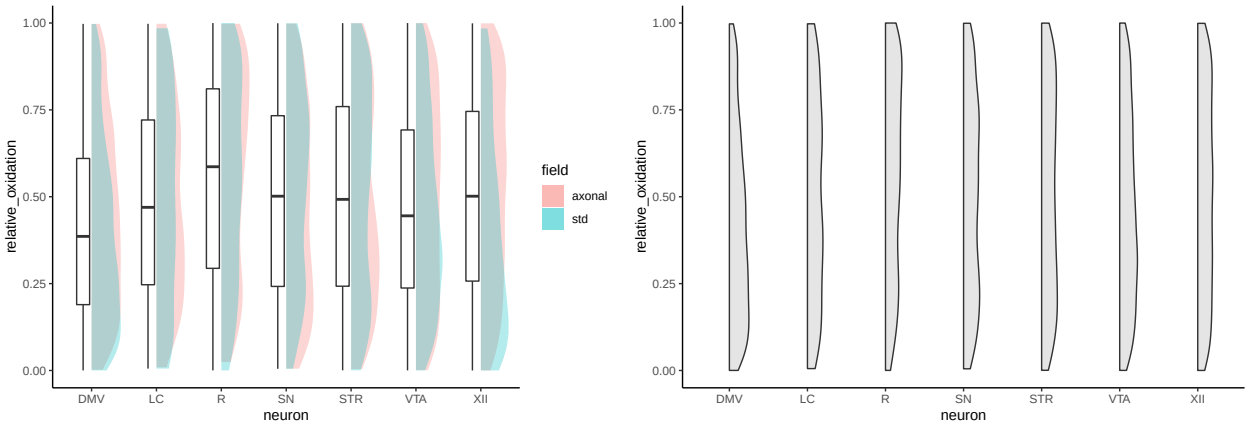
200




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 19:59 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  neuron_normalized

Unpaired mean difference of VTA (n = 16) minus SN (n = 20)
 0.387 [95CI  0.139; 0.611]

Unpaired mean difference of LC (n = 24) minus SN (n = 20)
 -0.105 [95CI  -0.268; -0.0105]

Unpaired mean difference of R (n = 8) minus SN (n = 20)
 0.0239 [95CI  -0.151; 0.163]
```

```
Unpaired mean difference of DMV (n = 16) minus SN (n = 20)
 0.342 [95CI  0.146; 0.507]

Unpaired mean difference of XII (n = 20) minus SN (n = 20)
 0.365 [95CI  0.17; 0.534]

Unpaired mean difference of STR (n = 12) minus SN (n = 20)
 0.585 [95CI  0.322; 0.827]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

No overt difference in mitochondrial ROS production is observed between neurons



Supplimentary Table n.n

Kruskal-Wallis

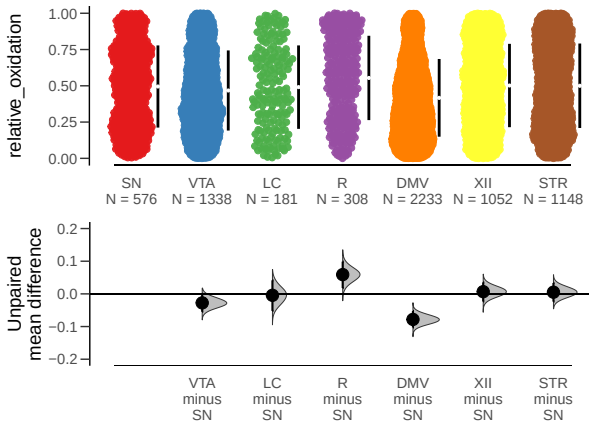
```
    Kruskal-Wallis rank sum test

data:  relative_oxidation by neuron
Kruskal-Wallis chi-squared = 133.58, df = 6, p-value < 2.2e-16
```

Dunn

```
   Comparison          Z      P.unadj        P.adj
1    DMV - LC -3.3231328 8.901252e-04 1.869263e-02
2     DMV - R -7.8362467 4.642135e-15 9.748483e-14
3      LC - R -2.3435415 1.910163e-02 4.011343e-01
4    DMV - SN -5.8719183 4.307810e-09 9.046400e-08
5     LC - SN -0.2064038 8.364755e-01 1.000000e+00
6      R - SN  2.8602152 4.233536e-03 8.890425e-02
7   DMV - STR -7.9501041 1.863548e-15 3.913451e-14
8    LC - STR -0.3988749 6.899854e-01 1.000000e+00
```

```
9      R - STR  2.9232967 3.463463e-03 7.273272e-02
10    SN - STR -0.2802927 7.792529e-01 1.000000e+00
11   DMV - VTA -5.1989318 2.004370e-07 4.209178e-06
12    LC - VTA  0.9733339 3.303874e-01 1.000000e+00
13     R - VTA  4.6926942 2.696303e-06 5.662237e-05
14    SN - VTA  1.8997528 5.746557e-02 1.000000e+00
15   STR - VTA  2.7090509 6.747598e-03 1.416996e-01
16   DMV - XII -7.9440379 1.957037e-15 4.109778e-14
17    LC - XII -0.5001405 6.169762e-01 1.000000e+00
18     R - XII  2.7666535 5.663492e-03 1.189333e-01
19    SN - XII -0.4371405 6.620094e-01 1.000000e+00
20   STR - XII -0.1955555 8.449581e-01 1.000000e+00
21   VTA - XII -2.8474318 4.407354e-03 9.255444e-02
```

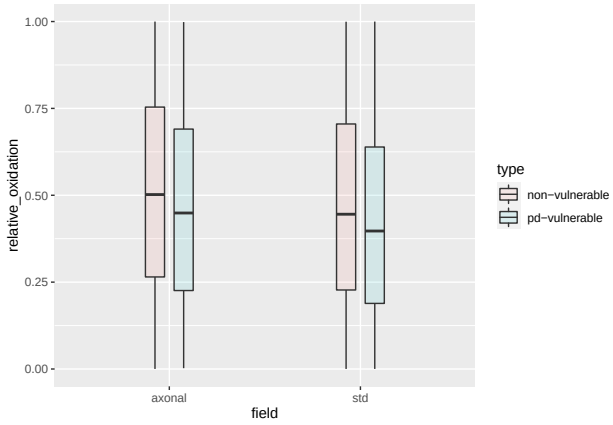
Estimation statistics




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  relative_oxidation

Unpaired mean difference of VTA (n = 1338) minus SN (n = 576)
 -0.0276 [95CI  -0.0548; 0.000542]

