Coronavirus Liver and Blood Capillary Samples

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2/8/2020

These samples are the headers added from three Gene Expression Omnibus studies at

* ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE89166
* ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE89160
* ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE100509

The first two studies are part of the same study that used human liver tumor samples in vitro to compare the effects of the coronavirus over time. The third study used human microvascular blood capillaries in vitro to study the effects of the coronavirus over time.

In the first two studies that used the liver tumor samples to examine the effects of the coronavirus in vitro, there were four groups inoculated or treated with the active coronavirus and four groups not inoculated with the active coranavirus, and two samples that were treated with heat inactivated coronavirus, and two samples that were treated with active coronavirus and IL-1alpha to see the gene expression changes over one hour’s time.

In the the third study that used blood capillaries, there were five samples followed over a 0,12,24,36, and 48 hour time intervals in groups A,B,C,D, and E that compared the time interval values of screening for changes in microarray analysis with a mock group of the same.

This following data is the data of all genes in common between these three studies, cleaned to remove missing values and with the attached gene symbols from the GEO platform for the probe IDs.

both <- read.csv('both\_clean\_liver\_capillary\_CoV.csv', sep=',', header=TRUE,   
 na.strings=c('',' '))

dim(both)

## [1] 21754 63

colnames(both)

## [1] "GENE\_SYMBOL"   
## [2] "LiverTumorSamples.GSM2359851\_CoV1"   
## [3] "LiverTumorSamples.GSM2359853\_CoV2"   
## [4] "LiverTumorSamples.GSM2359910\_CoV3"   
## [5] "LiverTumorSamples.GSM2359913\_CoV4"   
## [6] "LiverTumorSamples.GSM2359850\_ctrl1"   
## [7] "LiverTumorSamples.GSM2359852\_ctrl2"   
## [8] "LiverTumorSamples.GSM2359911\_ctrl3"   
## [9] "LiverTumorSamples.GSM2359914\_ctrl4"   
## [10] "LiverTumorSamples.GSM2359912\_Il1"   
## [11] "LiverTumorSamples.GSM2359917\_IL2"   
## [12] "LiverTumorSamples.GSM2359915\_inactiveHeatCoV1"  
## [13] "LiverTumorSamples.GSM2359916\_inactiveHeatCoV2"  
## [14] "capillarySamples.GSM2685693\_MERS\_CoV\_0hr\_A"   
## [15] "capillarySamples.GSM2685694\_MERS\_CoV\_0hr\_B"   
## [16] "capillarySamples.GSM2685695\_MERS\_CoV\_0hr\_C"   
## [17] "capillarySamples.GSM2685696\_MERS\_CoV\_0hr\_D"   
## [18] "capillarySamples.GSM2685697\_MERS\_CoV\_0hr\_E"   
## [19] "capillarySamples.GSM2685698\_ctrl\_0hr\_A"   
## [20] "capillarySamples.GSM2685699\_ctrl\_0hr\_B"   
## [21] "capillarySamples.GSM2685700\_ctrl\_0hr\_C"   
## [22] "capillarySamples.GSM2685701\_ctrl\_0hr\_D"   
## [23] "capillarySamples.GSM2685702\_ctrl\_0hr\_E"   
## [24] "capillarySamples.GSM2685703\_MERS\_CoV\_12hr\_A"   
## [25] "capillarySamples.GSM2685704\_MERS\_CoV\_12hr\_B"   
## [26] "capillarySamples.GSM2685705\_MERS\_CoV\_12hr\_C"   
## [27] "capillarySamples.GSM2685706\_MERS\_CoV\_12hr\_D"   
## [28] "capillarySamples.GSM2685707\_MERS\_CoV\_12hr\_E"   
## [29] "capillarySamples.GSM2685708\_ctrl\_12hr\_A"   
## [30] "capillarySamples.GSM2685709\_ctrl\_12hr\_B"   
## [31] "capillarySamples.GSM2685710\_ctrl\_12hr\_C"   
## [32] "capillarySamples.GSM2685711\_ctrl\_12hr\_D"   
## [33] "capillarySamples.GSM2685712\_ctrl\_12hr\_E"   
## [34] "capillarySamples.GSM2685713\_MERS\_CoV\_24hr\_A"   
## [35] "capillarySamples.GSM2685714\_MERS\_CoV\_24hr\_B"   
## [36] "capillarySamples.GSM2685715\_MERS\_CoV\_24hr\_C"   
## [37] "capillarySamples.GSM2685716\_MERS\_CoV\_24hr\_D"   
## [38] "capillarySamples.GSM2685717\_MERS\_CoV\_24hr\_E"   
## [39] "capillarySamples.GSM2685718\_ctrl\_24hr\_A"   
## [40] "capillarySamples.GSM2685719\_ctrl\_24hr\_B"   
## [41] "capillarySamples.GSM2685720\_ctrl\_24hr\_C"   
## [42] "capillarySamples.GSM2685721\_ctrl\_24hr\_D"   
## [43] "capillarySamples.GSM2685722\_ctrl\_24hr\_E"   
## [44] "capillarySamples.GSM2685723\_MERS\_CoV\_36hr\_A"   
## [45] "capillarySamples.GSM2685724\_MERS\_CoV\_36hr\_B"   
## [46] "capillarySamples.GSM2685725\_MERS\_CoV\_36hr\_C"   
## [47] "capillarySamples.GSM2685726\_MERS\_CoV\_36hr\_D"   
## [48] "capillarySamples.GSM2685727\_MERS\_CoV\_36hr\_E"   
## [49] "capillarySamples.GSM2685728\_ctrl\_36hr\_A"   
## [50] "capillarySamples.GSM2685729\_ctrl\_36hr\_B"   
## [51] "capillarySamples.GSM2685730\_ctrl\_36hr\_C"   
## [52] "capillarySamples.GSM2685731\_ctrl\_36hr\_D"   
## [53] "capillarySamples.GSM2685732\_ctrl\_36hr\_E"   
## [54] "capillarySamples.GSM2685733\_MERS\_CoV\_48hr\_A"   
## [55] "capillarySamples.GSM2685734\_MERS\_CoV\_48hr\_B"   
## [56] "capillarySamples.GSM2685735\_MERS\_CoV\_48hr\_C"   
## [57] "capillarySamples.GSM2685736\_MERS\_CoV\_48hr\_D"   
## [58] "capillarySamples.GSM2685737\_MERS\_CoV\_48hr\_E"   
## [59] "capillarySamples.GSM2685738\_ctrl\_48hr\_A"   
## [60] "capillarySamples.GSM2685739\_ctrl\_48hr\_B"   
## [61] "capillarySamples.GSM2685740\_ctrl\_48hr\_C"   
## [62] "capillarySamples.GSM2685741\_ctrl\_48hr\_D"   
## [63] "capillarySamples.GSM2685742\_ctrl\_48hr\_E"

