

# Intro to R for Biologists

## Session 5

### **Data Visualisation**

Irina & Rao

03/02/2021

Hilary 2021

# INTRO TO R FOR BIOLOGISTS

## ► Data Visualisation

- Plotting continued from Session 4
- Statistics
- Problem set from Session 4
- Heatmaps
- Colours
- Q & A

# Basic statistics

- Correlations – `cor()`, `cor.test()`

- T-test (parametric):

- Unpaired 2-group t-test

`t.test(y~x)` # where y is numeric and x is a binary factor

`t.test(y1, y2)` # where y1 and y2 are numeric

- Paired 2-group t-test

`t.test(y1, y2, paired=TRUE)` # where y1 & y2 are numeric

- Non-parametric tests:

- Unpaired 2-group Mann-Whitney U Test

`wilcox.test(y~A)` # where y is numeric and A is A binary factor

`wilcox.test(y, x)` # where y and x are numeric

- Paired 2-group Wilcoxon Signed Rank Test

`wilcox.test(y1, y2, paired=TRUE)` # where y1 and y2 are numeric

- More than 2 groups - analysis of variance (ANOVA, parametric)

`aov()`, `anova()`

# Adding statistics to the plots

```
library(ggpubr)
```

- Perform the test

```
compare_means(formula, data, method =  
  "wilcox.test", paired = FALSE, group.by =  
  NULL, ref.group = NULL, ...)
```

```
*method = "t.test", "anova"
```

- Or just add the significance levels to the plot

```
stat_compare_means(mapping = NULL,  
  comparisons = NULL, hide.ns = FALSE, label =  
  NULL, label.x = NULL, label.y = NULL, ...)
```

# Adding statistics to the plots - alternatively

```
library(ggsignif)

stat_signif(mapping = NULL, data = NULL,
position = "identity", na.rm = FALSE,
show.legend = NA, inherit.aes =
TRUE, comparisons = NULL, test =
"wilcox.test", test.args = NULL, annotations
= NULL, map_signif_level = FALSE ...)

map_signif_level = c("***"=0.001,  "**"=0.01,
"*"=0.05)
```