Unpaired mean difference of LC (n = 181) minus SN (n = 576)
 -0.00436 [95CI  -0.0521; 0.0415]

Unpaired mean difference of R (n = 308) minus SN (n = 576)
 0.059 [95CI  0.018; 0.0987]

Unpaired mean difference of DMV (n = 2233) minus SN (n = 576)
 -0.0782 [95CI  -0.103; -0.0525]

Unpaired mean difference of XII (n = 1052) minus SN (n = 576)
 0.00677 [95CI  -0.0235; 0.0352]
```

```
Unpaired mean difference of STR (n = 1148) minus SN (n = 576)
 0.00515 [95CI  -0.0237; 0.0334]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

Comparing axonal vs std (note - very small effect - significant)



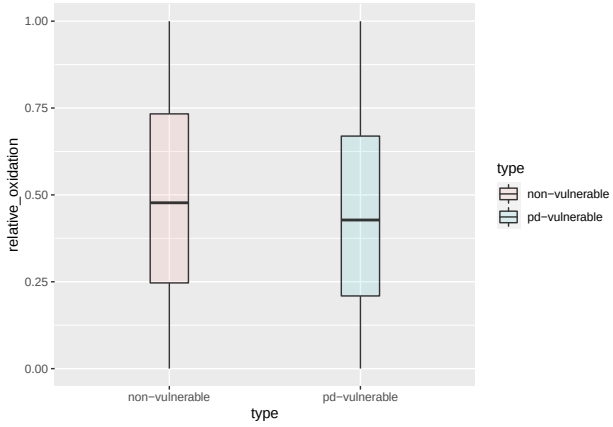
Welch Two Sample t-test - Axonal only

```
    Welch Two Sample t-test

data:  relative_oxidation by type
t = 4.0736, df = 3485, p-value = 4.732e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01993059 0.05691848
sample estimates:
mean in group non-vulnerable  mean in group pd-vulnerable
                   0.5063470                    0.4679225
```

Welch Two Sample t-test - STD only

```
    Welch Two Sample t-test

data:  relative_oxidation by type
t = 4.0736, df = 3485, p-value = 4.732e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01993059 0.05691848
sample estimates:
mean in group non-vulnerable  mean in group pd-vulnerable
                   0.5063470                    0.4679225
```

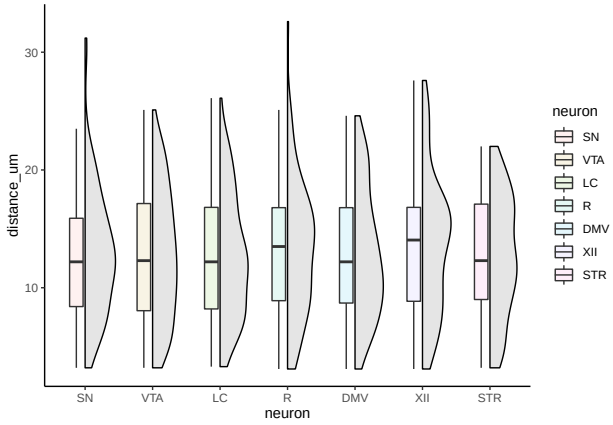
Comparing vulnerable vs non-vulnerable - significant by very small effect size



Welch Two Sample t-test

```
    Welch Two Sample t-test

data:  relative_oxidation by type
t = 6.016, df = 6820.1, p-value = 1.881e-09
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.02759581 0.05427272
sample estimates:
mean in group non-vulnerable  mean in group pd-vulnerable
                   0.4884508                    0.4475166
```

Distance between mitochondria from roGFP experiments

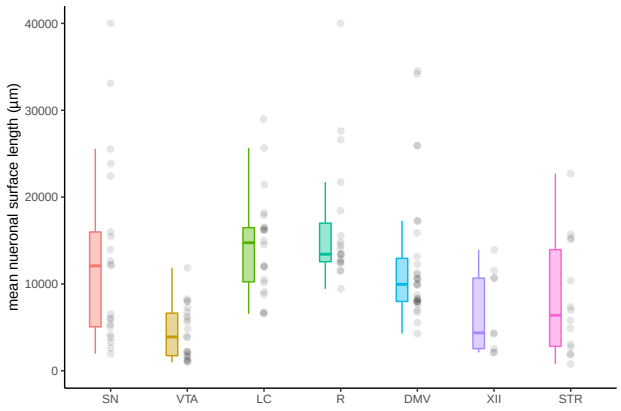


Supplimentary Tables n.n

Kurskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  distance_um by neuron
Kruskal-Wallis chi-squared = 1.4927, df = 6, p-value = 0.96
```

PD-vulnerable neurons have large axonal domains, that are globally more complex than PD-resilient neurons



Supplimentary Table n.n

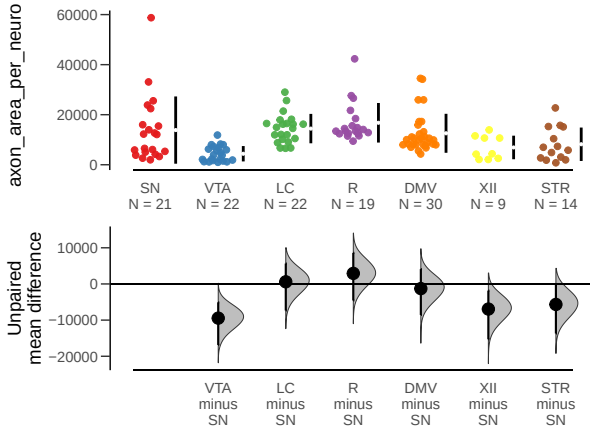
Kruskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  axon_area_per_neuron by neuron
Kruskal-Wallis chi-squared = 49.602, df = 6, p-value = 5.649e-09
```