Lets group the samples that are our columns with descriptive and GEO ID names into their respective groups, get the fold change between the controls from those groups, attach to the original data table, both, as a different names, then order by the genes that have the most fold change then the least fold change. Take the first 100 genes from both lists, combine into one table of 200 genes and the samples with their fold change values ordered, make into a transposed data frame so that the samples are the rows, the stats removed, and the 200 genes are the header columns to save as a machine learning ready file.

Liver tumor study control and CoV treated. Also, the IL-alpha treated and the inactive CoV treated tables are in this code block.

names <- both$GENE\_SYMBOL  
  
liverCtrl <- both[,c(6:9)]  
row.names(liverCtrl) <- names  
  
liverCoV <- both[,c(2:5)]  
row.names(liverCoV) <- names  
  
liverIL <- both[,10:11]  
row.names(liverIL) <- names  
  
liverIACoV <- both[,12:13]  
row.names(liverIACoV) <- names

Get the row means of those liver samples groups each.

liverCtrl$CtrlMeanLvr <- rowMeans(liverCtrl)  
liverCoV$CoVMeanLvr <- rowMeans(liverCoV)  
liverIL$ILMeanLvr <- rowMeans(liverIL)  
liverIACoV$IACoVMeanLvr <- rowMeans(liverIACoV)

Get the fold change values of those states as a ratio to the control group values.

fold1 <- as.data.frame(cbind(liverCtrl$CtrlMeanLvr,liverCoV$CoVMeanLvr,liverIL$ILMeanLvr,  
 liverIACoV$IACoVMeanLvr))  
row.names(fold1) <- names  
colnames(fold1) <- c('CtrlMeanLvr','CoVMeanLvr','ILMeanLvr','IACoVMeanLvr')  
  
fold1$FC\_CoV <- fold1$CoVMeanLvr/fold1$CtrlMeanLvr  
fold1$FC\_IL <- fold1$ILMeanLvr/fold1$CtrlMeanLvr  
fold1$FC\_IACov <- fold1$IACoVMeanLvr/fold1$CtrlMeanLvr

