

Intro to R for Biologists

Session 5

Data Visualisation

Irina & Rao

21/07/2021

Trinity 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**



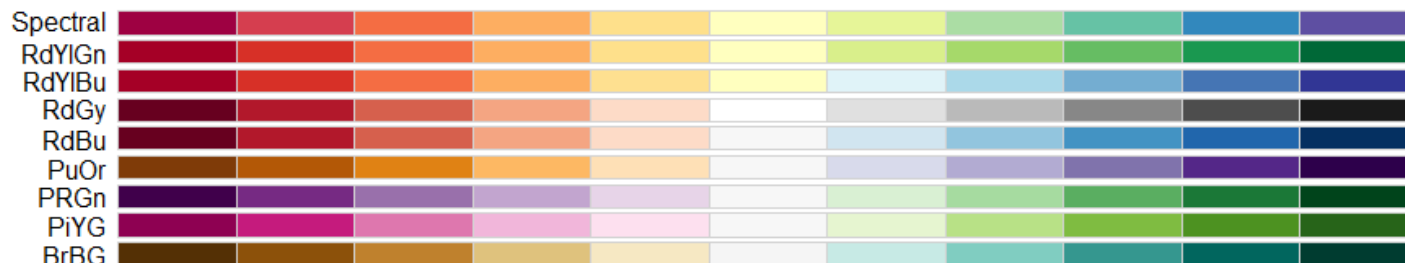
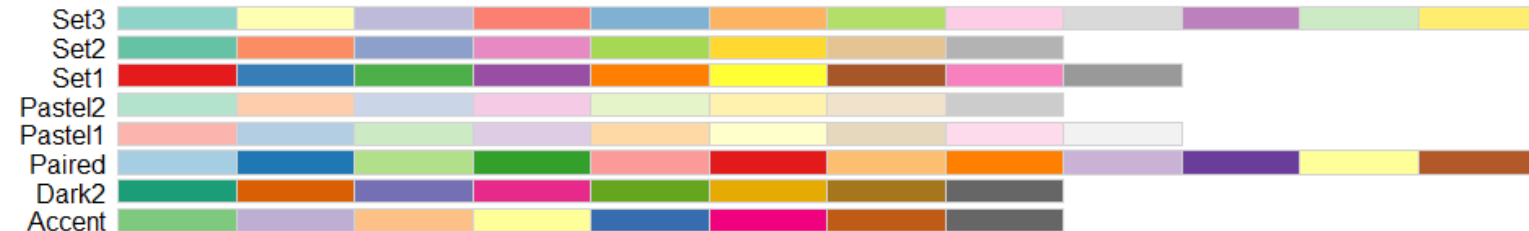
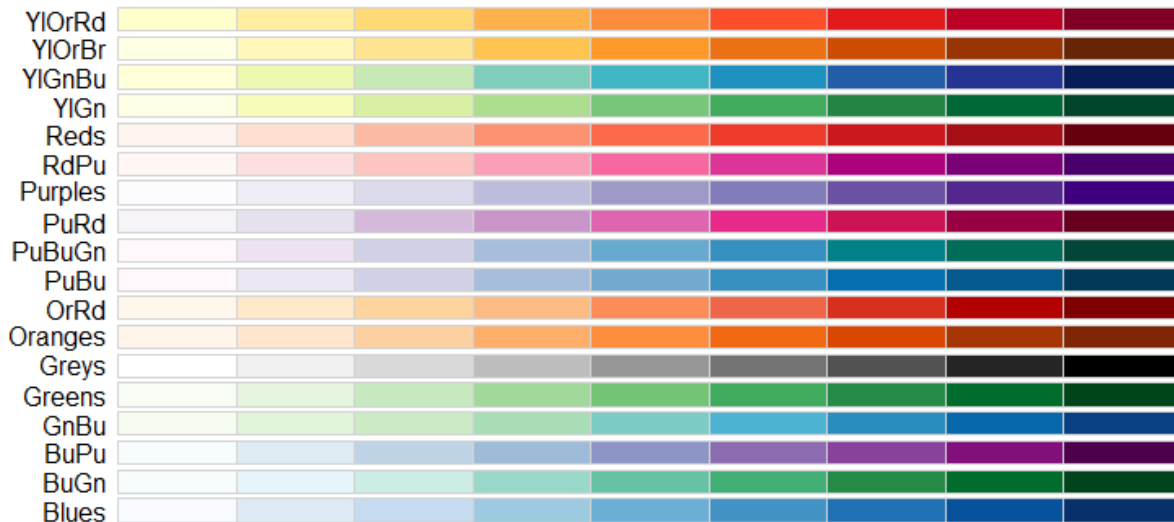
Colours in R