Dunn

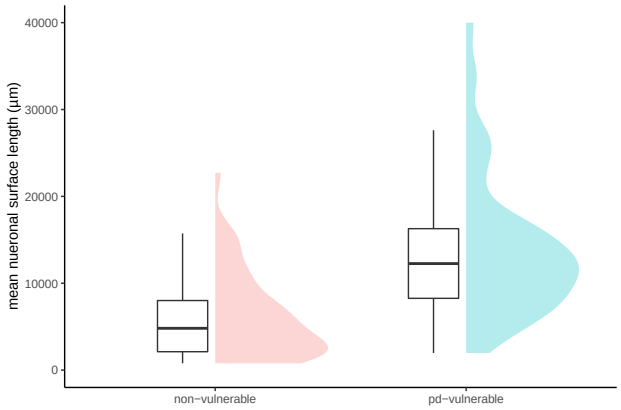
	Comparison	Z	P.unadj	P.adj
1	DMV - LC	-1.4910572	1.359465e-01	1.000000e+00
2	DMV - R	-2.1697753	3.002387e-02	6.305013e-01
3	LC - R	-0.6949384	4.870939e-01	1.000000e+00
4	DMV - SN	0.3799178	7.040065e-01	1.000000e+00
5	LC - SN	1.7261794	8.431515e-02	1.000000e+00
6	R - SN	2.3506380	1.874126e-02	3.935664e-01
7	DMV - STR	1.8240271	6.814798e-02	1.000000e+00
8	LC - STR	2.9510478	3.166979e-03	6.650657e-02
9	R - STR	3.4823377	4.970564e-04	1.043819e-02
10	SN - STR	1.3978009	1.621729e-01	1.000000e+00
11	DMV - VTA	4.2860413	1.818852e-05	3.819588e-04
12	LC - VTA	5.3781860	7.524006e-08	1.580041e-06
13	R - VTA	5.8726242	4.289502e-09	9.007953e-08
14	SN - VTA	3.5891017	3.318193e-04	6.968206e-03
15	STR - VTA	1.7920665	7.312232e-02	1.000000e+00
16	DMV - XII	1.8995788	5.748842e-02	1.000000e+00
17	LC - XII	2.8822979	3.947864e-03	8.290513e-02
18	R - XII	3.3562827	7.899777e-04	1.658953e-02
19	SN - XII	1.5407671	1.233735e-01	1.000000e+00
20	STR - XII	0.3079467	7.581229e-01	1.000000e+00
21	VTA - XII	-1.2158840	2.240291e-01	1.000000e+00

Estimation statistics



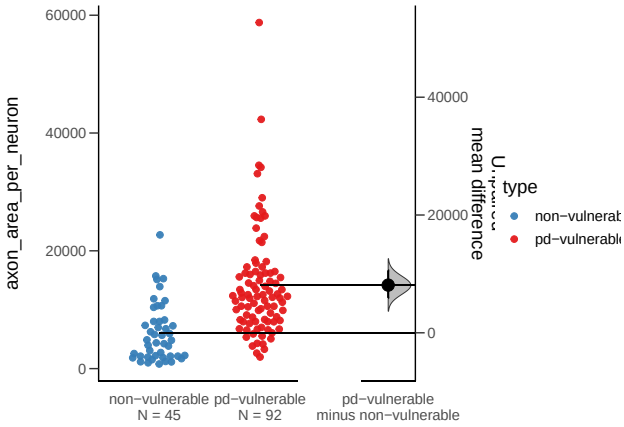

```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  axon_area_per_neuron

Unpaired mean difference of VTA (n = 22) minus SN (n = 21)
 -9450 [95CI  -16900; -5080]

Unpaired mean difference of LC (n = 22) minus SN (n = 21)
 595 [95CI  -7340; 5640]

Unpaired mean difference of R (n = 19) minus SN (n = 21)
 2920 [95CI  -4570; 8600]

Unpaired mean difference of DMV (n = 30) minus SN (n = 21)
 -1290 [95CI  -8570; 4100]

Unpaired mean difference of XII (n = 9) minus SN (n = 21)
 -6940 [95CI  -15300; -1850]

Unpaired mean difference of STR (n = 14) minus SN (n = 21)
 -5660 [95CI  -13700; -190]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

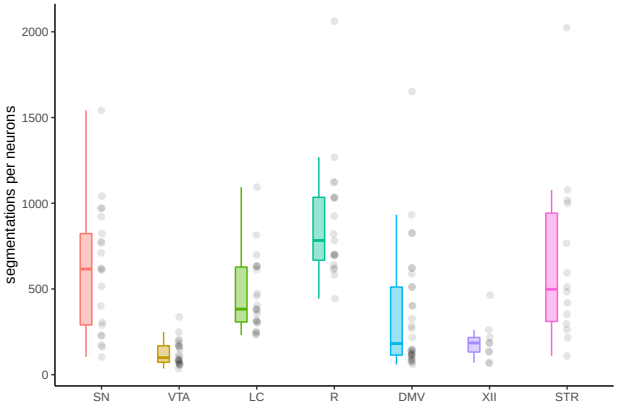
Grouped by vulnerable and non-vulnerable




```
    Wilcoxon rank sum test with continuity correction

data:  data$axon_area_per_neuron by data$type
W = 723, p-value = 6.78e-10
alternative hypothesis: true location shift is not equal to 0

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
================================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 9
  Count `Total Area` `Average Size` `%Area` neuron_number neuron
  <dbl>        <dbl>          <dbl>   <dbl>         <dbl> <fct>
1  1652        63087           38.2   0.394             1 DMV
2   814        53004           65.1   0.331             1 LC
3  1094        46894           42.9   0.293             1 LC
4  2062        77341           37.5   0.483             1 R
5   820        25720           31.4   0.161             1 R
# ... with 3 more variables: axon_area_per_neuron <dbl>,
#   count_per_neuron <dbl>, type <fct>

X Variable :  type
Y Variable :  axon_area_per_neuron

Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
================================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
```

```
Y Variable :  axon_area_per_neuron

Unpaired mean difference of pd-vulnerable (n = 92) minus non-vulnerable (n = 45)
 8100 [95CI  5930; 10600]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```





Kruskal-Wallis

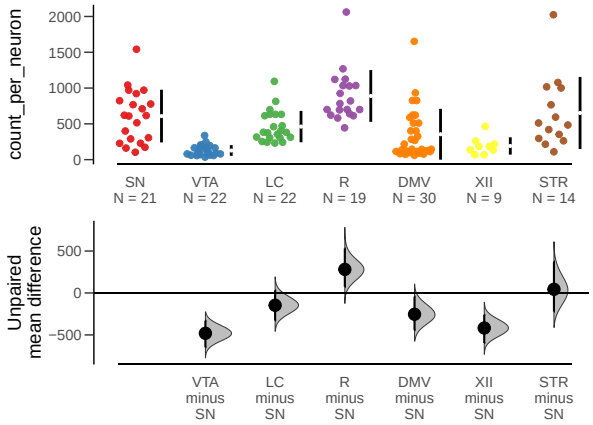
```
    Kruskal-Wallis rank sum test

data:  count_per_neuron by neuron
Kruskal-Wallis chi-squared = 67.386, df = 6, p-value = 1.403e-12
```

