

main

July 23, 2021

1 Cell deconvolution comparison and quality control

Performed by Louise Huuki

```
[1]: library(tidyverse)
library(ggpubr)
```

Attaching packages tidyverse
1.3.1

ggplot2	3.3.5	purrr	0.3.4
tibble	3.1.2	dplyr	1.0.7
tidyr	1.1.3	stringr	1.4.0
readr	1.4.0	forcats	0.5.1

Conflicts
tidyverse_conflicts()
dplyr::filter() masks stats::filter()
dplyr::lag() masks stats::lag()

1.1 Functions

```
[2]: get_pheno <- function(){
  df = data.table::fread("/ceph/projects/v4_phase3_paper/inputs/phenotypes/_m/
  ↪merged_phenotypes.csv") %>%
    filter(Dx %in% c("SZ", "CTL"), Age > 17)
  return(df)
}

memPHENO <- memoise::memoise(get_pheno)

save_img <- function(image, fn, w, h){
  for(ext in c(".svg", ".pdf", ".png")){
    ggsave(file=paste0(fn, ext), plot=image, width=w, height=h)
  }
}
```

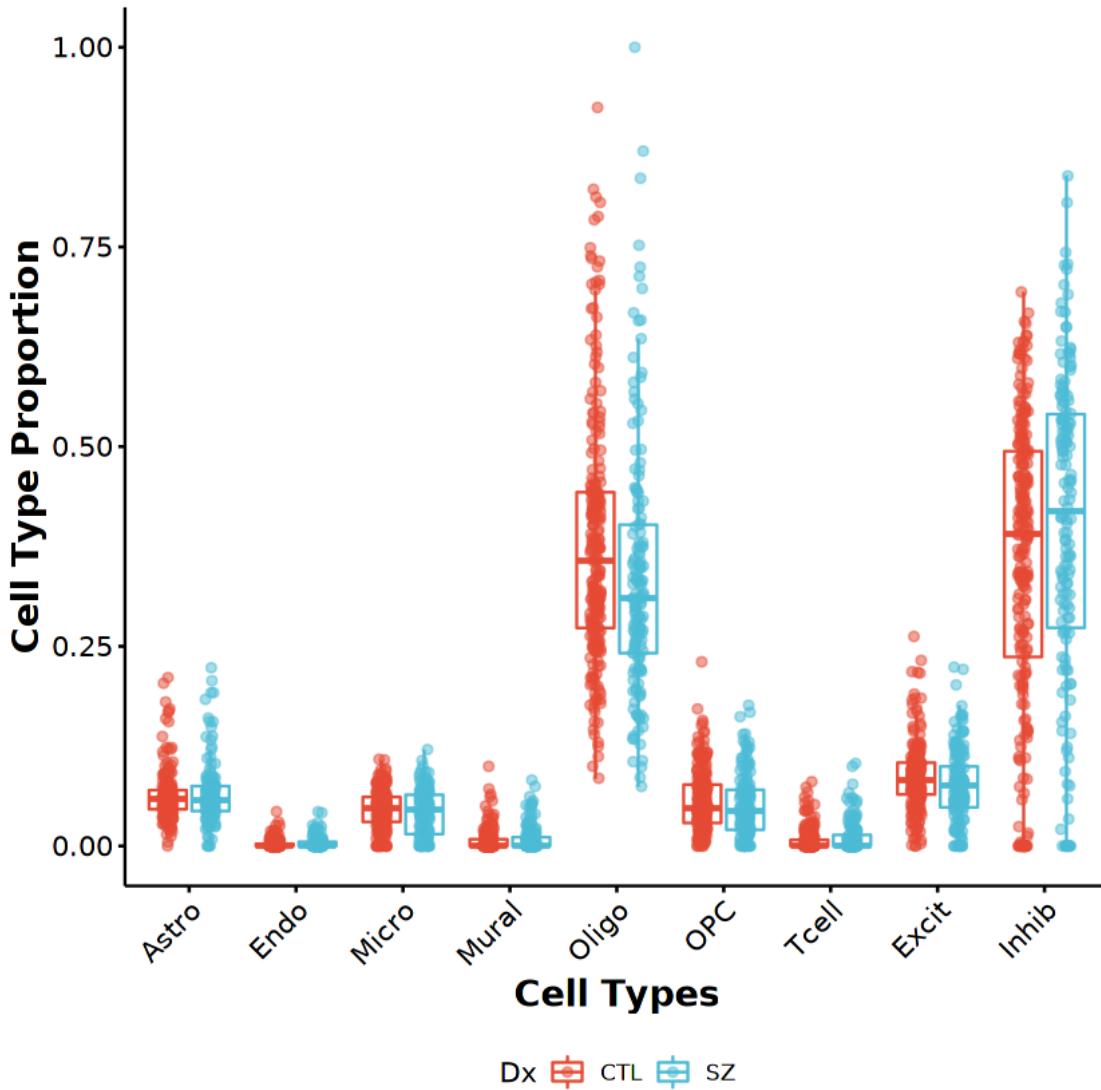
1.2 Prepare data

```
[3]: load("../_h/est_prop_Bisque.Rdata")  
  
[4]: df = est_prop_bisque$caudate$Est.prop.long %>%  
  inner_join(memPHENO(), by=c("sample"="RNum")) %>%  
  mutate_if(is.character, as.factor) %>%  
  rename("Proportion"="prop")  
df[1:2, 1:10]
```

A data.frame: 2 × 10	sample	cell_type	Proportion	Sex	Race	Dx	Age	mitoRate	rR
	<fct>	<fct>	<dbl>	<fct>	<fct>	<fct>	<dbl>	<dbl>	<dbl>
1	R12864	Astro	0.07995174	Female	AA	SZ	42.98	0.03265387	8.6
2	R12865	Astro	0.03964055	Male	AA	SZ	53.12	0.01978740	6.9

1.3 Cell type proportion plots

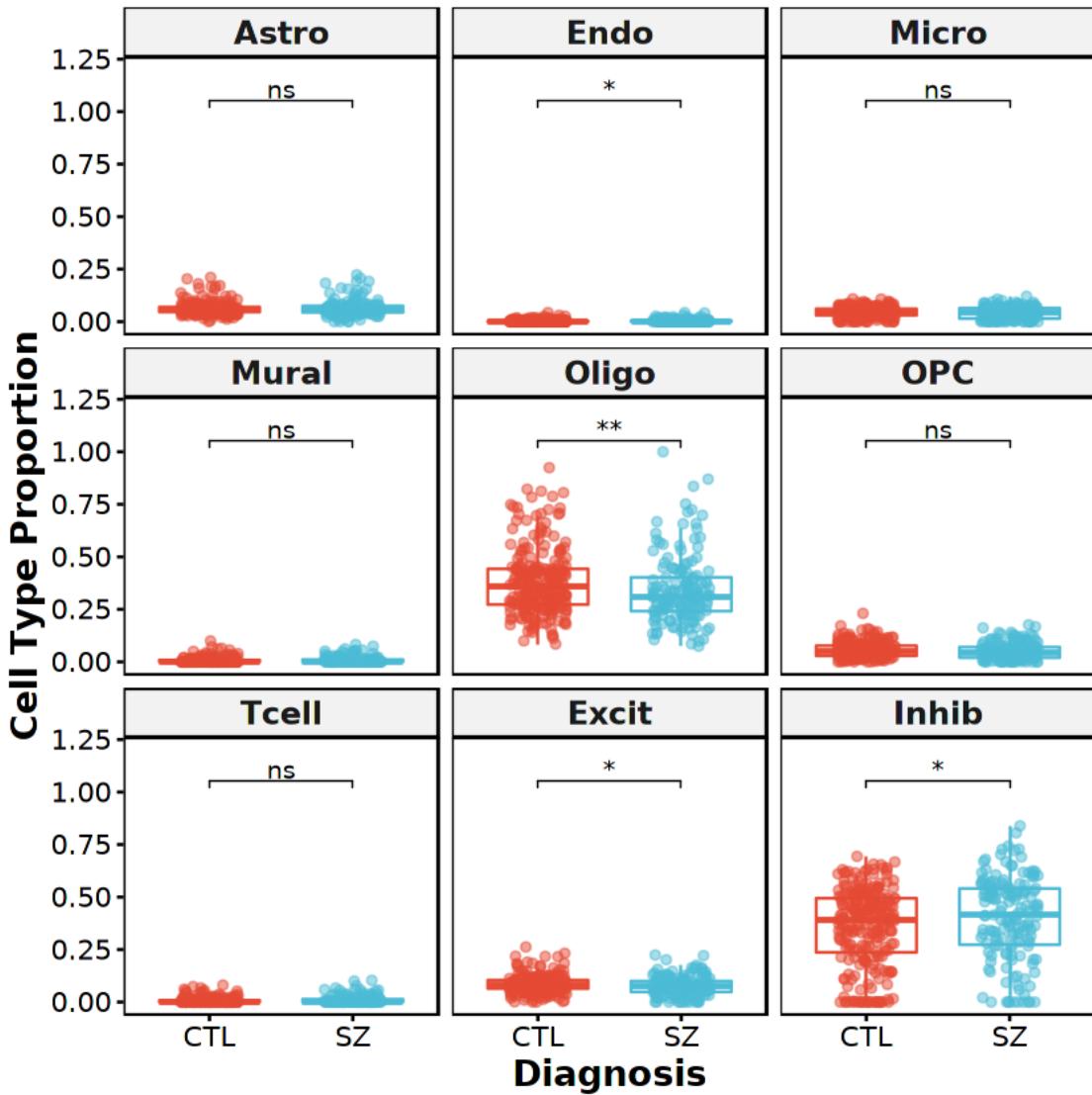
```
[5]: bxp = df %>% ggboxplot(x="cell_type", y="Proportion", color="Dx", #facet.  
  ↪by="Cell_Type",  
  panel.labs.font=list(face='bold', size = 14), palette="npg",  
  outlier.shape=NA, ylab='Cell Type Proportion', add='jitter',  
  add.params=list(alpha=0.5), ylim=c(0, 1), xlab="Cell Types",  
  legend="bottom") +  
  font("xy.text", size=12) + font("xy.title", size=16, face="bold") +  
  rotate_x_text(45)  
print(bxp)  
save_img(bxp, paste0("boxplot_celltypes_dx"), w=7, h=6)
```



```
[6]: bxp = df %>% ggboxplot(x="Dx", y="Proportion", color="Dx", facet.by="cell_type",
  panel.labs.font=list(face='bold', size = 14), palette="npg",
  outlier.shape=NA, ylab='Cell Type Proportion', add='jitter',
  add.params=list(alpha=0.5), ylim=c(0, 1.2), ncol=3,
  xlab="Diagnosis", legend="None") +
  stat_compare_means(comparisons=list(c("CTL", "SZ"))), aes(label=..p.signif..
  →),
  method="wilcox.test") +
  font("xy.text", size=12) + font("xy.title", size=16, face="bold")
print(bxp)
save_img(bxp, paste0("boxplot_dxBYcelltype"), w=7, h=6)
```