- 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	blanchedalmond	brown2	blue	burlywood	burlywood1	burlywood2
blueviolet	brown	brown1	cadetblue1	cadetblue2	cadetblue3	cadetblue4	chartreuse	chartreuse1	chartreuse2
burlywood4	cadetblue	cadetblue1	chocolate1	chocolate2	chocolate3	chocolate4	coral	coral1	coral2
chartreuse4	coral	cornflowerblue	cornsilk	cornsilk1	cornsilk2	cornsilk3	cyan	cyan1	cyan2
coral4	cyan3	darkcyan	darkcyan	darkgoldenrod	darkgoldenrod1	darkgoldenrod2	darkgoldenrod3	darkgoldenrod4	darkgray
darkgreen	darkgray	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	deeppink	deeppink1	deeppink2	deeppink3
deeppink4	deeppink1	deeppink2	deeppink3	deeppink4	deeppink1	deeppink2	deeppink3	deeppink4	deeppink1
deepskyblue	deepskyblue1	deepskyblue2	deepskyblue3	deepskyblue4	deepskyblue1	deepskyblue2	deepskyblue3	deepskyblue4	deepskyblue1
dodgerblue3	dodgerblue4	firebrick	firebrick1	firebrick2	firebrick3	firebrick4	floralwhite	forestgreen	gainsboro
ghostwhite	gold	gold1	gold2	gold3	gold4	goldenrod	goldenrod1	goldenrod2	goldenrod3
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gray321	gray322	gray323	gray324	gray325	gray326	gray327	gray328	gray329	gray330
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gray371	gray372	gray373	gray374	gray375	gray376	gray377	gray378	gray379	gray380
gray381	gray382	gray383	gray384	gray385	gray386	gray387	gray388	gray389	gray390
gray391	gray392	gray393	gray394	gray395	gray396	gray397	gray398	gray399	gray400
gray401	gray402	gray403	gray404	gray405	gray406	gray407	gray408	gray409	gray410
gray411	gray412	gray413	gray414	gray415	gray416	gray417	gray418	gray419	gray420
gray421	gray422	gray423	gray424	gray425	gray426	gray427	gray428	gray429	gray430
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gray471	gray472	gray473	gray474	gray475	gray476	gray477	gray478	gray479	gray480
gray481	gray482	gray483	gray484	gray485	gray486	gray487	gray488	gray489	gray490
gray491	gray492	gray493	gray494	gray495	gray496	gray497	gray498	gray499	gray500
gray501	gray502	gray503	gray504	gray505	gray506	gray507	gray508	gray509	gray510
gray511	gray512	gray513	gray514	gray515	gray516	gray517	gray518	gray519	gray520
gray521	gray522	gray523	gray524	gray525	gray526	gray527	gray528	gray529	gray530
gray531	gray532	gray533	gray534	gray535	gray536	gray537	gray538	gray539	gray540
gray541	gray542	gray543	gray544	gray545	gray546	gray547	gray548	gray549	gray550
gray551	gray552	gray553	gray554	gray555	gray556	gray557	gray558	gray559	gray560
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gray581	gray582	gray583	gray584	gray585	gray586	gray587	gray588	gray589	gray590
gray591	gray592	gray593	gray594	gray595	gray596	gray597	gray598	gray599	gray600
gray601	gray602	gray603	gray604	gray605	gray606	gray607	gray608	gray609	gray610
gray611	gray612	gray613	gray614	gray615	gray616	gray617	gray618	gray619	gray620
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gray651	gray652	gray653	gray654	gray655	gray656	gray657	gray658	gray659	gray660
gray661	gray662	gray663	gray664	gray665	gray666	gray667	gray668	gray669	gray670
gray671	gray672	gray673	gray674	gray675	gray676	gray677	gray678	gray679	gray680
gray681	gray682	gray683	gray684	gray685	gray686	gray687	gray688	gray689	gray690
gray691	gray692	gray693	gray694	gray695	gray696	gray697	gray698	gray699	gray700
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gray711	gray712	gray713	gray714	gray715	gray716	gray717	gray718	gray719	gray720