Dunn

```
   Comparison          Z      P.unadj        P.adj
1    DMV - LC -2.1117441 3.470840e-02 7.288765e-01
2     DMV - R -4.9124144 8.996166e-07 1.889195e-05
3      LC - R -2.7062408 6.804969e-03 1.429043e-01
4    DMV - SN -2.8158643 4.864621e-03 1.021570e-01
5     LC - SN -0.6831796 4.944934e-01 1.000000e+00
6      R - SN  2.0185955 4.352928e-02 9.141149e-01
```

```
7   DMV - STR -2.4474832 1.438578e-02 3.021014e-01
8    LC - STR -0.5833195 5.596782e-01 1.000000e+00
9     R - STR  1.8401285 6.574937e-02 1.000000e+00
10   SN - STR  0.0260784 9.791948e-01 1.000000e+00
11  DMV - VTA  2.7269895 6.391507e-03 1.342216e-01
12   LC - VTA  4.5046159 6.649311e-06 1.396355e-04
13    R - VTA  7.0429233 1.882478e-12 3.953204e-11
14   SN - VTA  5.1351081 2.819820e-07 5.921621e-06
15  STR - VTA  4.5560173 5.213265e-06 1.094786e-04
16  DMV - XII  1.1254594 2.603944e-01 1.000000e+00
17   LC - XII  2.5790534 9.907147e-03 2.080501e-01
18    R - XII  4.6164416 3.903759e-06 8.197894e-05
19   SN - XII  3.0845492 2.038609e-03 4.281079e-02
20  STR - XII  2.8552967 4.299664e-03 9.029294e-02
21  VTA - XII -0.8534673 3.934002e-01 1.000000e+00
```

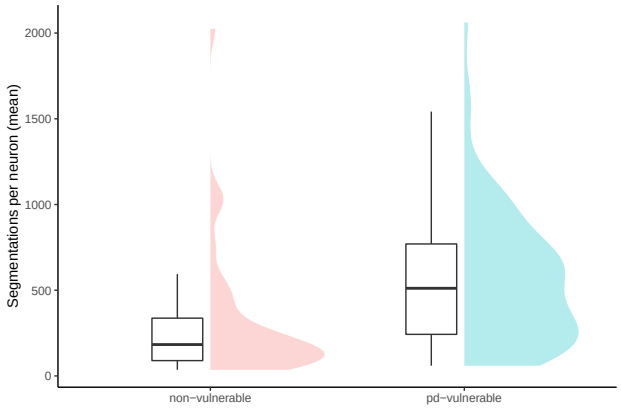
Estimation statistics




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  count_per_neuron

Unpaired mean difference of VTA (n = 22) minus SN (n = 21)
 -481 [95CI  -647; -330]

Unpaired mean difference of LC (n = 22) minus SN (n = 21)
 -147 [95CI  -329; 31]

Unpaired mean difference of R (n = 19) minus SN (n = 21)
 281 [95CI  73.5; 530]

Unpaired mean difference of DMV (n = 30) minus SN (n = 21)
 -254 [95CI  -443; -42.9]
```

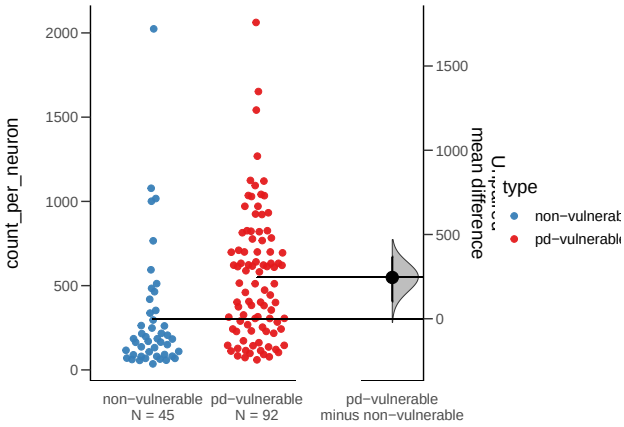
```
Unpaired mean difference of XII (n = 9) minus SN (n = 21)
 -417 [95CI  -596; -260]

Unpaired mean difference of STR (n = 14) minus SN (n = 21)
 43.9 [95CI  -222; 375]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

Grouped by type

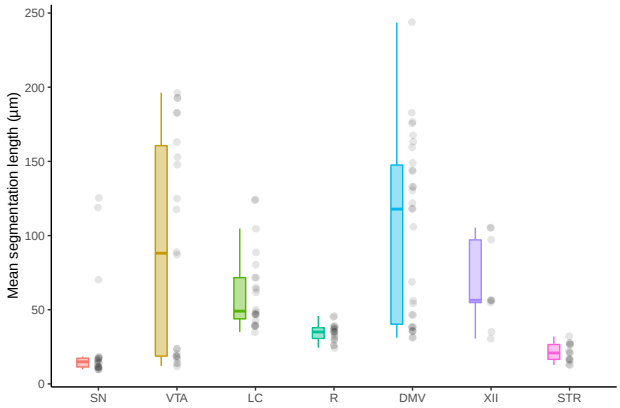



```
    Wilcoxon rank sum test with continuity correction

data:  data$count_per_neuron by data$type
W = 1068, p-value = 4.433e-06
alternative hypothesis: true location shift is not equal to 0

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 9
  Count `Total Area` `Average Size` `%Area` neuron_number neuron
  <dbl>        <dbl>          <dbl>   <dbl>         <dbl> <fct>
1  1652        63087           38.2   0.394             1 DMV
2   814        53004           65.1   0.331             1 LC
3  1094        46894           42.9   0.293             1 LC
4  2062        77341           37.5   0.483             1 R
5   820        25720           31.4   0.161             1 R
# ... with 3 more variables: axon_area_per_neuron <dbl>,
#   count_per_neuron <dbl>, type <fct>

X Variable :  type
Y Variable :  count_per_neuron
```

```
Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
Y Variable :  count_per_neuron

Unpaired mean difference of pd-vulnerable (n = 92) minus non-vulnerable (n = 45)
 245 [95CI  102; 368]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```



Average segmentation length (µm)



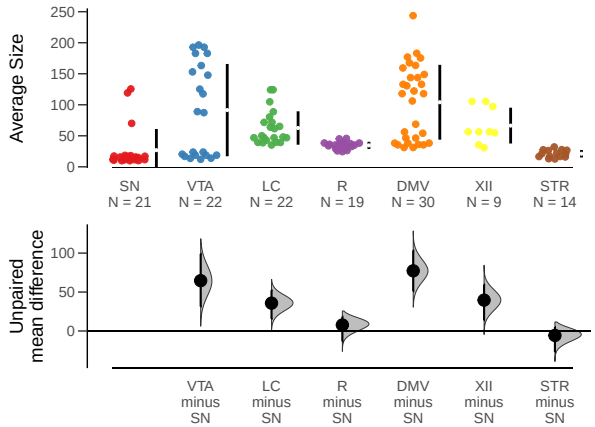
Kruskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  Average Size by neuron
Kruskal-Wallis chi-squared = 63.024, df = 6, p-value = 1.092e-11
```