Warning message:

"Using `as.character()`` on a quosure is deprecated as of rlang 0.3.0.
Please use `as_label()` or `as_name()` instead.
This warning is displayed once per session."



1.4 Quality control

```
[7]: celltypes = unique(est_prop_bisque$caudate$Est.prop.long$cell_type)
```

1.4.1 Normalized data

```
[8]: load("/ceph/projects/v4_phase3_paper/analysis/differential_expression/_m/genes/
        ↪voomSVA.RData")
norm_df = v$E %>% t
pca_df1 = prcomp(norm_df, center=TRUE)$x

norm_dt = pca_df1 %>% as.data.frame %>% rownames_to_column("sample") %>%
    select(c(sample, PC1, PC2, PC3, PC4, PC5)) %>%
    pivot_longer(-sample, names_to="PC", values_to="PC_values") %>%
    mutate_if(is.character, as.factor)
norm_dt %>% head(2)
```

Loading required package: limma

	sample	PC	PC_values
A tibble: 2 × 3	<fct>	<fct>	<dbl>
R12864	PC1		-35.34084
R12864	PC2		30.02432

1.4.2 Residualized data

```
[9]: res_df = data.table::fread(paste0("/ceph/projects/v4_phase3_paper/analysis/",
                                         "differential_expression/_m/genes/
                                         ↪residualized_expression.tsv")) %>%
    column_to_rownames("V1") %>% t
pca_df2 = prcomp(res_df, center=TRUE)$x

res_dt = pca_df2 %>% as.data.frame %>% rownames_to_column("sample") %>%
    select(c(sample, PC1, PC2, PC3, PC4, PC5)) %>%
    pivot_longer(-sample, names_to="PC", values_to="PC_values") %>%
    mutate_if(is.character, as.factor)
res_dt %>% head(2)
```

Warning message in
data.table::fread(paste0("/ceph/projects/v4_phase3_paper/analysis/", :
"Detected 393 column names but the data has 394 columns (i.e. invalid file).
Added 1 extra default column name for the first column which is guessed to be
row names or an index. Use setnames() afterwards if this guess is not correct,
or fix the file write command that created the file to create a valid file."

	sample	PC	PC_values
A tibble: 2 × 3	<fct>	<fct>	<dbl>
R12864	PC1		-0.2076714
R12864	PC2		57.5667551

1.4.3 Plot scatter for cell types

```
[10]: dir.create("quality_control")  
  
[11]: options(repr.plot.width=18, repr.plot.height=6)  
for(ct in celltypes){  
  flush.console()  
  print(ct)  
  ## Normalized  
  sca = norm_dt %>% inner_join(df, by="sample") %>% filter(cell_type == ct) %>%  
  ggscatter(y="PC_values", x="Proportion", color="Dx", facet.by=c('PC'), ncol=5,  
            add='reg.line', conf.int=TRUE, cor.coef=TRUE, palette="npg",  
            xlab=paste(ct, "Proportion"), ylab="Normalized Expression",  
            panel.labs.font=list(face='bold', size = 14),  
            add.params=list(color="blue", fill="lightgray")) +  
            font("xy.text", size=12) + font("xy.title", size=16, face="bold")  
  save_img(sca, paste0("quality_control/scatter_log2cpm_dx_5pcs_",ct), w=18, h=6)  
  print(sca)  
  ## Residualized  
  sca = res_dt %>% inner_join(df, by="sample") %>% filter(cell_type == ct) %>%  
  ggscatter(y="PC_values", x="Proportion", color="Dx", facet.by=c('PC'), ncol=5,  
            add='reg.line', conf.int=TRUE, cor.coef=TRUE, palette="npg",  
            xlab=paste(ct, "Proportion"), ylab="Residualized Expression",  
            panel.labs.font=list(face='bold', size = 14),  
            add.params=list(color="blue", fill="lightgray")) +  
            font("xy.text", size=12) + font("xy.title", size=16, face="bold")  
  save_img(sca, paste0("quality_control/scatter_resdf_dx_5pcs_",ct), w=18, h=6)  
  print(sca)  
}  
  
[1] "Astro"  
`geom_smooth()` using formula 'y ~ x'  
`geom_smooth()` using formula 'y ~ x'
```

```
`geom_smooth()` using formula 'y ~ x'
```

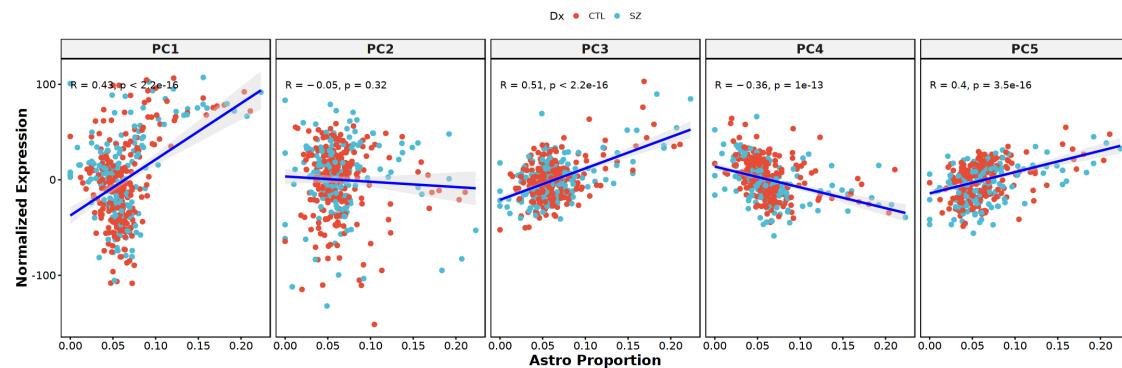
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Endo"
```

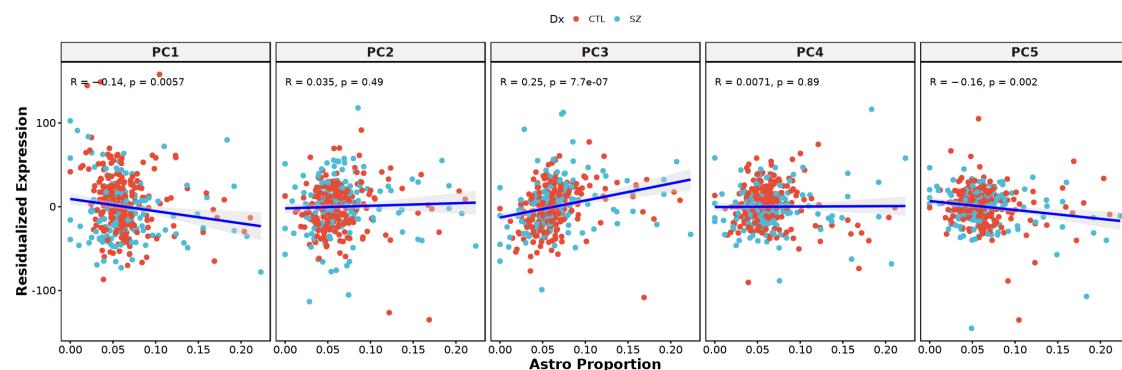
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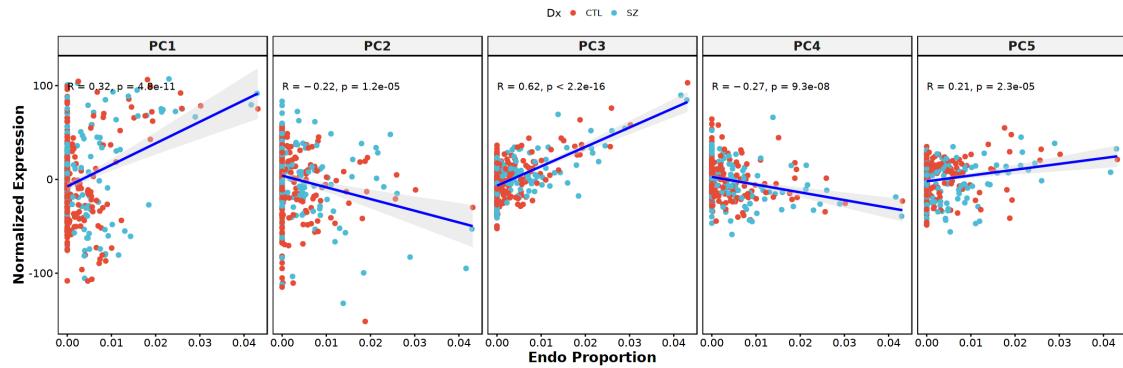
```
`geom_smooth()` using formula 'y ~ x'
```

[1] "Micro"

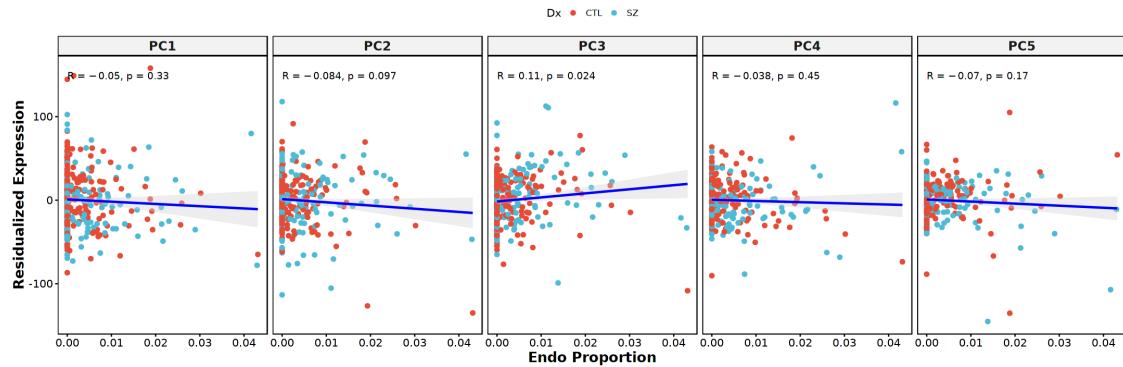
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`geom_smooth()` using formula 'y ~ x'
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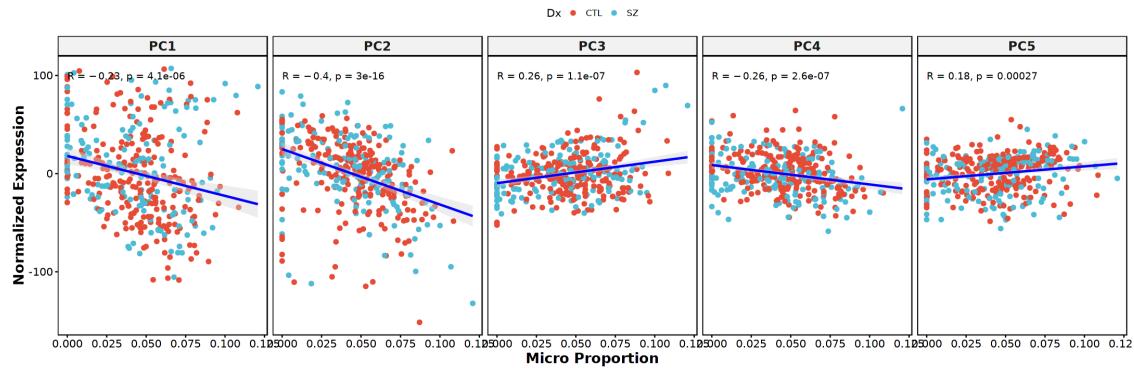
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Mural"
```