**Let's  
explore  
practically**



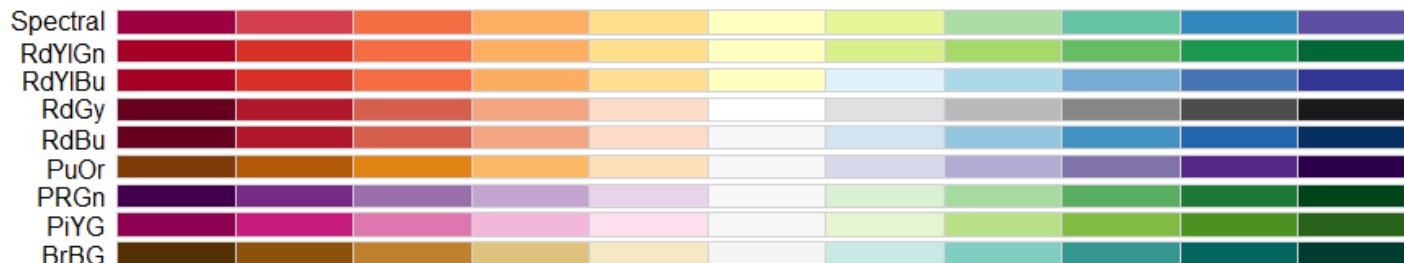
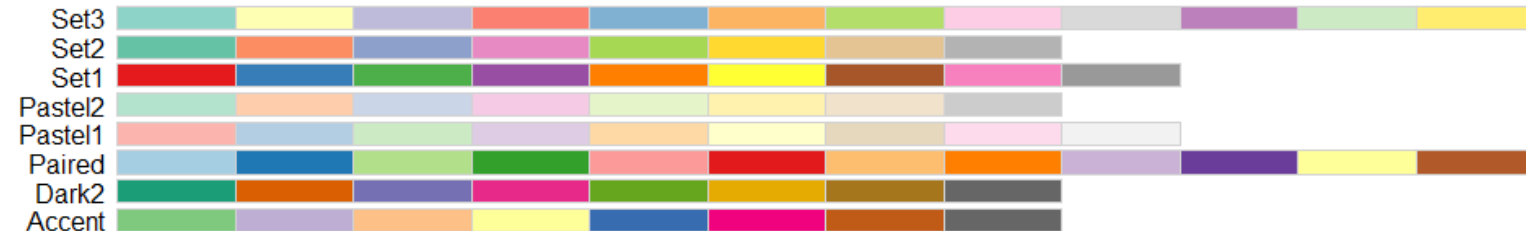
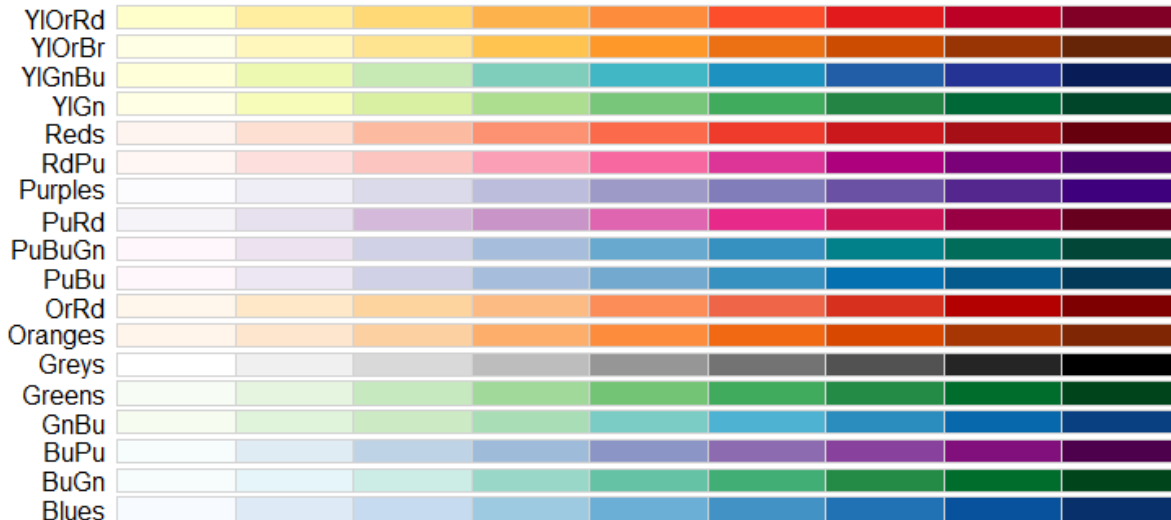
# Colours in R

- Represented as named colours (e.g. “red”, “mediumspringgreen”) or hexadecimal code (e.g. “#FF0000FF”, “#00FA9AFF”)