Dunn

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	1.03059727	3.027297e-01	1.000000e+00
2	DMV - R	3.60998615	3.062134e-04	6.430480e-03
3	LC - R	2.45591123	1.405279e-02	2.951085e-01
4	DMV - SN	6.35795802	2.044533e-10	4.293520e-09
5	LC - SN	4.98130378	6.315730e-07	1.326303e-05
6	R - SN	2.37043094	1.776736e-02	3.731146e-01
7	DMV - STR	5.32207495	1.025903e-07	2.154396e-06
8	LC - STR	4.19242298	2.759908e-05	5.795807e-04
9	R - STR	1.88561118	5.934737e-02	1.000000e+00
10	SN - STR	-0.25035765	8.023108e-01	1.000000e+00
11	DMV - VTA	1.85882864	6.305143e-02	1.000000e+00
12	LC - VTA	0.77104145	4.406824e-01	1.000000e+00
13	R - VTA	-1.71361442	8.659956e-02	1.000000e+00
14	SN - VTA	-4.21928067	2.450830e-05	5.146743e-04
15	STR - VTA	-3.51242834	4.440317e-04	9.324666e-03
16	DMV - XII	0.81906785	4.127477e-01	1.000000e+00
17	LC - XII	0.05563405	9.556333e-01	1.000000e+00
18	R - XII	-1.84639479	6.483490e-02	1.000000e+00
19	SN - XII	-3.75914928	1.704921e-04	3.580334e-03
20	STR - XII	-3.30324274	9.557362e-04	2.007046e-02
21	VTA - XII	-0.53190012	5.947952e-01	1.000000e+00

Estimation statistics



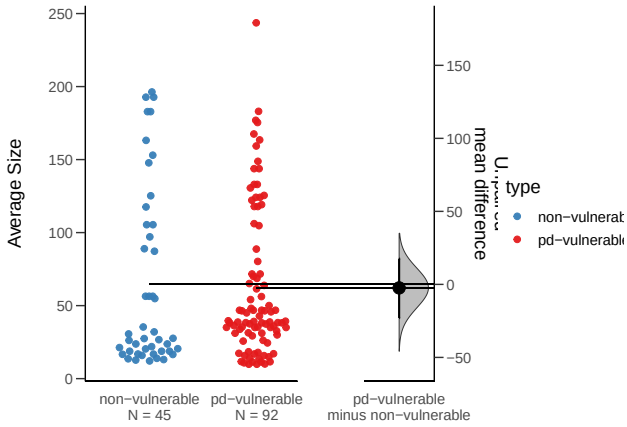

```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
```

```
X Variable :  neuron
Y Variable :  Average Size

Unpaired mean difference of VTA (n = 22) minus SN (n = 21)
 64.6 [95CI  31.4; 99.1]

Unpaired mean difference of LC (n = 22) minus SN (n = 21)
 35.8 [95CI  15.4; 52.3]

Unpaired mean difference of R (n = 19) minus SN (n = 21)
 7.73 [95CI  -13.3; 18.4]

Unpaired mean difference of DMV (n = 30) minus SN (n = 21)
 77.3 [95CI  50.9; 104]

Unpaired mean difference of XII (n = 9) minus SN (n = 21)
 39.6 [95CI  13.6; 59.7]

Unpaired mean difference of STR (n = 14) minus SN (n = 21)
 -5.7 [95CI  -27; 5.07]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

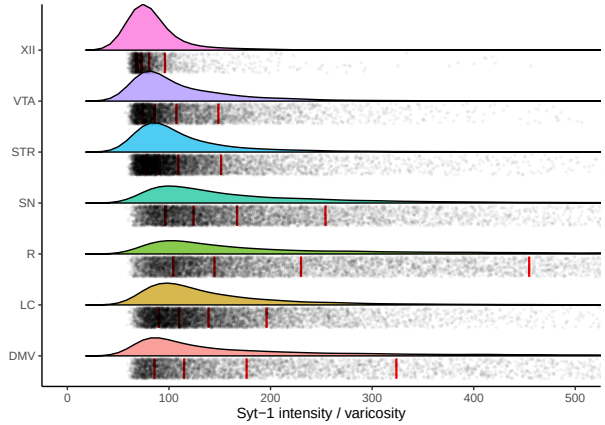
Comparing as groups

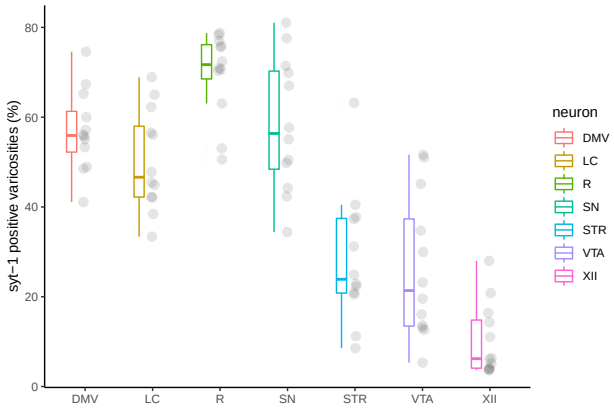
```
    Wilcoxon rank sum test with continuity correction

data:  data$`Average Size` by data$type
W = 1887, p-value = 0.4029
alternative hypothesis: true location shift is not equal to 0

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 9
  Count `Total Area` `Average Size` `%Area` neuron_number neuron
  <dbl>        <dbl>          <dbl>   <dbl>         <dbl> <fct>
1  1652        63087           38.2   0.394             1 DMV
2   814        53004           65.1   0.331             1 LC
3  1094        46894           42.9   0.293             1 LC
4  2062        77341           37.5   0.483             1 R
5   820        25720           31.4   0.161             1 R
# ... with 3 more variables: axon_area_per_neuron <dbl>,
#   count_per_neuron <dbl>, type <fct>

X Variable :  type
```

```
Y Variable :  Average Size

Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
=============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
Y Variable :  Average Size

Unpaired mean difference of pd-vulnerable (n = 92) minus non-vulnerable (n = 45)
 -2.4 [95CI  -23; 17.6]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```



PD-vulnerable neurons have a higher proportion of varicosities that are positive for Syt1