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gray731	gray732	gray733	gray734	gray735	gray736	gray737	gray738	gray739	gray740
gray741	gray742	gray743	gray744	gray745	gray746	gray747	gray748	gray749	gray750
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gray781	gray782	gray783	gray784	gray785	gray786	gray787	gray788	gray789	gray790
gray791	gray792	gray793	gray794	gray795	gray796	gray797	gray798	gray799	gray800
gray801	gray802	gray803	gray804	gray805	gray806	gray807	gray808	gray809	gray810
gray811	gray812	gray813	gray814	gray815	gray816	gray817	gray818	gray819	gray820
gray821	gray822	gray823	gray824	gray825	gray826	gray827	gray828	gray829	gray830
gray831	gray832	gray833	gray834	gray835	gray836	gray837	gray838	gray839	gray840
gray841	gray842	gray843	gray844	gray845	gray846	gray847	gray848	gray849	gray850
gray851	gray852	gray853	gray854	gray855	gray856	gray857	gray858	gray859	gray860
gray861	gray862	gray863	gray864	gray865	gray866	gray867	gray868	gray869	gray870
gray871	gray872	gray873	gray874	gray875	gray876	gray877	gray878	gray879	gray880
gray881	gray882	gray883	gray884	gray885	gray886	gray887	gray888	gray889	gray890
gray891	gray892	gray893	gray894	gray895	gray896	gray897	gray898	gray899	gray900
gray901	gray902	gray903	gray904	gray905	gray906	gray907	gray908	gray909	gray910
gray911	gray912	gray913	gray914	gray915	gray916	gray917	gray918	gray919	gray920
gray921	gray922	gray923	gray924	gray925	gray926	gray927	gray928	gray929	gray930
gray931	gray932	gray933	gray934	gray935	gray936	gray937	gray938	gray939	gray940
gray941	gray942	gray943	gray944	gray945	gray946	gray947	gray948	gray949	gray950
gray951	gray952	gray953	gray954	gray955	gray956	gray957	gray958	gray959	gray960
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gray971	gray972	gray973	gray974	gray975	gray976	gray977	gray978	gray979	gray980
gray981	gray982	gray983	gray984	gray985	gray986	gray987	gray988	gray989	gray990
gray991	gray992	gray993	gray994	gray995	gray996	gray997	gray998	gray999	gray1000
gray1001	gray1002	gray1003	gray1004	gray1005	gray1006	gray1007	gray1008	gray1009	gray1010
gray1011	gray1012	gray1013	gray1014	gray1015	gray1016	gray1017	gray1018	gray1019	gray1020
gray1021	gray1022	gray1023	gray1024	gray1025	gray1026	gray1027	gray1028	gray1029	gray1030
gray1031	gray1032	gray1033	gray1034	gray1035	gray1036	gray1037	gray1038	gray1039	gray1040
gray1041	gray1042	gray1043	gray1044	gray1045	gray1046	gray1047	gray1048	gray1049	gray1050
gray1051	gray1052	gray1053	gray1054	gray1055	gray1056	gray1057	gray1058	gray1059	gray1060
gray1061	gray1062	gray1063	gray1064	gray1065	gray1066	gray1067	gray1068	gray1069	gray1070
gray1071	gray1072	gray1073	gray1074	gray1075	gray1076	gray1077	gray1078	gray1079	gray1080
gray1081	gray1082	gray1083	gray1084	gray1085	gray1086	gray1087	gray1088	gray1089	gray1090
gray1091	gray1092	gray1093	gray1094	gray1095	gray1096	gray1097	gray1098	gray1099	gray1100
gray1101	gray1102	gray1103	gray1104	gray1105	gray1106	gray1107	gray1108	gray1109	gray1110
gray1111	gray1112	gray1113	gray1114	gray1115	gray1116	gray1117	gray1118	gray1119	gray1120
gray1121	gray1122	gray1123	gray1124	gray1125	gray1126	gray1127	gray1128	gray1129	gray1130
gray1131	gray1132	gray1133	gray1134	gray1135	gray1136	gray1137	gray1138	gray1139	gray1140
gray1141	gray1142	gray1143	gray1144	gray1145	gray1146	gray1147	gray1148	gray1149	gray1150
gray1151	gray1152	gray1153	gray1154	gray1155	gray1156	gray1157	gray1158	gray1159	gray1160
gray1161	gray1162	gray1163	gray1164	gray1165	gray1166</				