white	aliceblue	antiquewhite	antiquewhite1	antiquewhite2	antiquewhite3	antiquewhite4	aquamarine	aquamarine1	aquamarine2
aquamarine3	aquamarine4	azure	azure1	azure2	azure3	azure4	beige	bisque	bisque1
bisque2	bisque3	bisque4	brown1	brown2	blanchedalmond	brown3	burlywood	burlywood1	burlywood2
burlywood3	cadetblue	cadetblue1	cadetblue2	cadetblue3	cadetblue4	chartreuse	chartreuse1	chartreuse2	chartreuse3
chartreuse4	coral	cornflowerblue	cornsilk	cornsilk1	cornsilk2	cornsilk3	coral	coral2	coral3
cyan3	cyan4	darkcyan	darkcyan1	darkcyan2	darkgoldenrod	darkgoldenrod1	darkgoldenrod2	darkgoldenrod3	darkgoldenrod4
darkgreen	darkgrey	darkkhaki	darkmagenta	darkolivegreen	darkolivegreen1	darkolivegreen2	darkolivegreen3	darkolivegreen4	darkorange
darkorange1	darkorange2	darkorange3	darkorange4	darkorchid	darkorchid1	darkorchid2	darkorchid3	darkorchid4	darkred
darksalmon	darkseagreen	darkseagreen1	darkseagreen2	darkseagreen3	darkseagreen4	darkslateblue	darkslategray	darkslategray1	darkslategray2
darkslategray3	darkslategray4	darkslategray	darkslategray	darkslategray	darkslategray	darkslategray	darkslategray	darkslategray	darkslategray
deepskyblue	deepskyblue1	deepskyblue2	deepskyblue3	deepskyblue4	deeppink	deeppink2	deeppink3	deeppink4	deeppink5
dodgerblue3	dodgerblue4	firebrick	firebrick1	firebrick2	dimgray	dimgray	dodgerblue	dodgerblue1	dodgerblue2
ghostwhite	gold	gold1	gold2	gold3	firebrick3	firebrick4	floralwhite	forestgreen	gainsboro
goldenrod4	gray	gray1	gray2	gray3	goldenrod	goldenrod1	goldenrod2	goldenrod3	goldenrod4
gray5	gray6	gray7	gray8	gray9	gray10	gray11	gray12	gray13	gray14
gray15	gray16	gray17	gray18	gray19	gray20	gray21	gray22	gray23	gray24
gray25	gray26	gray27	gray28	gray29	gray30	gray31	gray32	gray33	gray34
gray35	gray36	gray37	gray38	gray39	gray40	gray41	gray42	gray43	gray44
gray45	gray46	gray47	gray48	gray49	gray50	gray51	gray52	gray53	gray54
gray55	gray56	gray57	gray58	gray59	gray60	gray61	gray62	gray63	gray64
gray65	gray66	gray67	gray68	gray69	gray70	gray71	gray72	gray73	gray74
gray75	gray76	gray77	gray78	gray79	gray80	gray81	gray82	gray83	gray84
gray85	gray86	gray87	gray88	gray89	gray90	gray91	gray92	gray93	gray94
gray95	gray96	gray97	gray98	gray99	gray100	green	green1	green2	green3
gray101	gray102	gray103	gray104	gray105	gray106	gray107	gray108	gray109	gray110
gray111	gray112	gray113	gray114	gray115	gray116	gray117	gray118	gray119	gray120
gray121	gray122	gray123	gray124	gray125	gray126	gray127	gray128	gray129	gray130
gray131	gray132	gray133	gray134	gray135	gray136	gray137	gray138	gray139	gray140
gray141	gray142	gray143	gray144	gray145	gray146	gray147	gray148	gray149	gray150
gray151	gray152	gray153	gray154	gray155	gray156	gray157	gray158	gray159	gray160
gray161	gray162	gray163	gray164	gray165	gray166	gray167	gray168	gray169	gray170
gray171	gray172	gray173	gray174	gray175	gray176	gray177	gray178	gray179	gray180
gray181	gray182	gray183	gray184	gray185	gray186	gray187	gray188	gray189	gray190