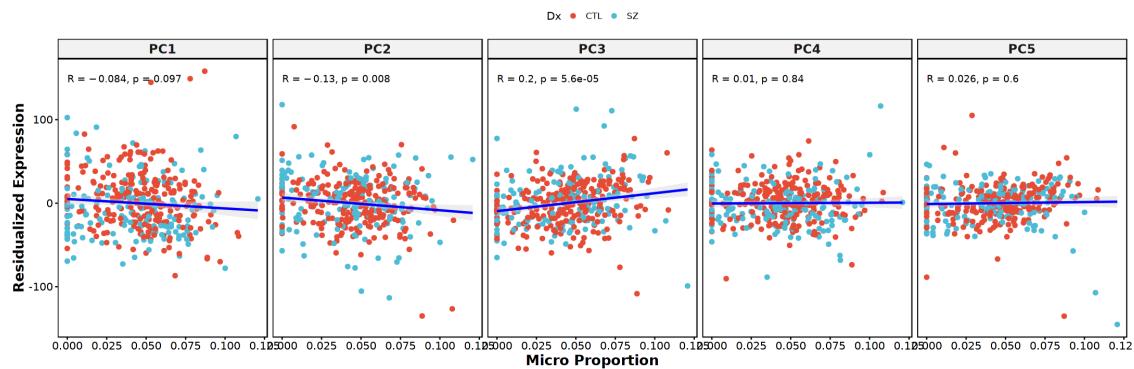
```
`geom_smooth()` using formula 'y ~ x'
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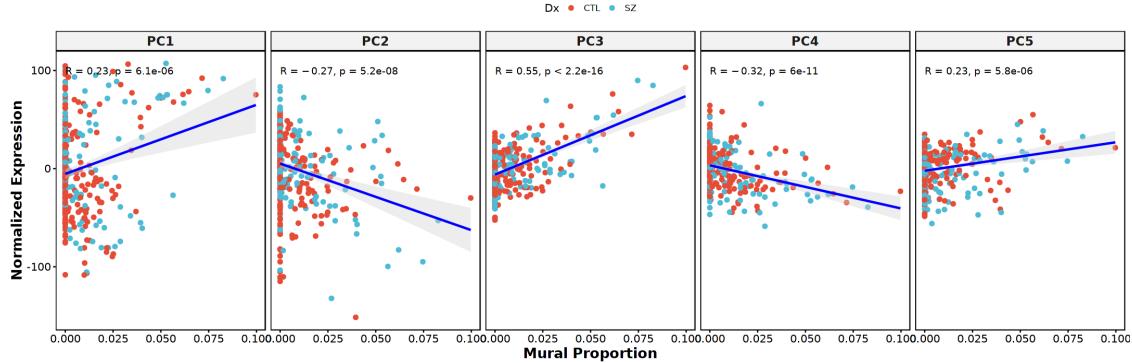
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Oligo"
```

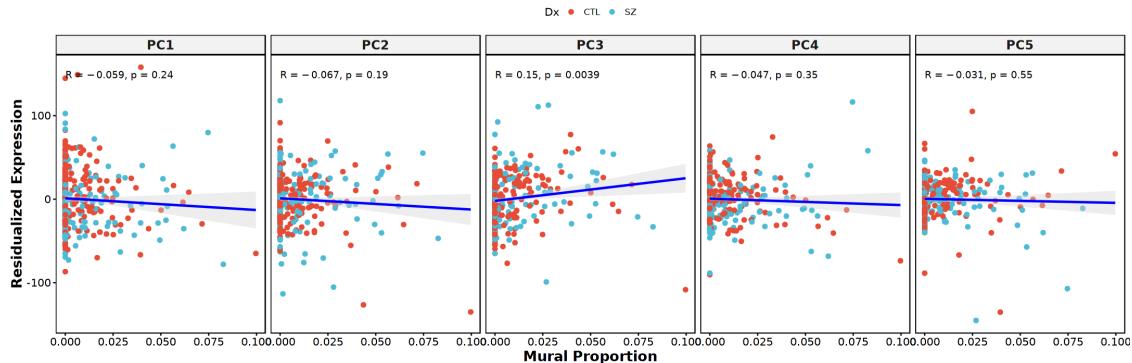
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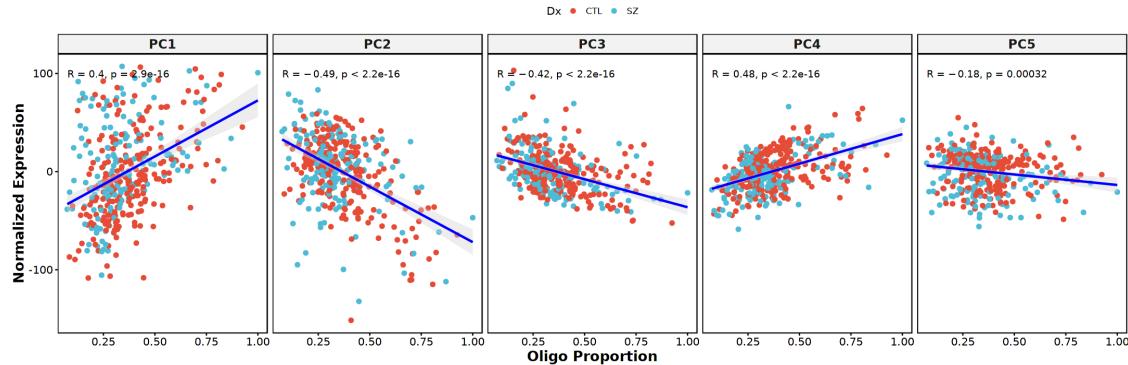
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "OPC"
```

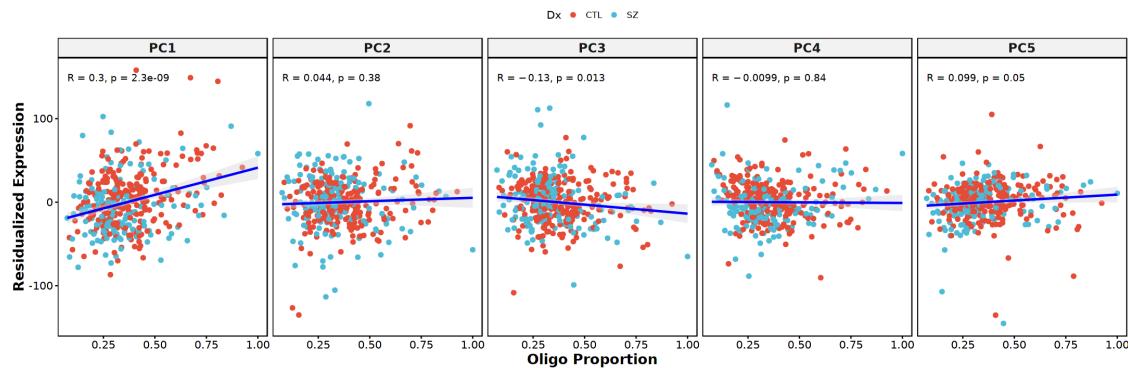
```
`geom_smooth()` using formula 'y ~ x'
```

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`geom_smooth()` using formula 'y ~ x'
```