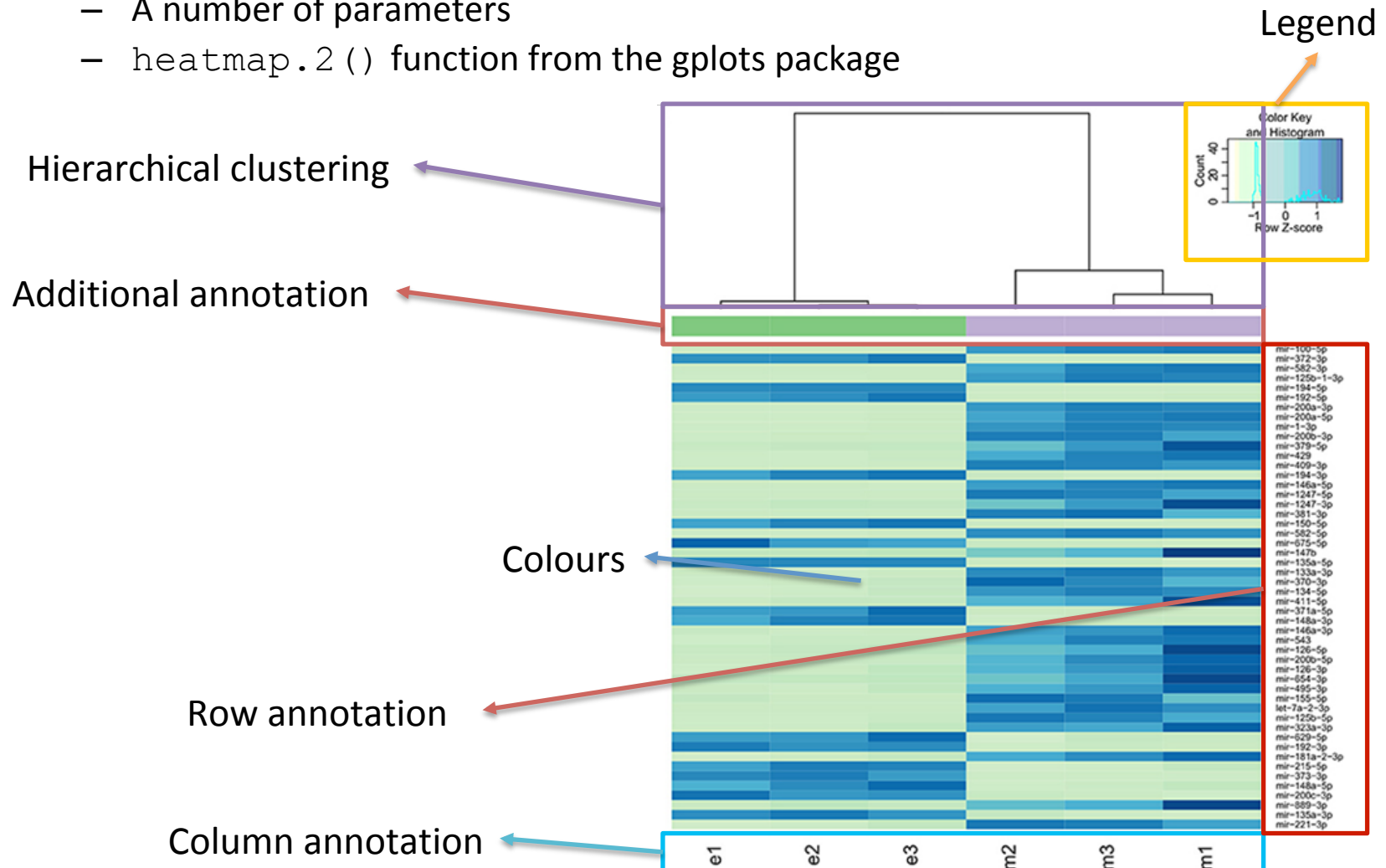
Colours in R

- 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

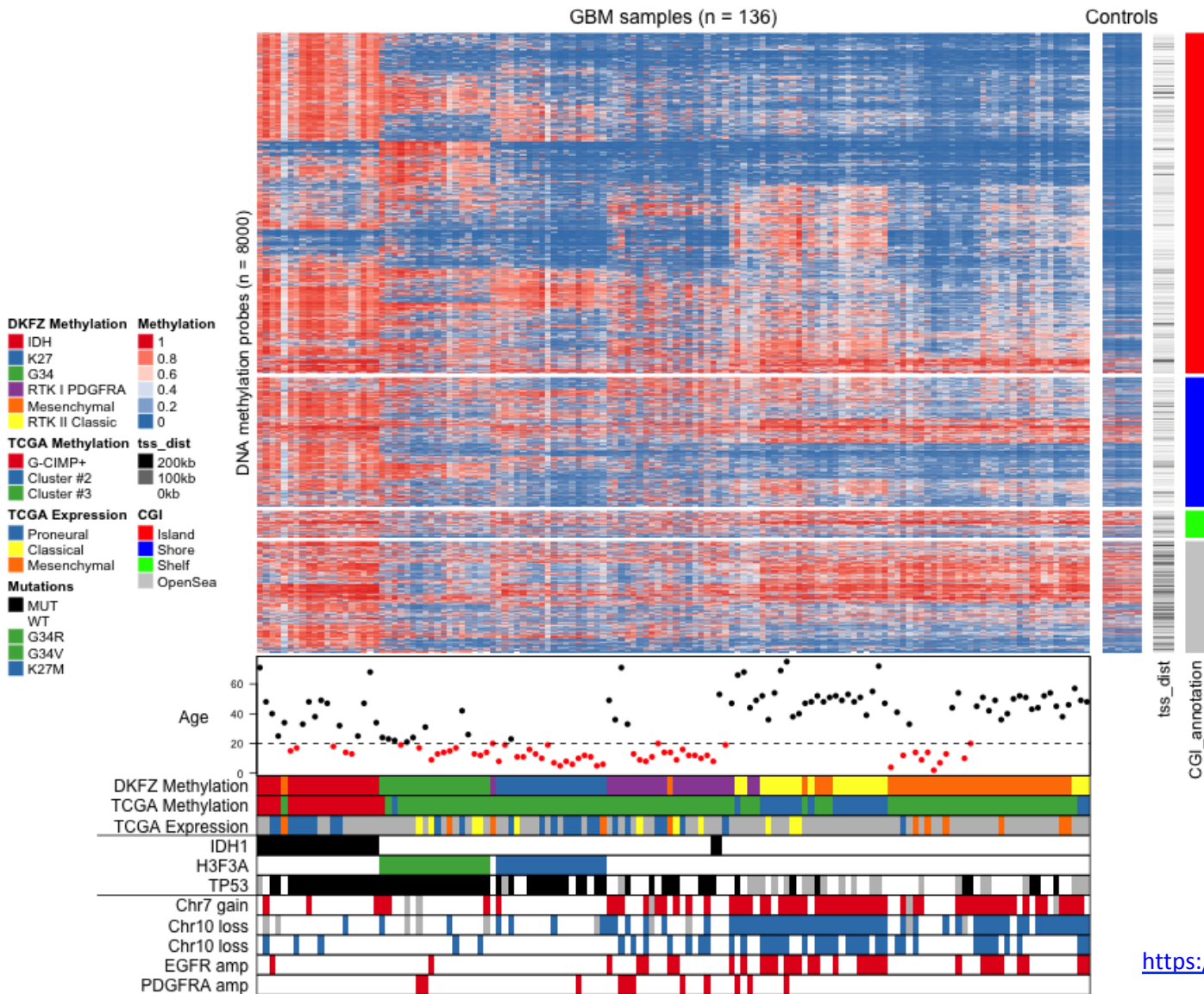


Heatmaps

- 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**



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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