Most expressed in liver samples by fold change of the Coronavirus, inactive CoronaVirus, and the IL-alpha treated Coronavirus as tables.

mostCoV <- fold1[order(fold1$FC\_CoV, decreasing = TRUE)[0:100],]  
mostIL <- fold1[order(fold1$FC\_IL, decreasing = TRUE)[0:100],]  
mostIACoV <- fold1[order(fold1$FC\_IACov, decreasing = TRUE)[0:100],]

Least expressed in liver samples by fold change of the Coronavirus, inactive CoronaVirus, and the IL-alpha treated Coronavirus as tables.

leastCoV <- fold1[order(fold1$FC\_CoV, decreasing = FALSE)[0:100],]  
leastIL <- fold1[order(fold1$FC\_IL, decreasing = FALSE)[0:100],]  
leastIACoV <- fold1[order(fold1$FC\_IACov, decreasing = FALSE)[0:100],]

Gene Expressions with most changes in the liver samples.

changes <- rbind(mostCoV,mostIL,mostIACoV,leastCoV,leastIL,leastIACoV)  
Changes <- changes[!duplicated(row.names(changes)),]  
length(unique(row.names(Changes)))

## [1] 600

Get the magnitude of the fold change genes’ row means.

Changes$MagnitudeFCs <- abs(rowMeans(Changes[,5:7]))

Combine this to the samples data for the liver tumor group.

Changes$Gene <- row.names(Changes)  
combined1 <- merge(both, Changes, by.x='GENE\_SYMBOL', by.y='Gene')  
  
combined2 <- combined1[order(combined1$MagnitudeFCs, decreasing=TRUE),]  
  
CombinedLiver <- combined2[c(0:100,354:453),]

Machine Learning data for liver samples with 200 genes in the group of most gene expression changes.

names1 <- CombinedLiver$GENE\_SYMBOL  
names2 <- colnames(CombinedLiver)  
row.names(CombinedLiver) <- names1  
  
Combo\_lvr\_ML <- as.data.frame(t(CombinedLiver))  
  
colnames(Combo\_lvr\_ML) <- gsub('-','\_',colnames(Combo\_lvr\_ML))  
Combo1 <- Combo\_lvr\_ML[c(2:63),] #remove stats of fold change values and gene symbol row

Lets add a class field called Class\_Type to use machine learning on predicting class with these 200 genes and 62 mixed samples of capillary and liver tumor both inoculated with Coronavirus.

a <- rep('liver\_CoV', 4)  
b <- rep('liver\_Ctrl',4)  
c <- rep('liver\_CoV\_IL',2)  
d <- rep('liver\_IA\_CoV',2)  
e <- rep('capillary\_CoV\_0hr',5)  
f <- rep('capillary\_Ctrl\_0hr',5)  
g <- rep('capillary\_Cov\_12hr',5)  
h <- rep('capillary\_Ctrl\_12hr',5)  
i <- rep('capillary\_Cov\_24hr',5)  
j <- rep('capillary\_Ctrl\_24hr',5)  
k <- rep('capillary\_Cov\_36hr',5)  
l <- rep('capillary\_Ctrl\_36hr',5)  
m <- rep('capillary\_Cov\_48hr',5)  
n <- rep('capillary\_Ctrl\_48hr',5)  
  
type <- as.data.frame(c(a,b,c,d,e,f,g,h,i,j,k,l,m,n))  
colnames(type) <- 'Class\_Type'  
row.names(type) <- row.names(Combo1)  
type

