# Class 5: Data Visualization with GGPLOT

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## Our first ggplot

To use the ggplot 2 package I first need to have it installed on my computer.

To install any package we use the `install.packages()` command

Now can I use it? NO! First we need tl call `library(ggplot2)`

```
library(ggplot2)
ggplot()
```

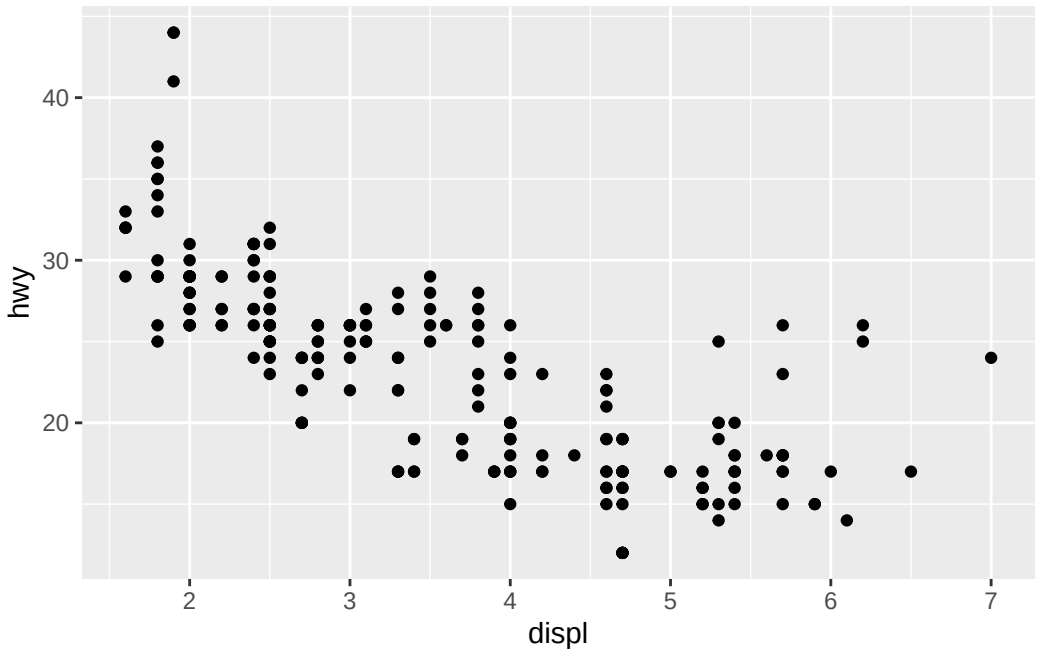
```
mpg
```

```
# A tibble: 234 x 11
   manufacturer model      displ  year   cyl trans drv     cty   hwy fl    class
   <chr>        <chr>      <dbl> <int> <int> <chr> <chr> <int> <int> <chr> <chr>
 1 audi         a4           1.8  1999     4 auto~ f        18    29 p     comp~
 2 audi         a4           1.8  1999     4 manu~ f        21    29 p     comp~
 3 audi         a4           2    2008     4 manu~ f        20    31 p     comp~
 4 audi         a4           2    2008     4 auto~ f        21    30 p     comp~
 5 audi         a4           2.8  1999     6 auto~ f        16    26 p     comp~
 6 audi         a4           2.8  1999     6 manu~ f        18    26 p     comp~
 7 audi         a4           3.1  2008     6 auto~ f        18    27 p     comp~
 8 audi         a4 quattro   1.8  1999     4 manu~ 4        18    26 p     comp~
 9 audi         a4 quattro   1.8  1999     4 auto~ 4        16    25 p     comp~
10 audi         a4 quattro   2    2008     4 manu~ 4        20    28 p     comp~
# ... with 224 more rows
```

Our first plot of displ vs hwy All ggplot() graphs are made in the same way.