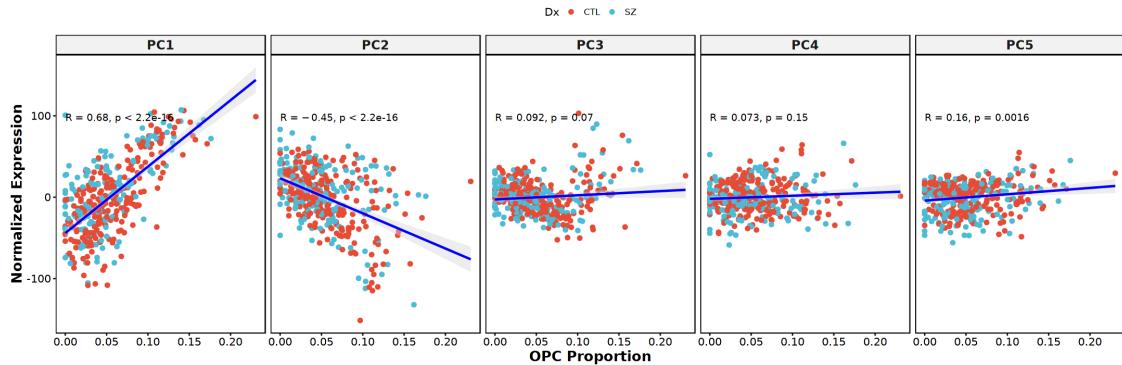
```
`geom_smooth()` using formula 'y ~ x'
```



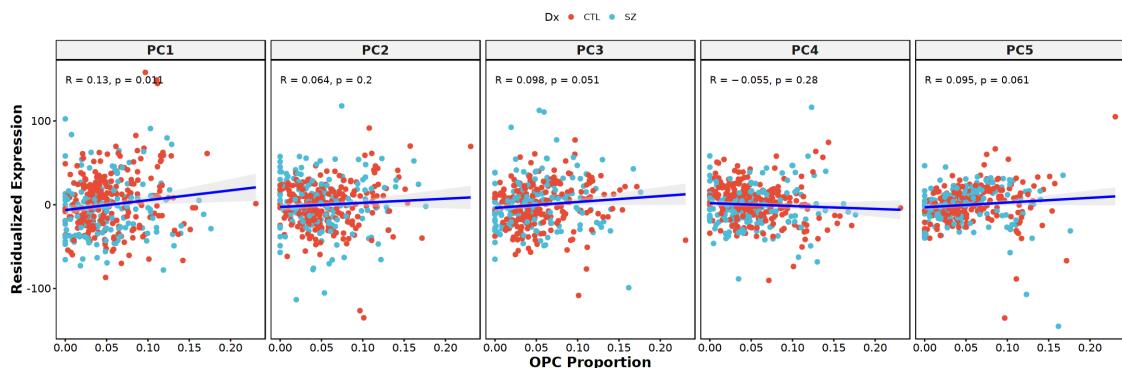
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Tcell"
```

```
`geom_smooth()` using formula 'y ~ x'  
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```



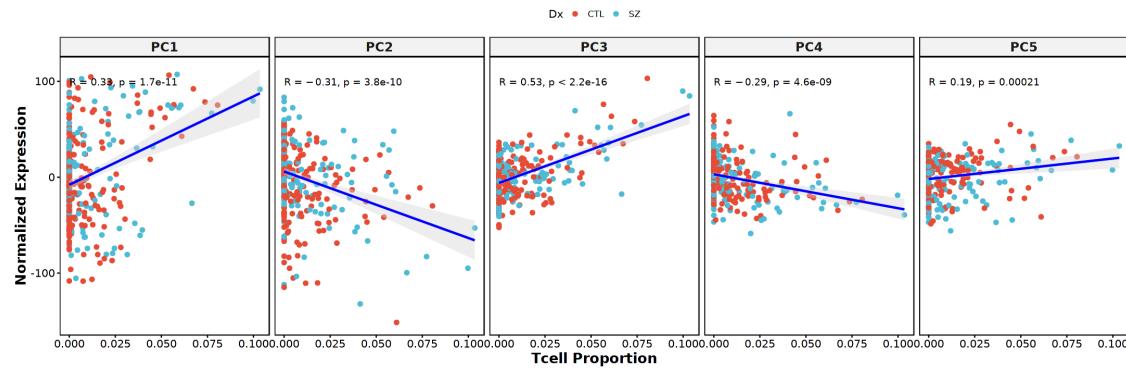
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`geom_smooth()` using formula 'y ~ x'  
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```



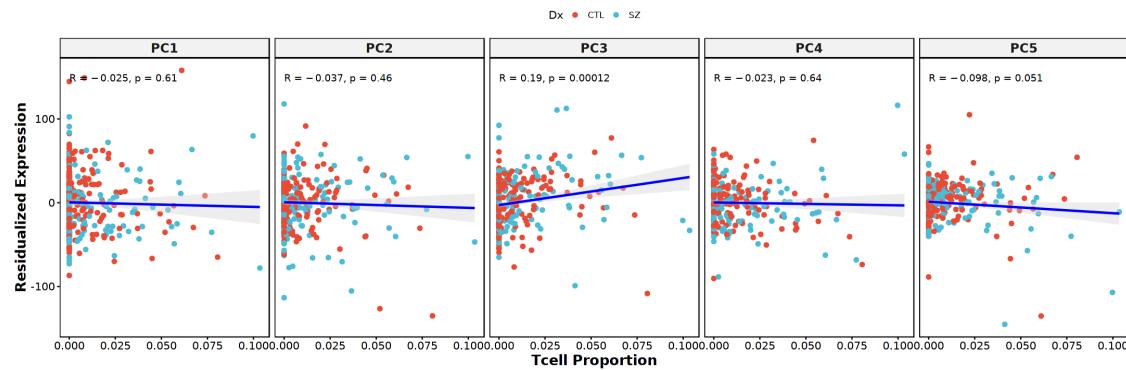
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`geom_smooth()` using formula 'y ~ x'  
[1] "Excit"  
`geom_smooth()` using formula 'y ~ x'
```

```
`geom_smooth()` using formula 'y ~ x'
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```
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```



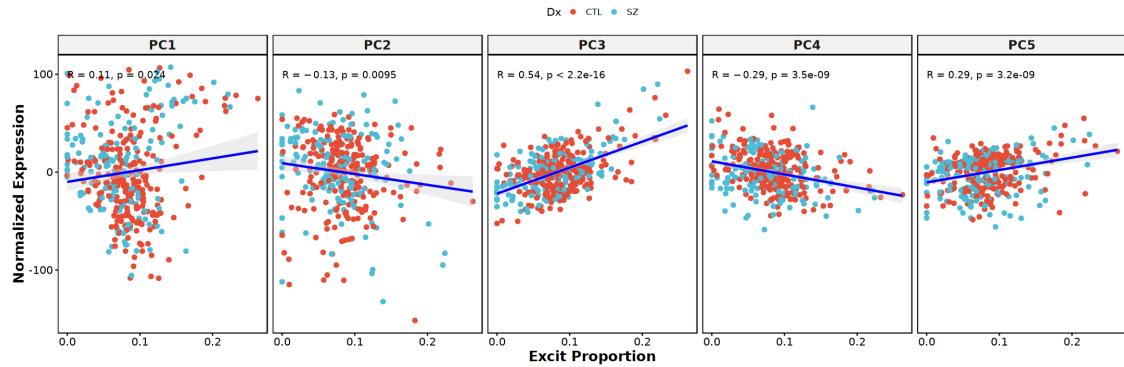
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Inhib"
```

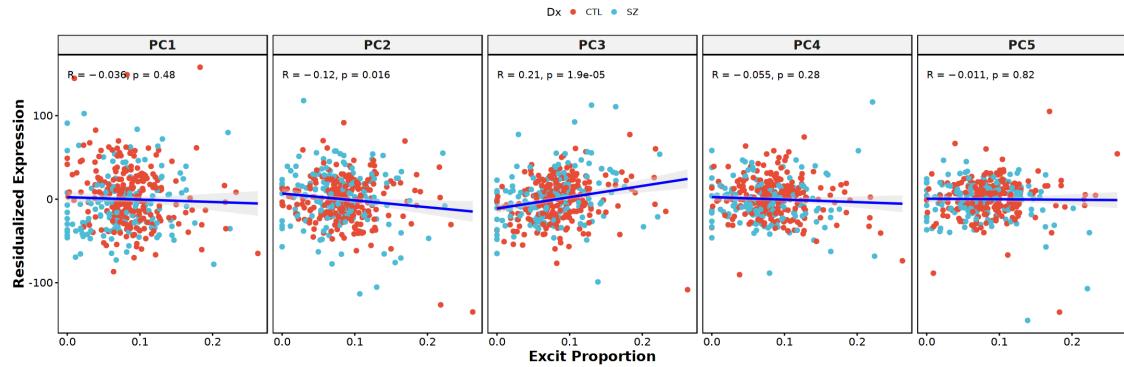
```
`geom_smooth()` using formula 'y ~ x'
```

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`geom_smooth()` using formula 'y ~ x'
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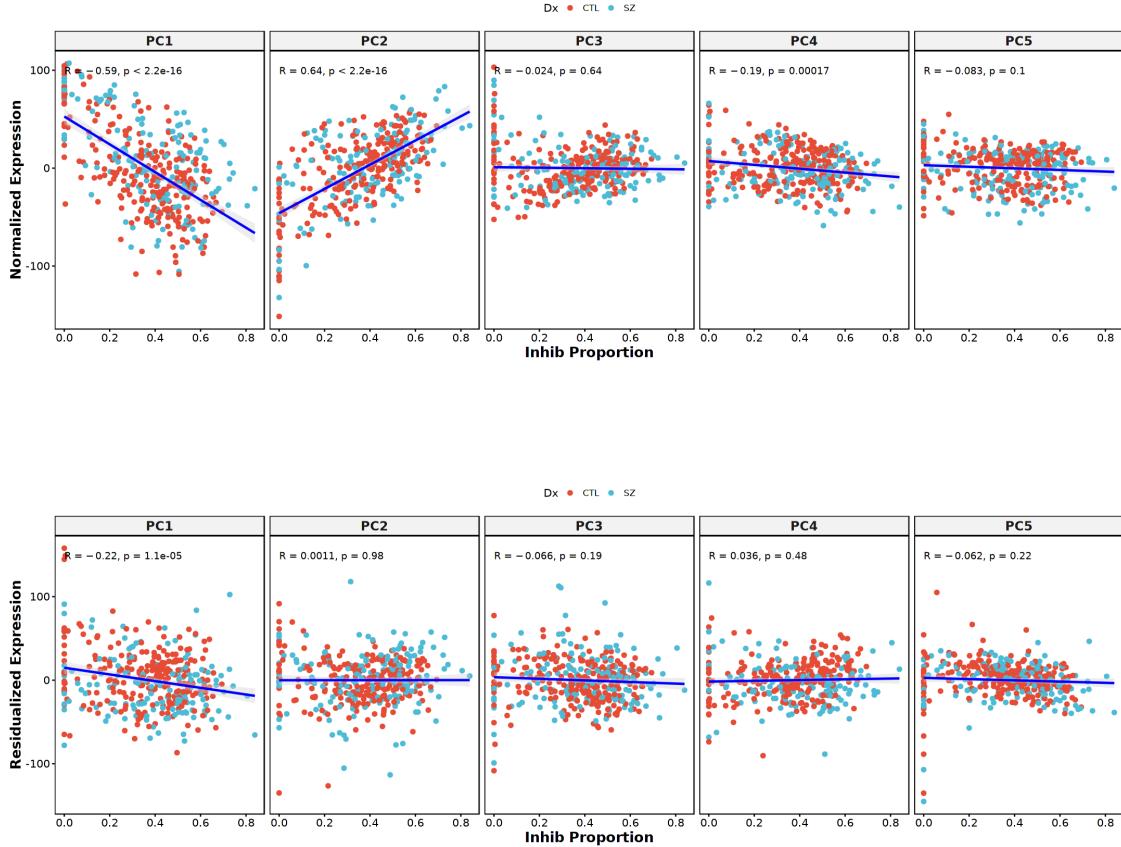
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```