## Class\_Type  
## LiverTumorSamples.GSM2359851\_CoV1 liver\_CoV  
## LiverTumorSamples.GSM2359853\_CoV2 liver\_CoV  
## LiverTumorSamples.GSM2359910\_CoV3 liver\_CoV  
## LiverTumorSamples.GSM2359913\_CoV4 liver\_CoV  
## LiverTumorSamples.GSM2359850\_ctrl1 liver\_Ctrl  
## LiverTumorSamples.GSM2359852\_ctrl2 liver\_Ctrl  
## LiverTumorSamples.GSM2359911\_ctrl3 liver\_Ctrl  
## LiverTumorSamples.GSM2359914\_ctrl4 liver\_Ctrl  
## LiverTumorSamples.GSM2359912\_Il1 liver\_CoV\_IL  
## LiverTumorSamples.GSM2359917\_IL2 liver\_CoV\_IL  
## LiverTumorSamples.GSM2359915\_inactiveHeatCoV1 liver\_IA\_CoV  
## LiverTumorSamples.GSM2359916\_inactiveHeatCoV2 liver\_IA\_CoV  
## capillarySamples.GSM2685693\_MERS\_CoV\_0hr\_A capillary\_CoV\_0hr  
## capillarySamples.GSM2685694\_MERS\_CoV\_0hr\_B capillary\_CoV\_0hr  
## capillarySamples.GSM2685695\_MERS\_CoV\_0hr\_C capillary\_CoV\_0hr  
## capillarySamples.GSM2685696\_MERS\_CoV\_0hr\_D capillary\_CoV\_0hr  
## capillarySamples.GSM2685697\_MERS\_CoV\_0hr\_E capillary\_CoV\_0hr  
## capillarySamples.GSM2685698\_ctrl\_0hr\_A capillary\_Ctrl\_0hr  
## capillarySamples.GSM2685699\_ctrl\_0hr\_B capillary\_Ctrl\_0hr  
## capillarySamples.GSM2685700\_ctrl\_0hr\_C capillary\_Ctrl\_0hr  
## capillarySamples.GSM2685701\_ctrl\_0hr\_D capillary\_Ctrl\_0hr  
## capillarySamples.GSM2685702\_ctrl\_0hr\_E capillary\_Ctrl\_0hr  
## capillarySamples.GSM2685703\_MERS\_CoV\_12hr\_A capillary\_Cov\_12hr  
## capillarySamples.GSM2685704\_MERS\_CoV\_12hr\_B capillary\_Cov\_12hr  
## capillarySamples.GSM2685705\_MERS\_CoV\_12hr\_C capillary\_Cov\_12hr  
## capillarySamples.GSM2685706\_MERS\_CoV\_12hr\_D capillary\_Cov\_12hr  
## capillarySamples.GSM2685707\_MERS\_CoV\_12hr\_E capillary\_Cov\_12hr  
## capillarySamples.GSM2685708\_ctrl\_12hr\_A capillary\_Ctrl\_12hr  
## capillarySamples.GSM2685709\_ctrl\_12hr\_B capillary\_Ctrl\_12hr  
## capillarySamples.GSM2685710\_ctrl\_12hr\_C capillary\_Ctrl\_12hr  
## capillarySamples.GSM2685711\_ctrl\_12hr\_D capillary\_Ctrl\_12hr  
## capillarySamples.GSM2685712\_ctrl\_12hr\_E capillary\_Ctrl\_12hr  
## capillarySamples.GSM2685713\_MERS\_CoV\_24hr\_A capillary\_Cov\_24hr  
## capillarySamples.GSM2685714\_MERS\_CoV\_24hr\_B capillary\_Cov\_24hr  
## capillarySamples.GSM2685715\_MERS\_CoV\_24hr\_C capillary\_Cov\_24hr  
## capillarySamples.GSM2685716\_MERS\_CoV\_24hr\_D capillary\_Cov\_24hr  
## capillarySamples.GSM2685717\_MERS\_CoV\_24hr\_E capillary\_Cov\_24hr  
## capillarySamples.GSM2685718\_ctrl\_24hr\_A capillary\_Ctrl\_24hr  
## capillarySamples.GSM2685719\_ctrl\_24hr\_B capillary\_Ctrl\_24hr  
## capillarySamples.GSM2685720\_ctrl\_24hr\_C capillary\_Ctrl\_24hr  
## capillarySamples.GSM2685721\_ctrl\_24hr\_D capillary\_Ctrl\_24hr  
## capillarySamples.GSM2685722\_ctrl\_24hr\_E capillary\_Ctrl\_24hr  
## capillarySamples.GSM2685723\_MERS\_CoV\_36hr\_A capillary\_Cov\_36hr  
## capillarySamples.GSM2685724\_MERS\_CoV\_36hr\_B capillary\_Cov\_36hr  
## capillarySamples.GSM2685725\_MERS\_CoV\_36hr\_C capillary\_Cov\_36hr  
## capillarySamples.GSM2685726\_MERS\_CoV\_36hr\_D capillary\_Cov\_36hr  
## capillarySamples.GSM2685727\_MERS\_CoV\_36hr\_E capillary\_Cov\_36hr  
## capillarySamples.GSM2685728\_ctrl\_36hr\_A capillary\_Ctrl\_36hr  
## capillarySamples.GSM2685729\_ctrl\_36hr\_B capillary\_Ctrl\_36hr  
## capillarySamples.GSM2685730\_ctrl\_36hr\_C capillary\_Ctrl\_36hr  
## capillarySamples.GSM2685731\_ctrl\_36hr\_D capillary\_Ctrl\_36hr  
## capillarySamples.GSM2685732\_ctrl\_36hr\_E capillary\_Ctrl\_36hr  
## capillarySamples.GSM2685733\_MERS\_CoV\_48hr\_A capillary\_Cov\_48hr  
## capillarySamples.GSM2685734\_MERS\_CoV\_48hr\_B capillary\_Cov\_48hr  
## capillarySamples.GSM2685735\_MERS\_CoV\_48hr\_C capillary\_Cov\_48hr  
## capillarySamples.GSM2685736\_MERS\_CoV\_48hr\_D capillary\_Cov\_48hr  
## capillarySamples.GSM2685737\_MERS\_CoV\_48hr\_E capillary\_Cov\_48hr  
## capillarySamples.GSM2685738\_ctrl\_48hr\_A capillary\_Ctrl\_48hr  
## capillarySamples.GSM2685739\_ctrl\_48hr\_B capillary\_Ctrl\_48hr  
## capillarySamples.GSM2685740\_ctrl\_48hr\_C capillary\_Ctrl\_48hr  
## capillarySamples.GSM2685741\_ctrl\_48hr\_D capillary\_Ctrl\_48hr  
## capillarySamples.GSM2685742\_ctrl\_48hr\_E capillary\_Ctrl\_48hr