Supplimentary Table n.n

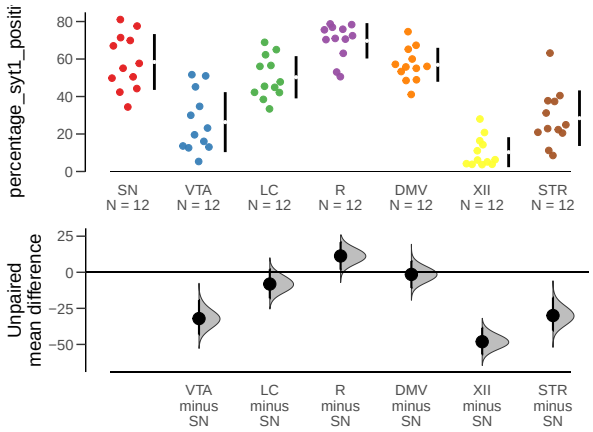
Kruskal-Wallis

```
    Kruskal-Wallis rank sum test

data:  percentage_syt1_positive by neuron
Kruskal-Wallis chi-squared = 59.589, df = 6, p-value = 5.456e-11
```

Dunn

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	0.8368274	4.026896e-01	1.000000e+00
2	DMV - R	-1.5062893	1.319929e-01	1.000000e+00
3	LC - R	-2.3431167	1.912340e-02	4.015914e-01
4	DMV - SN	-0.1422607	8.868741e-01	1.000000e+00
5	LC - SN	-0.9790881	3.275365e-01	1.000000e+00
6	R - SN	1.3640287	1.725585e-01	1.000000e+00
7	DMV - STR	3.0042104	2.662711e-03	5.591694e-02
8	LC - STR	2.1673830	3.020566e-02	6.343189e-01
9	R - STR	4.5104997	6.467508e-06	1.358177e-04
10	SN - STR	3.1464711	1.652536e-03	3.470326e-02
11	DMV - VTA	3.1632076	1.560410e-03	3.276861e-02
12	LC - VTA	2.3263802	1.999828e-02	4.199638e-01
13	R - VTA	4.6694969	3.019382e-06	6.340702e-05
14	SN - VTA	3.3054683	9.481784e-04	1.991175e-02
15	STR - VTA	0.1589972	8.736711e-01	1.000000e+00
16	DMV - XII	4.7197066	2.361851e-06	4.959887e-05
17	LC - XII	3.8828792	1.032269e-04	2.167764e-03
18	R - XII	6.2259959	4.785065e-10	1.004864e-08
19	SN - XII	4.8619672	1.162249e-06	2.440722e-05
20	STR - XII	1.7154962	8.625429e-02	1.000000e+00
21	VTA - XII	1.5564990	1.195895e-01	1.000000e+00

Estimation statistics

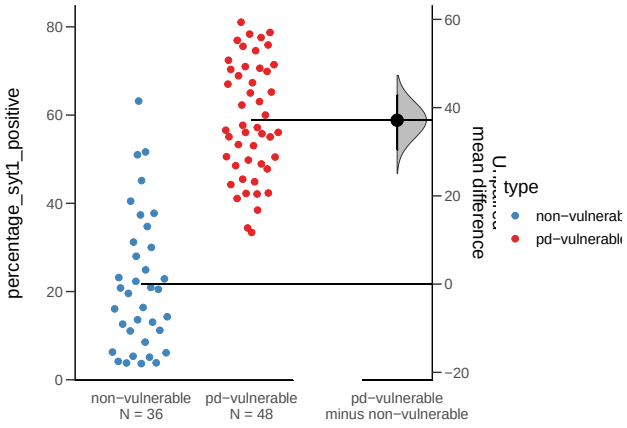


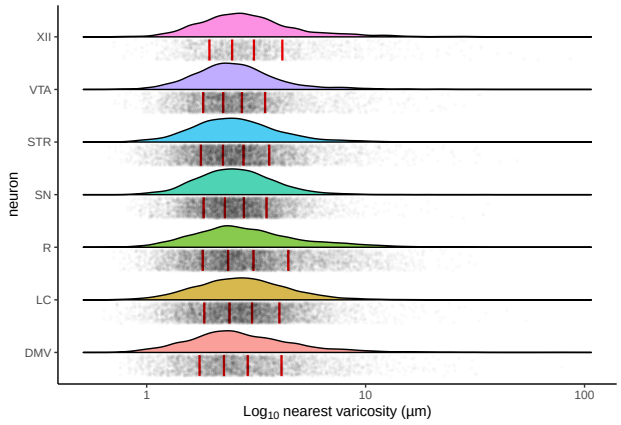

```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
=============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  percentage_syt1_positive

Unpaired mean difference of VTA (n = 12) minus SN (n = 12)
 -32.1 [95CI  -43.2; -19.3]

Unpaired mean difference of LC (n = 12) minus SN (n = 12)
 -8.15 [95CI  -18; 2.03]

Unpaired mean difference of R (n = 12) minus SN (n = 12)
 11.3 [95CI  1.79; 20.9]

Unpaired mean difference of DMV (n = 12) minus SN (n = 12)
 -1.49 [95CI  -10.9; 7.75]

Unpaired mean difference of XII (n = 12) minus SN (n = 12)
 -48.1 [95CI  -56.9; -38.5]

Unpaired mean difference of STR (n = 12) minus SN (n = 12)
 -30 [95CI  -40.4; -17.5]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

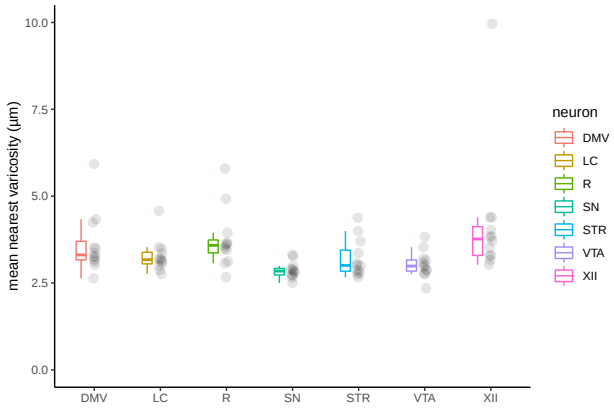
PD vs non-PD

```
    Wilcoxon rank sum exact test

data:  data_percentage_syt1_positive$percentage_syt1_positive by data_percentage_syt1_positive$type
W = 79, p-value = 2.941e-16
alternative hypothesis: true location shift is not equal to 0
```