```
[12]: options(repr.plot.width=18, repr.plot.height=6)
for(ct in celltypes){
  flush.console()
  print(ct)
  ## Normalized
  sca = norm_dt %>% inner_join(df, by="sample") %>% filter(cell_type == ct) %>%
  ggscatter(y="PC_values", x="Proportion", facet.by=c('PC'), ncol=5,
            add='reg.line', conf.int=TRUE, cor.coef=TRUE, palette="npg",
            xlab=paste(ct, "Proportion"), ylab="Normalized Expression",
            panel.labs.font=list(face='bold', size = 14),
            add.params=list(color="blue", fill="lightgray")) +
  font("xy.text", size=12) + font("xy.title", size=16, face="bold")
  save_img(sca, paste0("quality_control/scatter_log2cpm_5pcs_",ct), w=18, h=6)
  print(sca)
  ## Residualized
  sca = res_dt %>% inner_join(df, by="sample") %>% filter(cell_type == ct) %>%
  ggscatter(y="PC_values", x="Proportion", facet.by=c('PC'), ncol=5,
            add='reg.line', conf.int=TRUE, cor.coef=TRUE, palette="npg",
            xlab=paste(ct, "Proportion"), ylab="Residualized Expression",
```

```

        panel.labs.font=list(face='bold', size = 14),
        add.params=list(color="blue", fill="lightgray")) +
      font("xy.text", size=12) + font("xy.title", size=16, face="bold")
  save_img(sca, paste0("quality_control/scatter_resdf_5pcs_",ct), w=18, h=6)
  print(sca)
}

```

[1] "Astro"

```

`geom_smooth()` using formula 'y ~ x'

```

[1] "Endo"

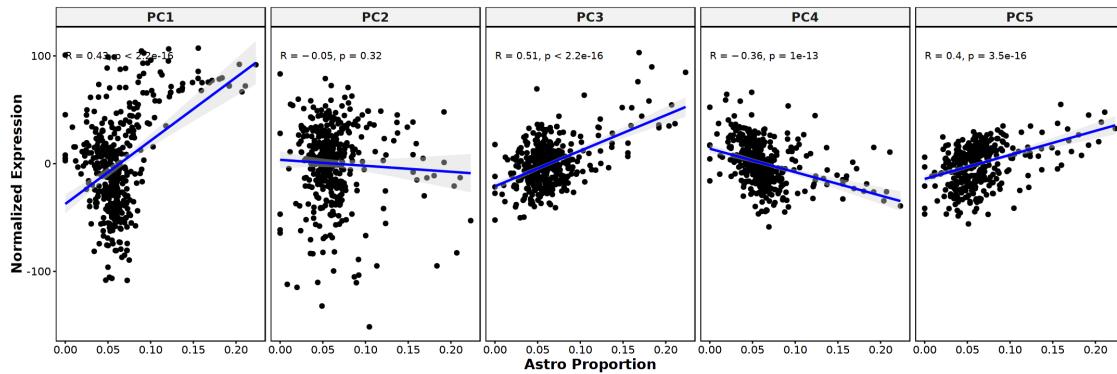
```

`geom_smooth()` using formula 'y ~ x'

`geom_smooth()` using formula 'y ~ x'

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```



```

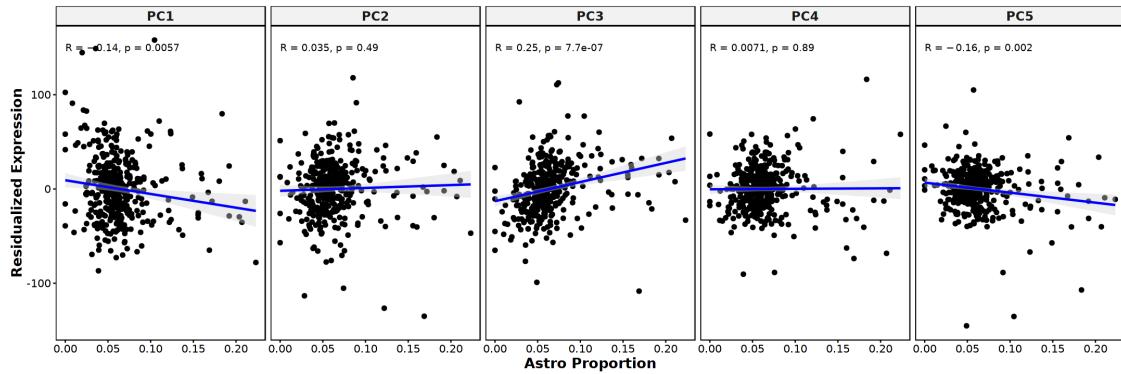
`geom_smooth()` using formula 'y ~ x'

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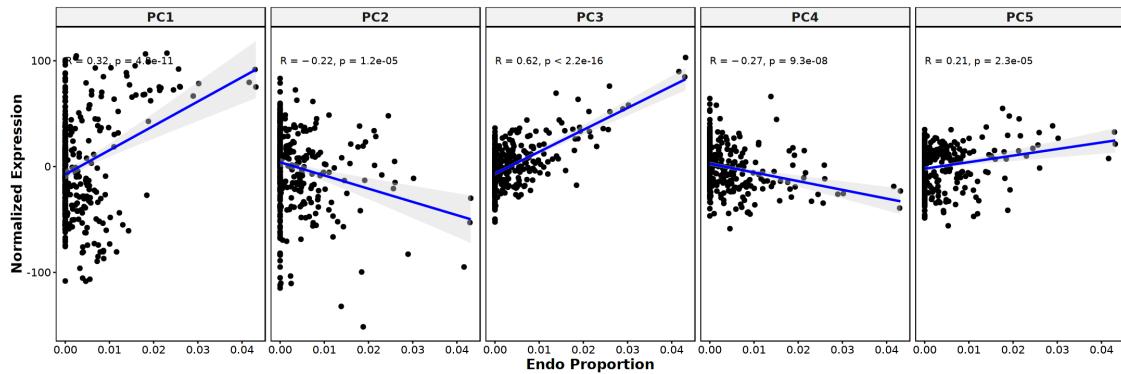
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`geom_smooth()` using formula 'y ~ x'
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```
[1] "Micro"
```