Combo2 <- cbind(type,Combo1)  
Combo2[1:10,1:5]

## Class\_Type NEURL3 DUSP1  
## LiverTumorSamples.GSM2359851\_CoV1 liver\_CoV 1429.61750 8491.40875  
## LiverTumorSamples.GSM2359853\_CoV2 liver\_CoV 190.21750 2219.85650  
## LiverTumorSamples.GSM2359910\_CoV3 liver\_CoV 10.004148 11.494585  
## LiverTumorSamples.GSM2359913\_CoV4 liver\_CoV 11.245589 12.898250  
## LiverTumorSamples.GSM2359850\_ctrl1 liver\_Ctrl 34.57000 228.18775  
## LiverTumorSamples.GSM2359852\_ctrl2 liver\_Ctrl 17.25750 216.08550  
## LiverTumorSamples.GSM2359911\_ctrl3 liver\_Ctrl 3.708157 7.184185  
## LiverTumorSamples.GSM2359914\_ctrl4 liver\_Ctrl 4.757780 7.113854  
## LiverTumorSamples.GSM2359912\_Il1 liver\_CoV\_IL 4.879242 9.576161  
## LiverTumorSamples.GSM2359917\_IL2 liver\_CoV\_IL 5.1138565 9.5527540  
## ATF3 PCLO  
## LiverTumorSamples.GSM2359851\_CoV1 3608.28250 17.74792  
## LiverTumorSamples.GSM2359853\_CoV2 974.76937 613.28583  
## LiverTumorSamples.GSM2359910\_CoV3 8.337322 3.355859  
## LiverTumorSamples.GSM2359913\_CoV4 9.441972 2.741117  
## LiverTumorSamples.GSM2359850\_ctrl1 108.52250 13.80667  
## LiverTumorSamples.GSM2359852\_ctrl2 97.05125 12.88750  
## LiverTumorSamples.GSM2359911\_ctrl3 5.373051 3.904719  
## LiverTumorSamples.GSM2359914\_ctrl4 5.513552 3.621765  
## LiverTumorSamples.GSM2359912\_Il1 6.500059 3.653289  
## LiverTumorSamples.GSM2359917\_IL2 6.6111744 3.7909157

Write this ML ready file to csv.

write.csv(Combo2, 'ML\_ready\_CoV\_14\_classes.csv', row.names=TRUE)