```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 6
  neuron image  negative positive percentage_syt1_positive type
  <chr>  <chr>     <int>    <int>                     <dbl> <fct>
1 DMV    DMV_01      274      313                      53.3 pd-vulnerable
2 DMV    DMV_02      423      540                      56.1 pd-vulnerable
3 DMV    DMV_03      163      336                      67.3 pd-vulnerable
4 DMV    DMV_04      185      247                      57.2 pd-vulnerable
5 DMV    DMV_05      180      227                      55.8 pd-vulnerable

X Variable :  type
Y Variable :  percentage_syt1_positive

Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
Y Variable :  percentage_syt1_positive

Unpaired mean difference of pd-vulnerable (n = 48) minus non-vulnerable (n = 36)
 37.1 [95CI  30.4; 42.9]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```







Kruskal-Wallis

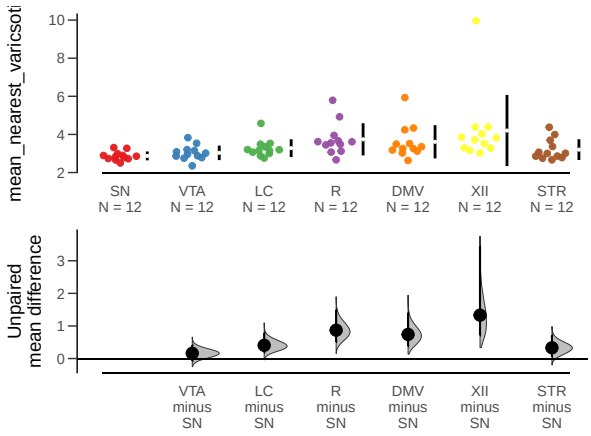
```
    Kruskal-Wallis rank sum test

data:  mean_nearest_varicsotiey by neuron
Kruskal-Wallis chi-squared = 28.368, df = 6, p-value = 8.011e-05
```

Dunn

	Comparison	Z	P.unadj	P.adj
1	DMV - LC	0.8703005	3.841362e-01	1.0000000000
2	DMV - R	-0.5941475	5.524135e-01	1.0000000000
3	LC - R	-1.4644480	1.430716e-01	1.0000000000
4	DMV - SN	3.1297345	1.749644e-03	0.0367425146
5	LC - SN	2.2594340	2.385640e-02	0.5009844259
6	R - SN	3.7238820	1.961827e-04	0.0041198361
7	DMV - STR	1.5732355	1.156643e-01	1.0000000000
8	LC - STR	0.7029350	4.820962e-01	1.0000000000
9	R - STR	2.1673830	3.020566e-02	0.6343189291
10	SN - STR	-1.5564990	1.195895e-01	1.0000000000
11	DMV - VTA	2.0334906	4.200298e-02	0.8820626214
12	LC - VTA	1.1631901	2.447524e-01	1.0000000000
13	R - VTA	2.6276381	8.597994e-03	0.1805578807
14	SN - VTA	-1.0962439	2.729721e-01	1.0000000000
15	STR - VTA	0.4602551	6.453331e-01	1.0000000000
16	DMV - XII	-1.2133997	2.249770e-01	1.0000000000
17	LC - XII	-2.0837002	3.718744e-02	0.7809362753

```
18    R - XII -0.6192523 5.357502e-01 1.0000000000
19   SN - XII -4.3431343 1.404642e-05 0.0002949749
20  STR - XII -2.7866353 5.325838e-03 0.1118426079
21  VTA - XII -3.2468903 1.166733e-03 0.0245013998
```

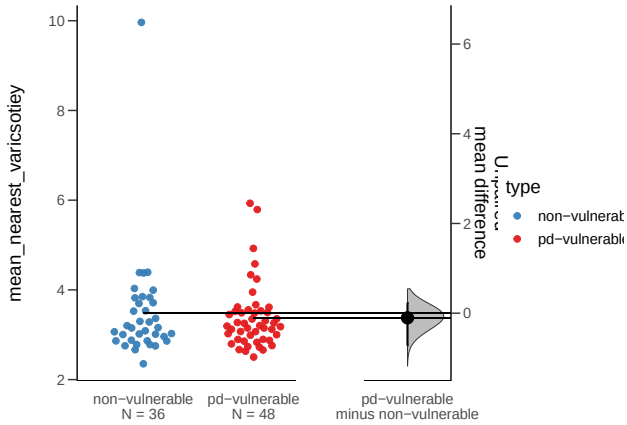
Estimation Statistics

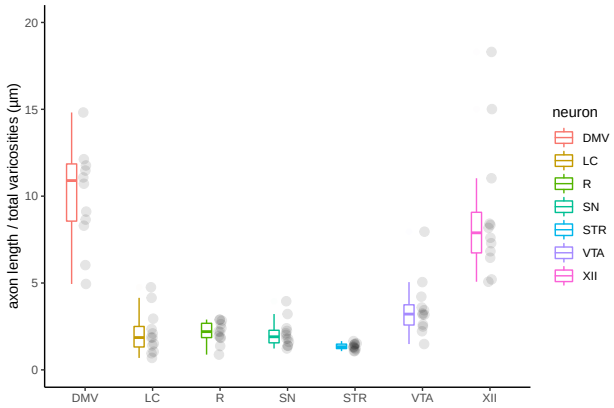



```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  mean_nearest_varicsotiey

Unpaired mean difference of VTA (n = 12) minus SN (n = 12)
 0.162 [95CI  -0.0767; 0.415]

Unpaired mean difference of LC (n = 12) minus SN (n = 12)
 0.406 [95CI  0.183; 0.789]

Unpaired mean difference of R (n = 12) minus SN (n = 12)
 0.871 [95CI  0.507; 1.5]

Unpaired mean difference of DMV (n = 12) minus SN (n = 12)
 0.74 [95CI  0.375; 1.41]

Unpaired mean difference of XII (n = 12) minus SN (n = 12)
 1.33 [95CI  0.708; 3.44]

Unpaired mean difference of STR (n = 12) minus SN (n = 12)
 0.331 [95CI  0.0556; 0.717]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

PD-vulnerable vs Non-vulnerable

```
    Wilcoxon rank sum exact test

data:  mean_varicosity_nn_length$mean_nearest_varicsotiey by mean_varicosity_nn_length$type
W = 875, p-value = 0.9248
alternative hypothesis: true location shift is not equal to 0

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 5
  neuron image  mean_nearest_varicsotiey     n type
  <chr>  <chr>                     <dbl> <int> <fct>
1 DMV    DMV_01                     3.12   587 pd-vulnerable
2 DMV    DMV_02                     2.63   963 pd-vulnerable
3 DMV    DMV_03                     3.25   499 pd-vulnerable
4 DMV    DMV_04                     3.52   432 pd-vulnerable
5 DMV    DMV_05                     3.26   407 pd-vulnerable