gray191	gray192	gray193	gray194	gray195	gray196	gray197	gray198	gray199	gray200
hotpink4	indianred	indianred1	indianred2	indianred3	indianred4	ivory	ivory1	ivory2	ivory3
ivory4	khaki	khaki1	khaki2	khaki3	khaki4	lavender	lavenderblush	lavenderblush1	lavenderblush2
lavenderblush3	lavenderblush4	lawngreen	lemonchiffon	lemonchiffon1	lemonchiffon2	lemonchiffon3	lemonchiffon4	lightblue	lightblue1
lightblue2	lightblue3	lightblue4	lightcoral	lightcyan	lightcyan1	lightcyan2	lightcyan3	lightcyan4	lightgoldenrod
lightgoldenrod1	lightgoldenrod2	lightgoldenrod3	lightgoldenrod4	lightgoldenrodyellow	lightgray	lightgreen	lightgray	lightpink	lightpink1
lightpink2	lightsalmon	lightsalmon1	lightsalmon2	lightsalmon3	lightsalmon4	lightsalmon5	lightsalmon6	lightsalmon7	lightsalmon8
lightskyblue	lightskyblue2	lightskyblue3	lightskyblue4	lightslateblue	lightslategray	lightslategray1	lightslategray2	lightslategray3	lightslategray4
lightsteelblue3	lightsteelblue4	lightyellow	lightyellow1	lightyellow2	lightyellow3	lightyellow4	lightyellow5	lightyellow6	lightyellow7
magenta1	magenta2	magenta3	magenta4	maroon	maroon1	maroon2	maroon3	maroon4	mediumaquamarine
mediumblue	mediumorchid	mediumorchid1	mediumorchid2	mediumorchid3	mediumorchid4	mediumorchid5	mediumorchid6	mediumorchid7	mediumorchid8
mediumpurple4	mediumseagreen	mediumslateblue	mediumspringgreen	mediumturquoise	mediumvioletred	midnightblue	mintcream	mistyrose	mistyrose1
mistyrose2	mistyrose3	moccasin	moccasin1	moccasin2	moccasin3	navajowhite	navajowhite1	navajowhite2	navajowhite3
navajowhite4	oldlace	olivedrab	olivedrab1	olivedrab2	olivedrab3	olivedrab4	olivedrab5	orange	orange1
orange3	orchid4	palegoldenrod	palegreen	palegreen1	palegreen2	palegreen3	palegreen4	orchid	orchid2
paleturquoise2	paleturquoise3	paleturquoise4	palevioletred	palevioletred1	palevioletred2	palevioletred3	palevioletred4	paleturquoise1	paleturquoise3
peachpuff1	peachpuff2	peachpuff3	peachpuff4	peru	pink	pink1	pink2	peachpuff	peachpuff1
plum	plum1	plum2	plum3	plum4	powderblue	rosybrown	rosybrown1	plum4	plum5
rosybrown4	royalblue	royalblue1	royalblue2	royalblue3	royalblue4	saddlebrown	salmon	rosybrown2	rosybrown3
salmon3	seashell2	seashell3	seashell4	sienna	sienna1	sienna2	sienna3	seashell1	seashell2
skyblue2	skyblue3	skyblue4	slateblue	slateblue1	slateblue2	slateblue3	slateblue4	skyblue1	skyblue2
slategray2	slategray3	slategray4	springgreen3	springgreen4	snow	snow1	snow2	slategray1	slategray2
springgreen1	springgreen2	springgreen3	springgreen4	steelblue	steelblue1	steelblue2	steelblue3	springgreen	springgreen1
tan1	tan2	tan3	tan4	thistle	thistle1	thistle2	thistle3	tan	tan1
tomato1	tomato2	tomato3	tomato4	turquoise	turquoise1	turquoise2	turquoise3	tomato	tomato1
violetred	violetred1	violetred2	violetred3	violetred4	wheat	wheat1	wheat2	violet	violet1
whitesmoke	yellow	yellow1	yellow2	yellow3	yellow4	yellowgreen	yellow1	yellow2	yellow3