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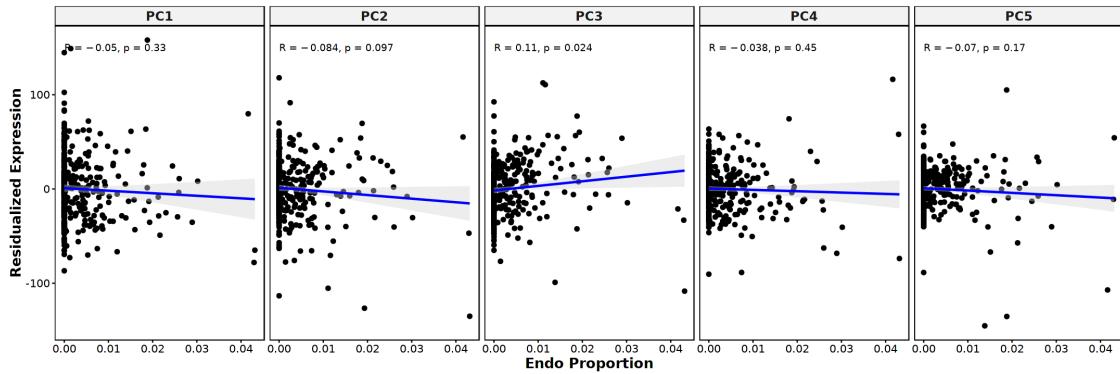
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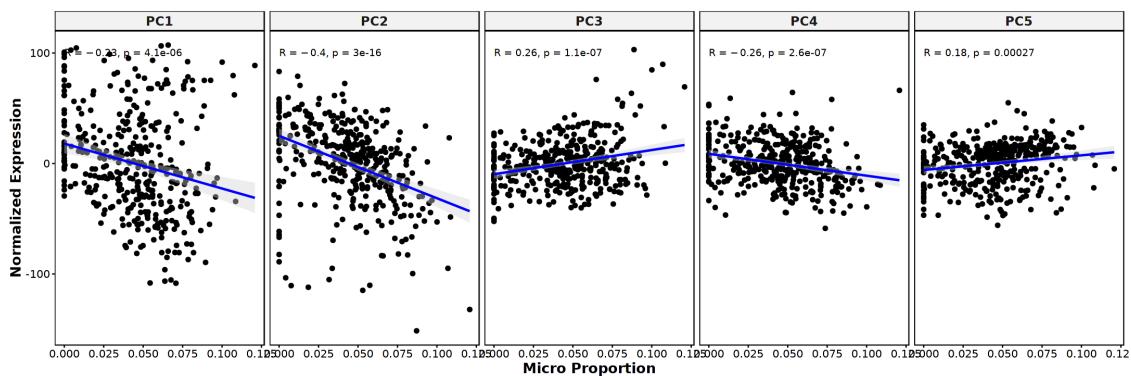
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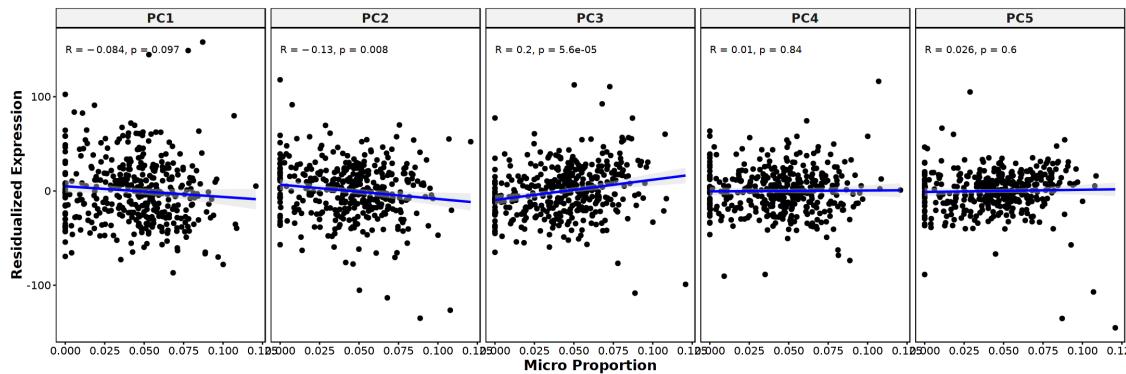
```
[1] "Mural"  
`geom_smooth()` using formula 'y ~ x'  
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```



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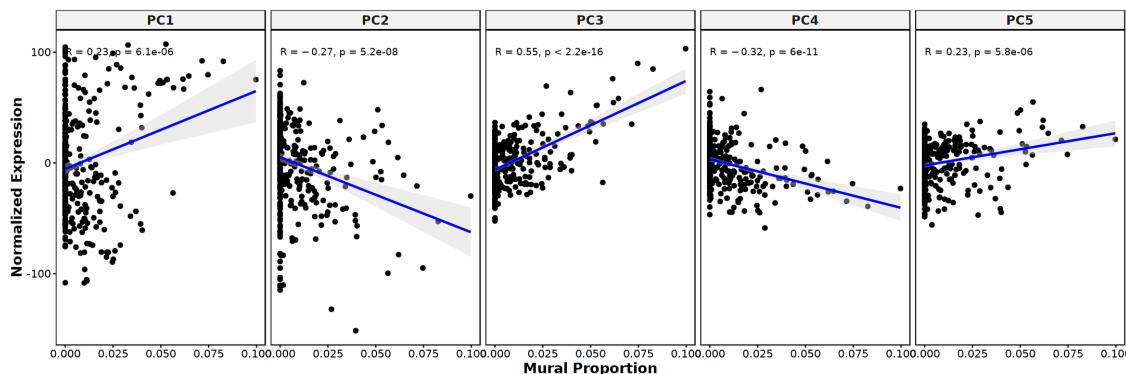
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[1] "Oligo"
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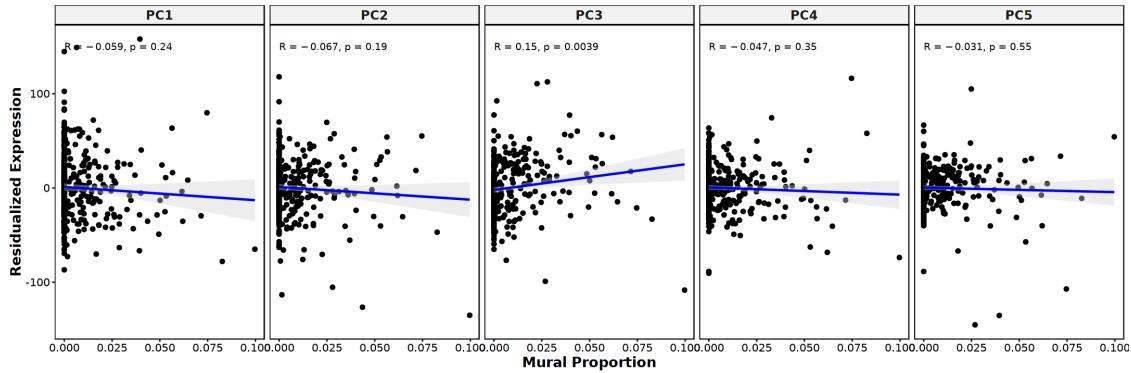
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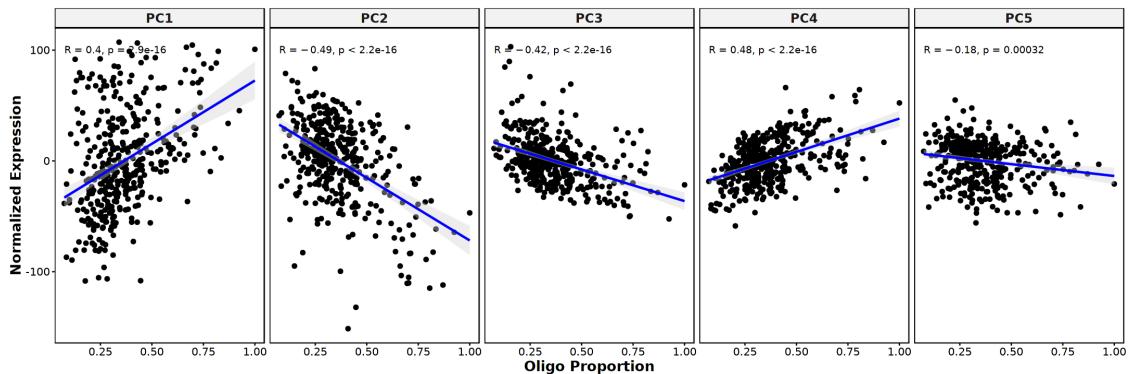
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[1] "OPC"
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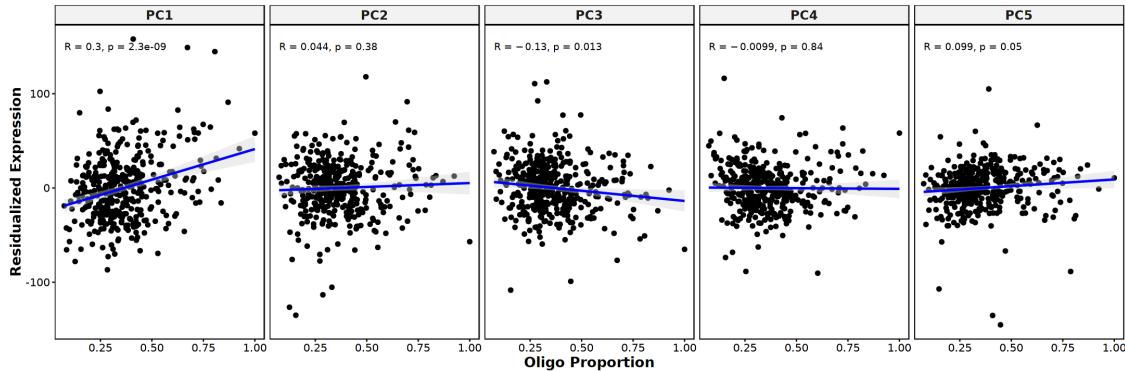
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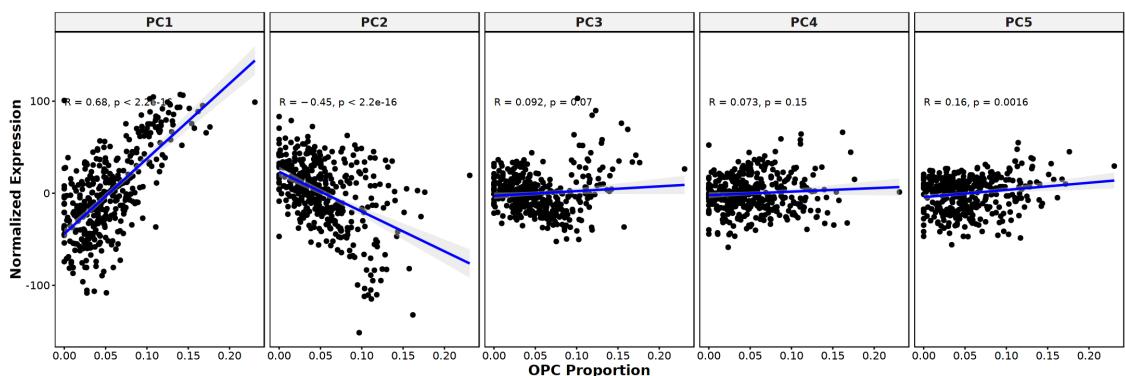
```
`geom_smooth()` using formula 'y ~ x'
```