- data + aes + geoms

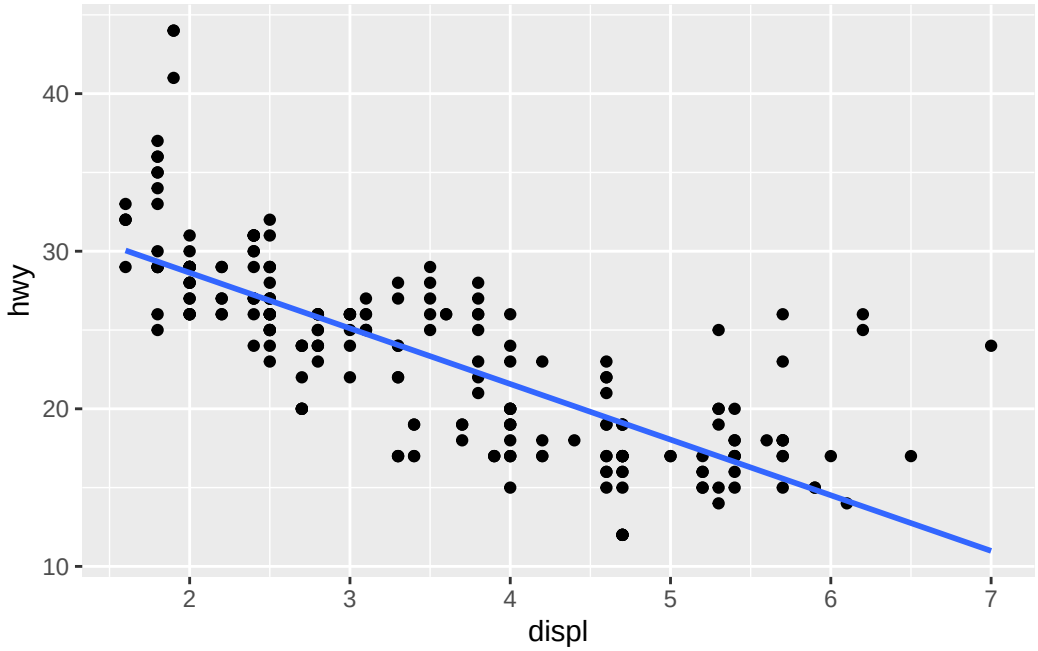
```
ggplot(mpg) +
  aes(x=displ, y=hwy) +
  geom_point()
```




I can add more layers: Look at the documentation using `?function_name` in order to see what a certain function does and what arguments it takes.

```
ggplot(mpg) +
  aes(x=displ, y=hwy) +
  geom_point() +
  geom_smooth(method = lm, se = FALSE)
```

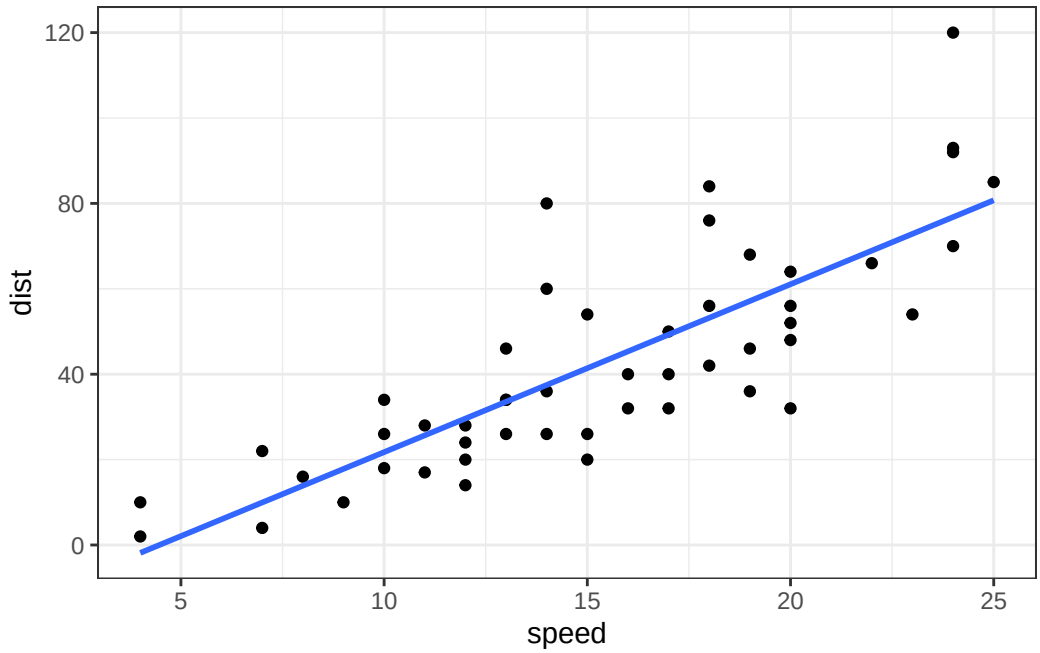
```
`geom_smooth()` using formula 'y ~ x'
```




In order to add labels and a theme for the graph use `labs()` and `theme_bw()`

```
ggplot(cars) +
  aes(x=speed, y=dist) +
  geom_point() +
  geom_smooth(method="lm", se= FALSE) +
  theme_bw()
```