Make a separate ML ready file with a smaller set of classes to classify by liver or capillary and control or CoronaVirus

a <- rep('liver', 4)  
b <- rep('liver',4)  
c <- rep('liver',2)  
d <- rep('liver',2)  
e <- rep('capillary',5)  
f <- rep('capillary',5)  
g <- rep('capillary',5)  
h <- rep('capillary',5)  
i <- rep('capillary',5)  
j <- rep('capillary',5)  
k <- rep('capillary',5)  
l <- rep('capillary',5)  
m <- rep('capillary',5)  
n <- rep('capillary',5)  
  
type <- as.data.frame(c(a,b,c,d,e,f,g,h,i,j,k,l,m,n))  
colnames(type) <- 'Class\_Type'  
row.names(type) <- row.names(Combo1)  
  
Combo3 <- cbind(type,Combo1)  
  
Combo3[1:10,1:5]

## Class\_Type NEURL3 DUSP1  
## LiverTumorSamples.GSM2359851\_CoV1 liver 1429.61750 8491.40875  
## LiverTumorSamples.GSM2359853\_CoV2 liver 190.21750 2219.85650  
## LiverTumorSamples.GSM2359910\_CoV3 liver 10.004148 11.494585  
## LiverTumorSamples.GSM2359913\_CoV4 liver 11.245589 12.898250  
## LiverTumorSamples.GSM2359850\_ctrl1 liver 34.57000 228.18775  
## LiverTumorSamples.GSM2359852\_ctrl2 liver 17.25750 216.08550  
## LiverTumorSamples.GSM2359911\_ctrl3 liver 3.708157 7.184185  
## LiverTumorSamples.GSM2359914\_ctrl4 liver 4.757780 7.113854  
## LiverTumorSamples.GSM2359912\_Il1 liver 4.879242 9.576161  
## LiverTumorSamples.GSM2359917\_IL2 liver 5.1138565 9.5527540  
## ATF3 PCLO  
## LiverTumorSamples.GSM2359851\_CoV1 3608.28250 17.74792  
## LiverTumorSamples.GSM2359853\_CoV2 974.76937 613.28583  
## LiverTumorSamples.GSM2359910\_CoV3 8.337322 3.355859  
## LiverTumorSamples.GSM2359913\_CoV4 9.441972 2.741117  
## LiverTumorSamples.GSM2359850\_ctrl1 108.52250 13.80667  
## LiverTumorSamples.GSM2359852\_ctrl2 97.05125 12.88750  
## LiverTumorSamples.GSM2359911\_ctrl3 5.373051 3.904719  
## LiverTumorSamples.GSM2359914\_ctrl4 5.513552 3.621765  
## LiverTumorSamples.GSM2359912\_Il1 6.500059 3.653289  
## LiverTumorSamples.GSM2359917\_IL2 6.6111744 3.7909157

write.csv(Combo3, 'ML\_ready\_CoV\_2\_classes.csv', row.names=TRUE)

a <- rep('CoV', 4)  
b <- rep('Ctrl',4)  
c <- rep('CoV\_IL',2)  
d <- rep('IA\_CoV',2)  
e <- rep('CoV',5)  
f <- rep('Ctrl',5)  
g <- rep('Cov',5)  
h <- rep('Ctrl',5)  
i <- rep('Cov',5)  
j <- rep('Ctrl',5)  
k <- rep('Cov',5)  
l <- rep('Ctrl',5)  
m <- rep('Cov',5)  
n <- rep('Ctrl',5)  
  
type <- as.data.frame(c(a,b,c,d,e,f,g,h,i,j,k,l,m,n))  
colnames(type) <- 'Class\_Type'  
row.names(type) <- row.names(Combo1)  
  
Combo4 <- cbind(type,Combo1)  
  
Combo4[1:10,1:5]