# Colours in R

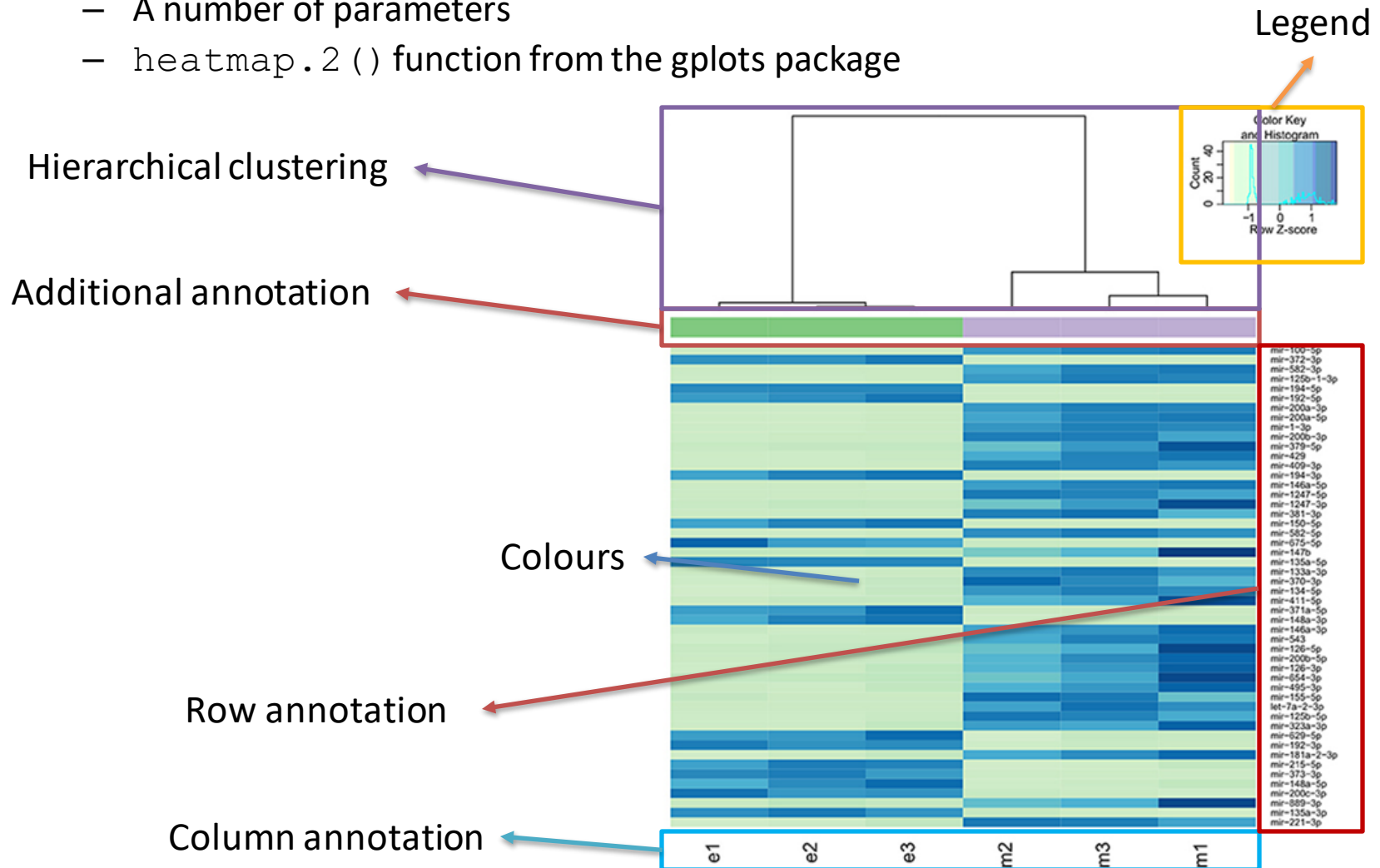
- Palettes – a set of colours that can be used together
- RColorBrewer package
  - Sequential
  - Qualitative
  - Diverging
- <https://github.com/EmilHvitfeldt/r-color-palettes> for a huge list of palettes and the packages they come in