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




## Plot of gene expression data

First read the data from online.

```
url <- "https://bioboot.github.io/bimm143_S20/class-material/up_down_expression.txt"
genes <- read.delim(url)
head(genes)
```

```
        Gene Condition1 Condition2      State
1      A4GNT -3.6808610 -3.4401355 unchanging
2       AAAS  4.5479580  4.3864126 unchanging
3      AASDH  3.7190695  3.4787276 unchanging
4       AATF  5.0784720  5.0151916 unchanging
5       AATK  0.4711421  0.5598642 unchanging
6 AB015752.4 -3.6808610 -3.5921390 unchanging
```

Q. How many genes are in this dataset?

```
nrow(genes)
```

```
[1] 5196
```

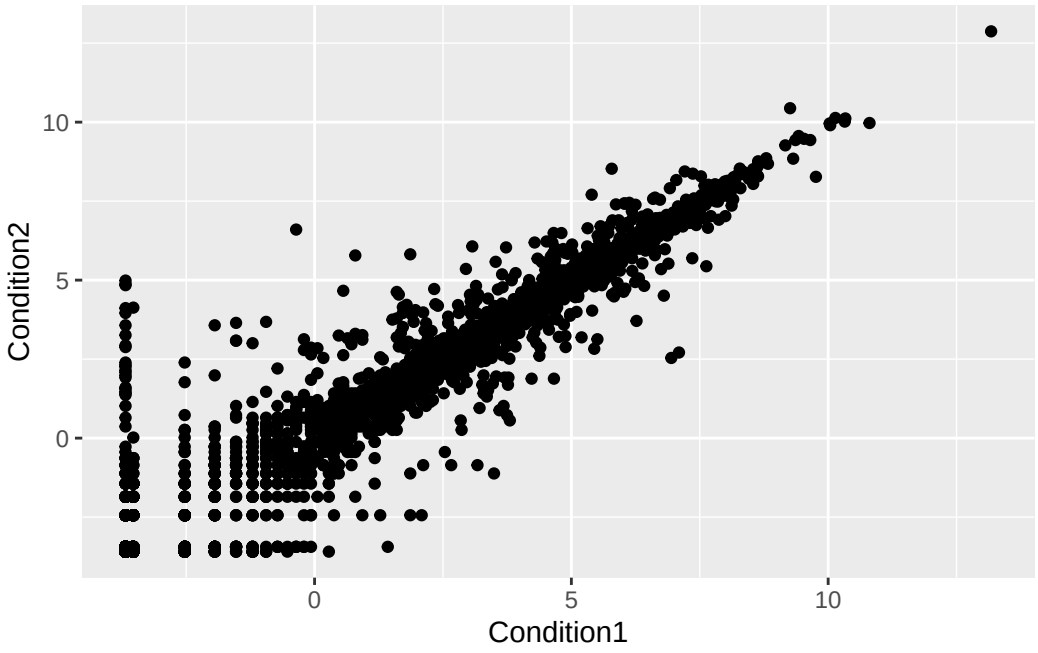
What are the colnames?

```
colnames(genes)
```

```
[1] "Gene"       "Condition1" "Condition2" "State"
```

How to make this into a ggplot?

```
ggplot(genes) +
  aes(x = Condition1, y= Condition2) +
  geom_point();
```




Let's add some color. To tdo this we can add another `aes()` mapping of color to the `State` column in our data

```
p <- ggplot(genes) +
  aes(x = Condition1, y= Condition2, col = State) +
  geom_point();
```

Q. How many genes are up regulated and down regulated?

```
head(genes)
```

```
        Gene Condition1 Condition2      State
1      A4GNT -3.6808610 -3.4401355 unchanging
2       AAAS  4.5479580  4.3864126 unchanging
3      AASDH  3.7190695  3.4787276 unchanging
4       AATF  5.0784720  5.0151916 unchanging
5       AATK  0.4711421  0.5598642 unchanging
6 AB015752.4 -3.6808610 -3.5921390 unchanging
```

To get at just the State column `table()` helps summarize data

```
table(genes$State)
```

```
      down unchanging         up
        72       4997        127
```