```
[1] "Tcell"
```

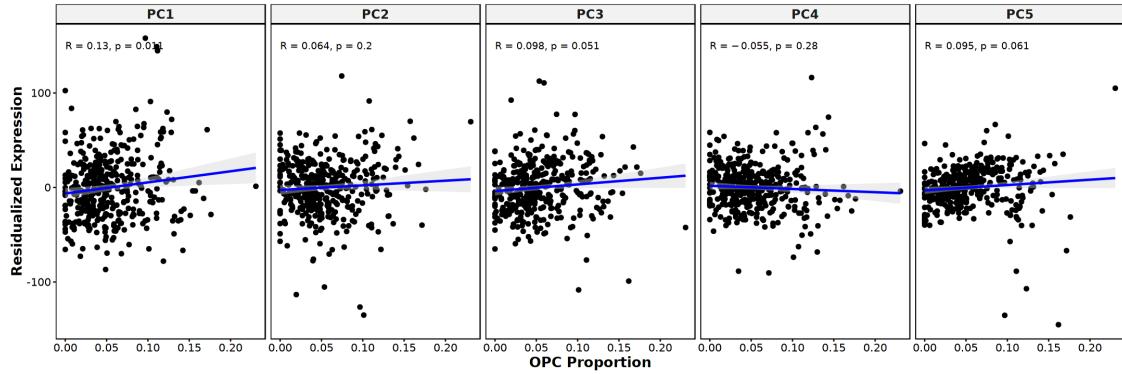
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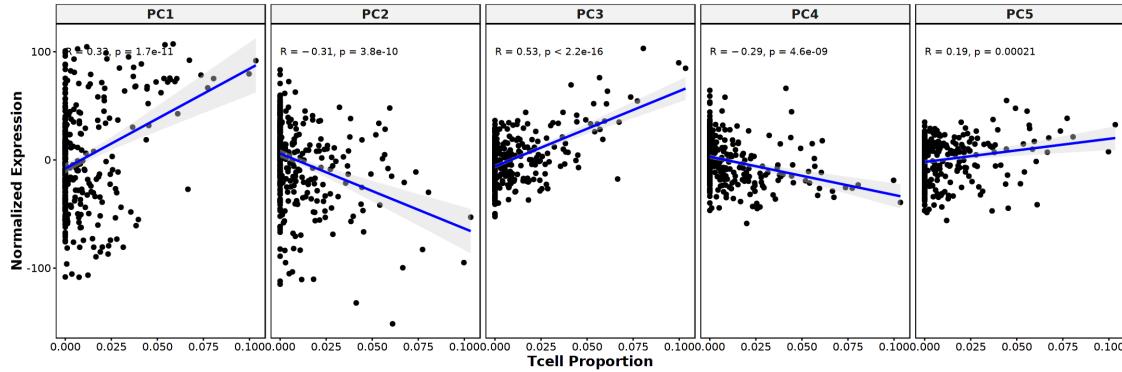
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```

```
[1] "Excit"
```

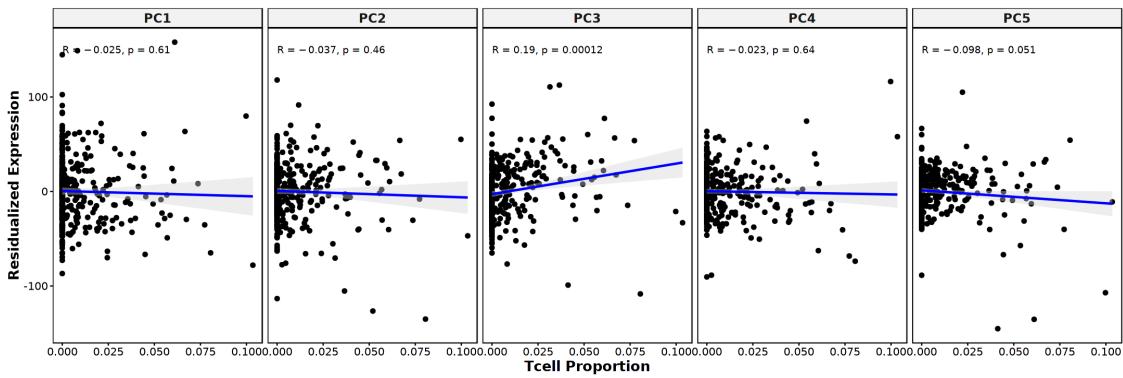
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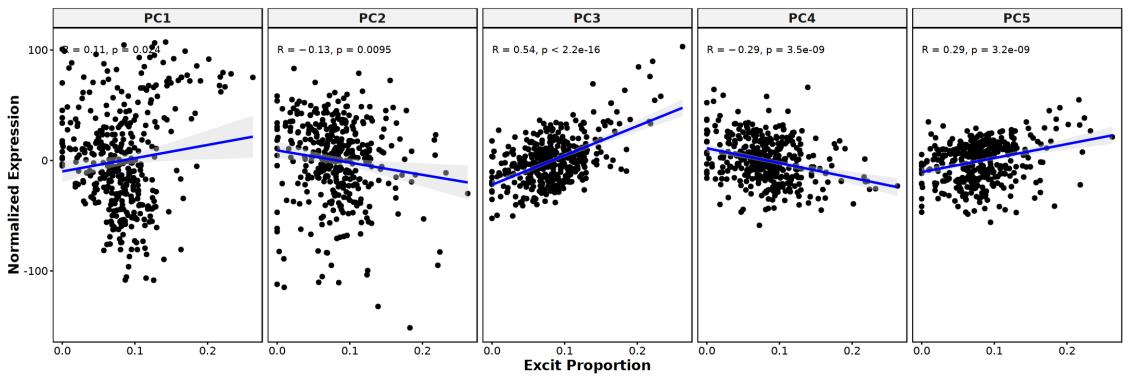
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[1] "Inhib"
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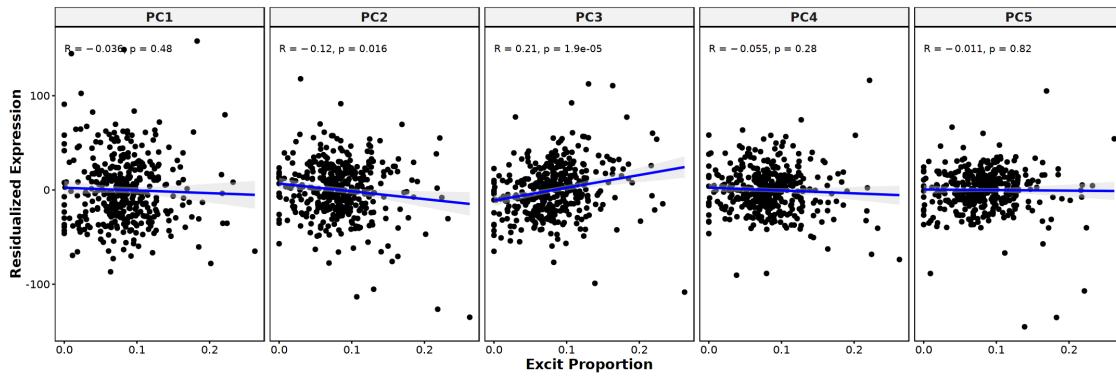
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```

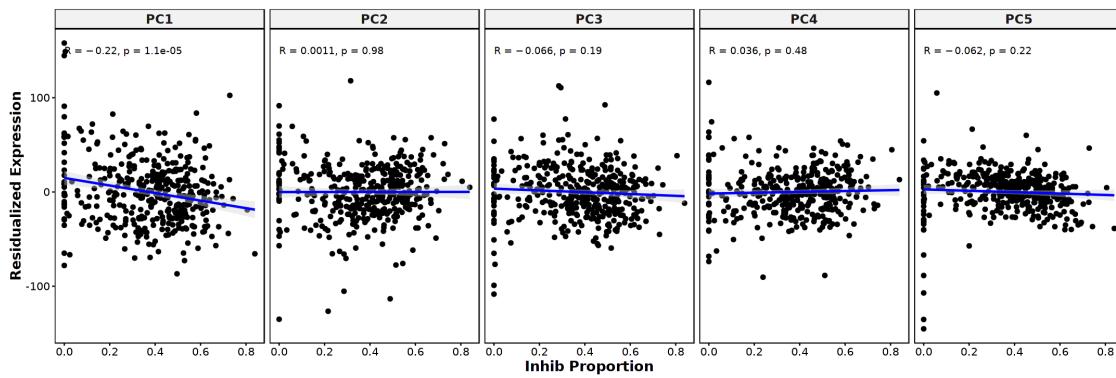
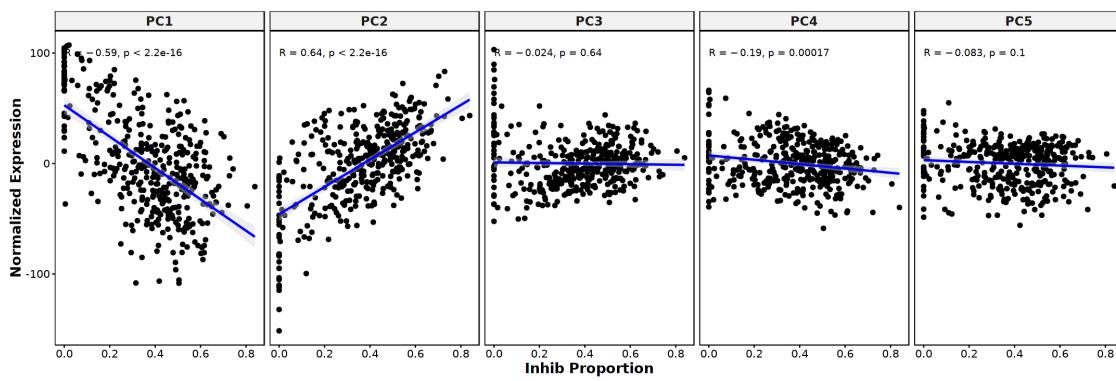
```
`geom_smooth()` using formula 'y ~ x'
```