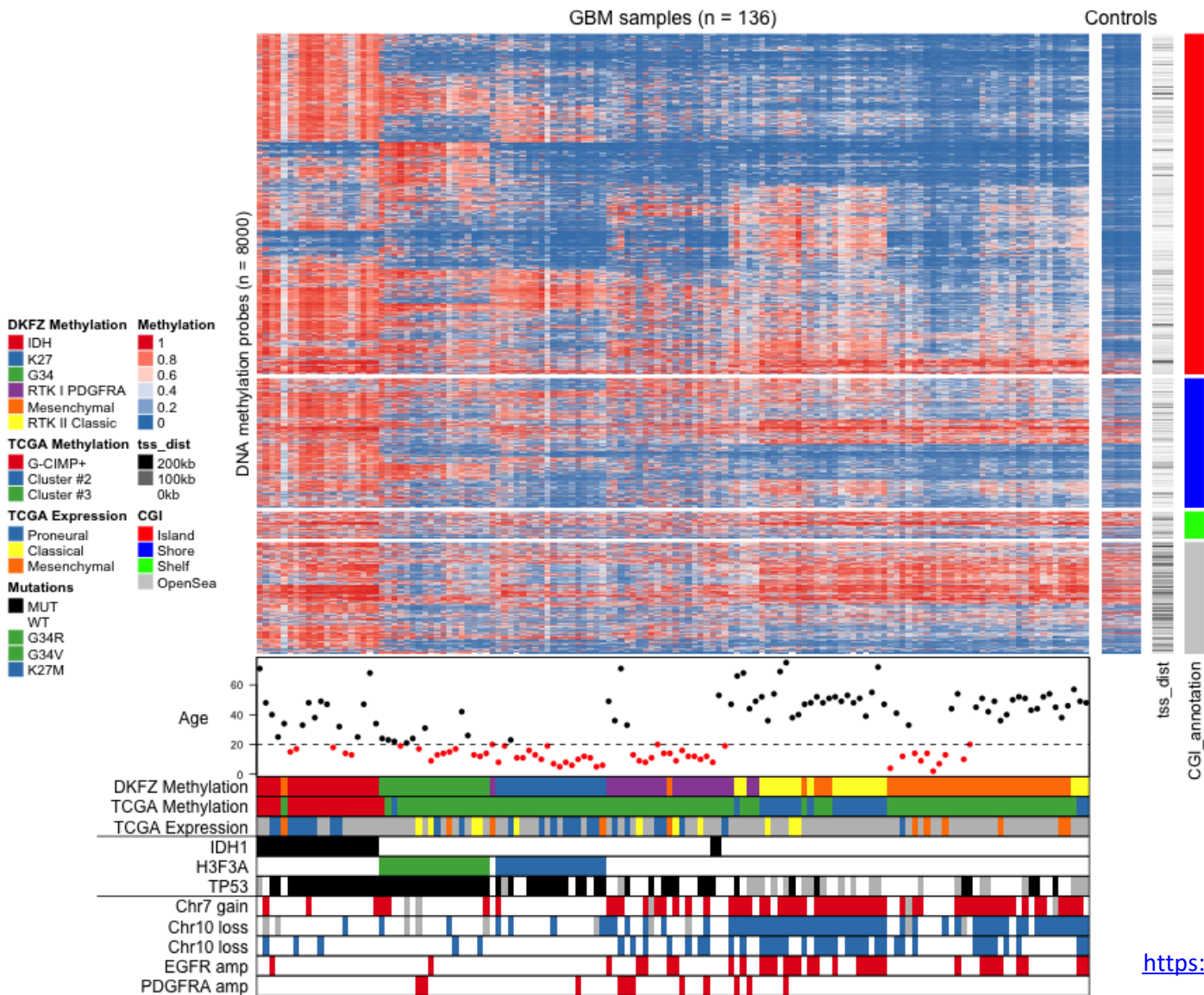


# Heatmaps

- Useful for displaying multidimensional data
  - A number of parameters
  - `heatmap.2()` function from the `gplots` package



# A lot of information can be conveyed!



- A more complicated example with the Complex Heatmap package

**Let's  
explore  
practically**



**Let's  
explore  
practically**



**Address the tasks in breakout rooms!**

# Useful references

- <https://github.com/EmilHvitfeldt/r-color-palettes> - a huge list of R palettes
- <https://colorbrewer2.org/> - RColorBrewer package based on this tool by Cynthia Brewer
- <https://jokergoo.github.io/ComplexHeatmap-reference/book/> - R package to produce Complex Heatmaps