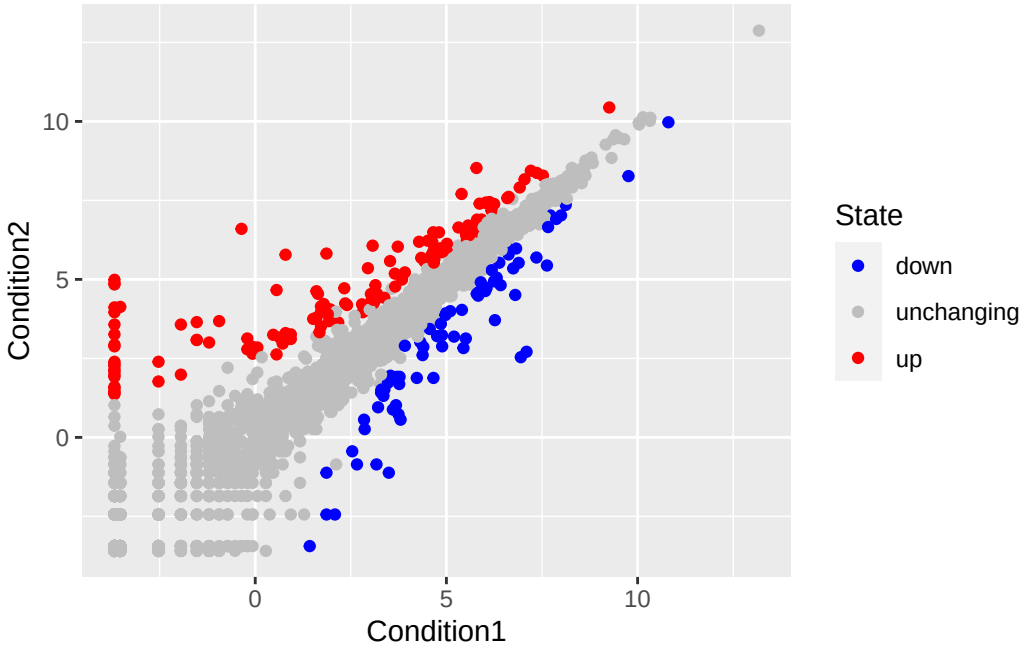
To find the fraction of total genes up-regulated we can use `round()`

```
round( table(genes$State)/nrow(genes) * 100, 2)
```

```
      down unchanging         up
      1.39      96.17       2.44
```

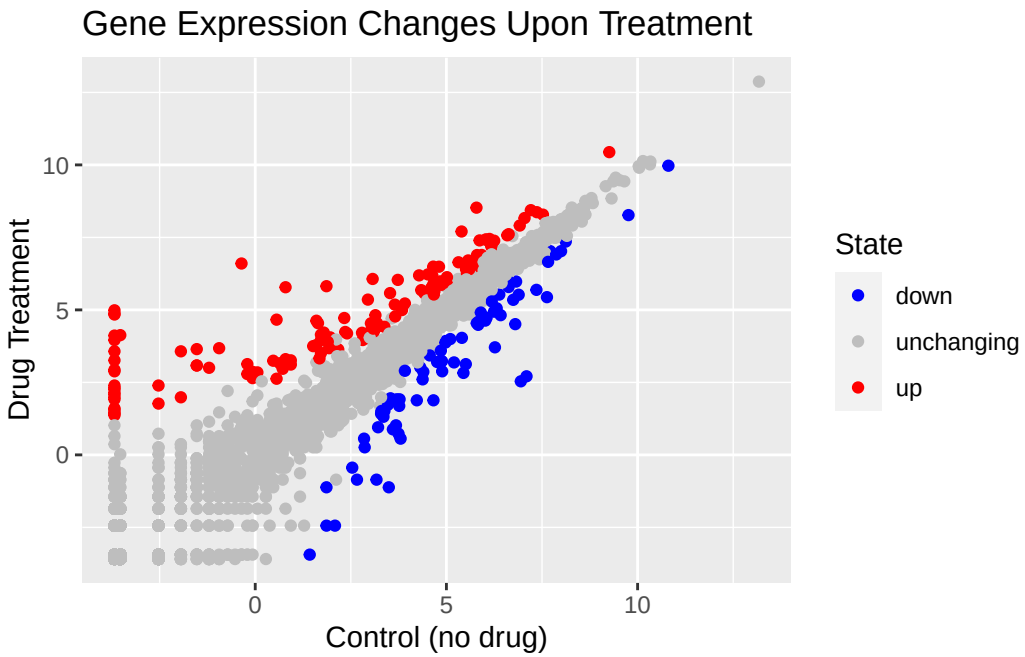
In order to change color of the plot can use `scale_color_manual()`

```
p + scale_color_manual( values=c("blue", "gray", "red"))
```




Lets add some labels to our newly colored graph (Remember: Use `labs()`)

```
p + scale_color_manual( values=c("blue", "gray", "red")) +
  labs(title="Gene Expression Changes Upon Treatment", x="Control (no drug)", y="Drug Trea
```


Gene Expression Changes Upon Treatment
Drug Treatment
10
5
0
0
5
10
Control (no drug)
State
down
unchanging
up