```
`geom_smooth()` using formula 'y ~ x'
```



```
`geom_smooth()` using formula 'y ~ x'
```



1.5 Reproducibility Information

```
[13]: Sys.time()
proc.time()
options(width = 120)
sessioninfo::session_info()
```

```
[1] "2021-07-23 11:27:50 EDT"

    user   system elapsed
667.893 315.655 162.788

Session info
setting  value
version R version 4.0.3 (2020-10-10)
os       Arch Linux
system  x86_64, linux-gnu
ui       X11
language (EN)
collate en_US.UTF-8
ctype   en_US.UTF-8
tz      America/New_York
date    2021-07-23

Packages
package      * version date     lib source
abind        1.4-5   2016-07-21 [1] CRAN (R 4.0.2)
assertthat    0.2.1   2019-03-21 [1] CRAN (R 4.0.2)
backports     1.2.1   2020-12-09 [1] CRAN (R 4.0.2)
base64enc     0.1-3   2015-07-28 [1] CRAN (R 4.0.2)
broom         0.7.8   2021-06-24 [1] CRAN (R 4.0.3)
cachem        1.0.5   2021-05-15 [1] CRAN (R 4.0.3)
Cairo         1.5-12.2 2020-07-07 [1] CRAN (R 4.0.2)
car            3.0-11  2021-06-27 [1] CRAN (R 4.0.3)
carData        3.0-4   2020-05-22 [1] CRAN (R 4.0.2)
cellranger     1.1.0   2016-07-27 [1] CRAN (R 4.0.2)
cli            3.0.0   2021-06-30 [1] CRAN (R 4.0.3)
colorspace     2.0-2   2021-06-24 [1] CRAN (R 4.0.3)
crayon         1.4.1   2021-02-08 [1] CRAN (R 4.0.3)
curl           4.3.2   2021-06-23 [1] CRAN (R 4.0.3)
data.table     1.14.0  2021-02-21 [1] CRAN (R 4.0.3)
DBI            1.1.1   2021-01-15 [1] CRAN (R 4.0.2)
dbplyr         2.1.1   2021-04-06 [1] CRAN (R 4.0.3)
digest         0.6.27  2020-10-24 [1] CRAN (R 4.0.2)
dplyr          * 1.0.7   2021-06-18 [1] CRAN (R 4.0.3)
ellipsis        0.3.2   2021-04-29 [1] CRAN (R 4.0.3)
evaluate       0.14    2019-05-28 [1] CRAN (R 4.0.2)
fansi          0.5.0   2021-05-25 [1] CRAN (R 4.0.3)
farver         2.1.0   2021-02-28 [1] CRAN (R 4.0.3)
```

fastmap	1.1.0	2021-01-25	[1]	CRAN	(R 4.0.2)
forcats	* 0.5.1	2021-01-27	[1]	CRAN	(R 4.0.2)
foreign	0.8-80	2020-05-24	[2]	CRAN	(R 4.0.3)
fs	1.5.0	2020-07-31	[1]	CRAN	(R 4.0.2)
generics	0.1.0	2020-10-31	[1]	CRAN	(R 4.0.2)
ggplot2	* 3.3.5	2021-06-25	[1]	CRAN	(R 4.0.3)
ggpubr	* 0.4.0	2020-06-27	[1]	CRAN	(R 4.0.2)
ggsci	2.9	2018-05-14	[1]	CRAN	(R 4.0.2)
ggsignif	0.6.2	2021-06-14	[1]	CRAN	(R 4.0.3)
glue	1.4.2	2020-08-27	[1]	CRAN	(R 4.0.2)
gttable	0.3.0	2019-03-25	[1]	CRAN	(R 4.0.2)
haven	2.4.1	2021-04-23	[1]	CRAN	(R 4.0.3)
hms	1.1.0	2021-05-17	[1]	CRAN	(R 4.0.3)
htmltools	0.5.1.1	2021-01-22	[1]	CRAN	(R 4.0.2)
httr	1.4.2	2020-07-20	[1]	CRAN	(R 4.0.2)
IRdisplay	1.0	2021-01-20	[1]	CRAN	(R 4.0.2)
IRkernel	1.2	2021-05-11	[1]	CRAN	(R 4.0.3)
jsonlite	1.7.2	2020-12-09	[1]	CRAN	(R 4.0.2)
labeling	0.4.2	2020-10-20	[1]	CRAN	(R 4.0.2)
lattice	0.20-41	2020-04-02	[2]	CRAN	(R 4.0.3)
lifecycle	1.0.0	2021-02-15	[1]	CRAN	(R 4.0.3)
limma	* 3.46.0	2020-10-27	[1]	Bioconductor	
lubridate	1.7.10	2021-02-26	[1]	CRAN	(R 4.0.3)
magrittr	2.0.1	2020-11-17	[1]	CRAN	(R 4.0.2)
Matrix	1.3-4	2021-06-01	[1]	CRAN	(R 4.0.3)
memoise	2.0.0	2021-01-26	[1]	CRAN	(R 4.0.2)
mgcv	1.8-33	2020-08-27	[2]	CRAN	(R 4.0.3)
modelr	0.1.8	2020-05-19	[1]	CRAN	(R 4.0.2)
munsell	0.5.0	2018-06-12	[1]	CRAN	(R 4.0.2)
nlme	3.1-152	2021-02-04	[1]	CRAN	(R 4.0.3)
openxlsx	4.2.4	2021-06-16	[1]	CRAN	(R 4.0.3)
pbdZMQ	0.3-5	2021-02-10	[1]	CRAN	(R 4.0.3)
pillar	1.6.1	2021-05-16	[1]	CRAN	(R 4.0.3)
pkgconfig	2.0.3	2019-09-22	[1]	CRAN	(R 4.0.2)
purrr	* 0.3.4	2020-04-17	[1]	CRAN	(R 4.0.2)
R6	2.5.0	2020-10-28	[1]	CRAN	(R 4.0.2)
Rcpp	1.0.7	2021-07-07	[1]	CRAN	(R 4.0.3)
readr	* 1.4.0	2020-10-05	[1]	CRAN	(R 4.0.2)
readxl	1.3.1	2019-03-13	[1]	CRAN	(R 4.0.2)
repr	1.1.3	2021-01-21	[1]	CRAN	(R 4.0.2)
reprex	2.0.0	2021-04-02	[1]	CRAN	(R 4.0.3)
rio	0.5.27	2021-06-21	[1]	CRAN	(R 4.0.3)
rlang	0.4.11	2021-04-30	[1]	CRAN	(R 4.0.3)
rstatix	0.7.0	2021-02-13	[1]	CRAN	(R 4.0.3)
rstudioapi	0.13	2020-11-12	[1]	CRAN	(R 4.0.2)
rvest	1.0.0	2021-03-09	[1]	CRAN	(R 4.0.3)
scales	1.1.1	2020-05-11	[1]	CRAN	(R 4.0.2)
sessioninfo	1.1.1	2018-11-05	[1]	CRAN	(R 4.0.2)

```
stringi      1.7.3   2021-07-16 [1] CRAN (R 4.0.3)
stringr      * 1.4.0   2019-02-10 [1] CRAN (R 4.0.2)
svglite       2.0.0   2021-02-20 [1] CRAN (R 4.0.3)
systemfonts   1.0.2   2021-05-11 [1] CRAN (R 4.0.3)
tibble        * 3.1.2   2021-05-16 [1] CRAN (R 4.0.3)
tidyverse     * 1.3.1   2021-04-15 [1] CRAN (R 4.0.3)
tidyselect    1.1.1   2021-04-30 [1] CRAN (R 4.0.3)
utf8          1.2.1   2021-03-12 [1] CRAN (R 4.0.3)
uuid          0.1-4    2020-02-26 [1] CRAN (R 4.0.2)
vctrs          0.3.8   2021-04-29 [1] CRAN (R 4.0.3)
withr          2.4.2    2021-04-18 [1] CRAN (R 4.0.3)
xml2          1.3.2    2020-04-23 [1] CRAN (R 4.0.2)
zip           2.2.0    2021-05-31 [1] CRAN (R 4.0.3)
```

```
[1] /home/jbenja13/R/x86_64-pc-linux-gnu-library/4.0
[2] /usr/lib/R/library
```