X Variable :  type
Y Variable :  mean_nearest_varicsotiey

Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
Y Variable :  mean_nearest_varicsotiey

Unpaired mean difference of pd-vulnerable (n = 48) minus non-vulnerable (n = 36)
 -0.104 [95CI  -0.722; 0.231]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```





Kruskal-Wallis

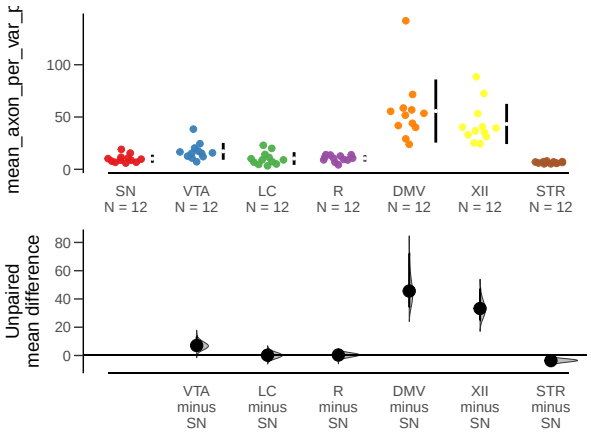
```
    Kruskal-Wallis rank sum test

data:  mean_axon_per_var_px by neuron
Kruskal-Wallis chi-squared = 62.576, df = 6, p-value = 1.346e-11
```

Dunn

```
   Comparison          Z      P.unadj        P.adj
1    DMV - LC  4.6611287 3.144800e-06 6.604081e-05
2     DMV - R  4.1506639 3.315122e-05 6.961756e-04
3      LC - R -0.5104647 6.097259e-01 1.000000e+00
4    DMV - SN  4.4519218 8.510516e-06 1.787208e-04
5     LC - SN -0.2092069 8.342868e-01 1.000000e+00
6      R - SN  0.3012579 7.632179e-01 1.000000e+00
7   DMV - STR  6.1255766 9.035577e-10 1.897471e-08
8    LC - STR  1.4644480 1.430716e-01 1.000000e+00
9     R - STR  1.9749127 4.827806e-02 1.000000e+00
10   SN - STR  1.6736548 9.419846e-02 1.000000e+00
11  DMV - VTA  2.5857967 9.715422e-03 2.040239e-01
12   LC - VTA -2.0753320 3.795578e-02 7.970713e-01
13    R - VTA -1.5648673 1.176140e-01 1.000000e+00
14   SN - VTA -1.8661251 6.202386e-02 1.000000e+00
15  STR - VTA -3.5397799 4.004608e-04 8.409677e-03
16  DMV - XII  0.4602551 6.453331e-01 1.000000e+00
17   LC - XII -4.2008736 2.658870e-05 5.583627e-04
```

```
18    R - XII -3.6904089 2.238939e-04 4.701772e-03
19   SN - XII -3.9916667 6.561053e-05 1.377821e-03
20  STR - XII -5.6653216 1.467491e-08 3.081731e-07
21  VTA - XII -2.1255416 3.354145e-02 7.043703e-01
```

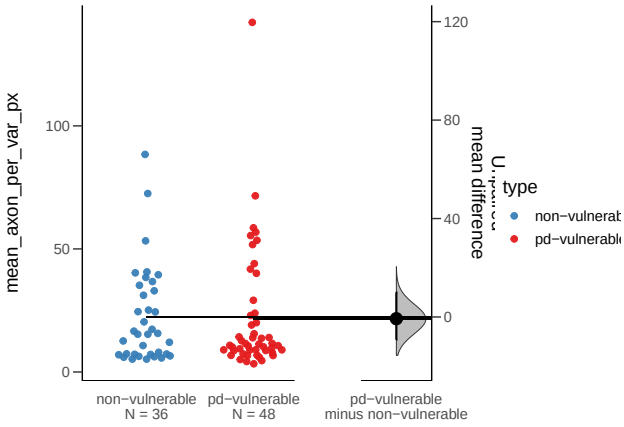
Estimation Statistics




```
dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
==============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  neuron
Y Variable :  mean_axon_per_var_px

Unpaired mean difference of VTA (n = 12) minus SN (n = 12)
 7.05 [95CI  3.24; 13.3]

Unpaired mean difference of LC (n = 12) minus SN (n = 12)
 0.197 [95CI  -3.3; 4.45]

Unpaired mean difference of R (n = 12) minus SN (n = 12)
 0.326 [95CI  -2.72; 2.68]

Unpaired mean difference of DMV (n = 12) minus SN (n = 12)
 45.6 [95CI  34.2; 72.2]

Unpaired mean difference of XII (n = 12) minus SN (n = 12)
 33.2 [95CI  24.8; 47.4]

Unpaired mean difference of STR (n = 12) minus SN (n = 12)
 -3.62 [95CI  -6.41; -1.89]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```

PD-vulnerable vs Non-vulnerable

```
    Wilcoxon rank sum exact test

data:  mean_varicosity_lengthpervar_length$mean_axon_per_var_px by mean_varicosity_lengthpervar_length$
W = 917, p-value = 0.6369
alternative hypothesis: true location shift is not equal to 0

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
The first five rows are:
# A tibble: 5 x 5
  neuron image  mean_axon_per_var_px     n type
  <chr>  <chr>                 <dbl> <int> <fct>
1 DMV    DMV_01                 41.8   587 pd-vulnerable
2 DMV    DMV_02                 29.1   963 pd-vulnerable
3 DMV    DMV_03                 44.0   499 pd-vulnerable
4 DMV    DMV_04                 58.6   432 pd-vulnerable
5 DMV    DMV_05                 23.9   407 pd-vulnerable

X Variable :  type
Y Variable :  mean_axon_per_var_px

Effect sizes(s) will be computed for:
  1. pd-vulnerable minus non-vulnerable

dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0
============================================================

Good evening!
The current time is 20:01 pm on Tuesday January 25, 2022.

Dataset    :  .
X Variable :  type
Y Variable :  mean_axon_per_var_px

Unpaired mean difference of pd-vulnerable (n = 48) minus non-vulnerable (n = 36)
 -0.694 [95CI  -9.26; 10]


5000 bootstrap resamples.
All confidence intervals are bias-corrected and accelerated.
```


mean_axon_per_var_px
100
50
0
120
80
40
0
mean difference
type
non−vulnerab
pd−vulnerable
non−vulnerable
N = 36
pd−vulnerable
N = 48
pd−vulnerable
minus non−vulnerable