## Class\_Type NEURL3 DUSP1  
## LiverTumorSamples.GSM2359851\_CoV1 CoV 1429.61750 8491.40875  
## LiverTumorSamples.GSM2359853\_CoV2 CoV 190.21750 2219.85650  
## LiverTumorSamples.GSM2359910\_CoV3 CoV 10.004148 11.494585  
## LiverTumorSamples.GSM2359913\_CoV4 CoV 11.245589 12.898250  
## LiverTumorSamples.GSM2359850\_ctrl1 Ctrl 34.57000 228.18775  
## LiverTumorSamples.GSM2359852\_ctrl2 Ctrl 17.25750 216.08550  
## LiverTumorSamples.GSM2359911\_ctrl3 Ctrl 3.708157 7.184185  
## LiverTumorSamples.GSM2359914\_ctrl4 Ctrl 4.757780 7.113854  
## LiverTumorSamples.GSM2359912\_Il1 CoV\_IL 4.879242 9.576161  
## LiverTumorSamples.GSM2359917\_IL2 CoV\_IL 5.1138565 9.5527540  
## ATF3 PCLO  
## LiverTumorSamples.GSM2359851\_CoV1 3608.28250 17.74792  
## LiverTumorSamples.GSM2359853\_CoV2 974.76937 613.28583  
## LiverTumorSamples.GSM2359910\_CoV3 8.337322 3.355859  
## LiverTumorSamples.GSM2359913\_CoV4 9.441972 2.741117  
## LiverTumorSamples.GSM2359850\_ctrl1 108.52250 13.80667  
## LiverTumorSamples.GSM2359852\_ctrl2 97.05125 12.88750  
## LiverTumorSamples.GSM2359911\_ctrl3 5.373051 3.904719  
## LiverTumorSamples.GSM2359914\_ctrl4 5.513552 3.621765  
## LiverTumorSamples.GSM2359912\_Il1 6.500059 3.653289  
## LiverTumorSamples.GSM2359917\_IL2 6.6111744 3.7909157

write.csv(Combo4, 'ML\_ready\_CoV\_4\_classes.csv', row.names=TRUE)

We didn’t do any fold change or stat measures on the capillary samples, but we can plot them by using ggplot2 and group the sets by timed intervals for each group A through E and picking a handful of genes to compare over the 0,12,24,36, and 48 hour time intervals for the control group and the Coronavirus inoculated groups.

When the values are a ratio like this, it is easier to see the larger changes as in 9 compared to a low change like 0.0005, but this just means that compared to the control samples the inoculated Coronavirus had 9 times the gene expression values or had downregulated or suppressed gene expression values to 1/5000th the amount of the normal range of gene expression values respectively. \*\*\*

It makes sense to use some genes we already know have a higher magnitude of change, and we have a column for that in the CombinedLiver table called MagnitudeFCs that was already sorted from largest to smallest when made. We’ll just select the first five of those genes to compare in these capillary samples over time.

mostChanged <- CombinedLiver[1:5,c(1,71)]  
mostSuppressed <- CombinedLiver[196:200,c(1,71)]  
row.names(mostChanged)

## [1] "NEURL3" "DUSP1" "ATF3" "PCLO" "LHB"

row.names(mostSuppressed)

## [1] "RASSF7" "LOC100335030" "C2orf78" "DEFB1" "ZNF610"

capillary <- merge(mostChanged, CombinedLiver, by.x='GENE\_SYMBOL', by.y='GENE\_SYMBOL')  
capillary1 <- merge(mostSuppressed, CombinedLiver, by.x='GENE\_SYMBOL', by.y='GENE\_SYMBOL')  
capillaries <- rbind(capillary,capillary1)  
Capillaries <- capillaries[,c(1,15:64)]  
row.names(Capillaries) <- Capillaries$GENE\_SYMBOL  
  
Capillaries2 <- as.data.frame(t(Capillaries))  
Capillaries2 <- Capillaries2[-1,]  
row.names(Capillaries2) <- gsub('capillarySamples.','',row.names(Capillaries2))  
row.names(Capillaries2) <- gsub('GSM[0-9][0-9][0-9][0-9][0-9][0-9][0-9]\_','',row.names(Capillaries2))  
row.names(Capillaries2) <- gsub('MERS\_','', row.names(Capillaries2))

CoV <- grep('CoV', row.names(Capillaries2))  
ctrl <- grep('ctrl', row.names(Capillaries2))  
  
Capillaries2$Class <- 'CoV or ctrl'  
  
Capillaries2[CoV,11] <- 'Coronavirus'  
Capillaries2[ctrl,11] <- 'control'  
  
A <- grep('\_A', row.names(Capillaries2))  
B <- grep('\_B', row.names(Capillaries2))  
C <- grep('\_C', row.names(Capillaries2))  
D <- grep('\_D', row.names(Capillaries2))  
E <- grep('\_E', row.names(Capillaries2))  
  
Capillaries2$Group <- 'group'  
  
Capillaries2[A,12] <- 'A'  
Capillaries2[B,12] <- 'B'  
Capillaries2[C,12] <- 'C'  
Capillaries2[D,12] <- 'D'  
Capillaries2[E,12] <- 'E'  
  
hr0 <- grep('0hr', row.names(Capillaries2))  
hr12 <- grep('12hr', row.names(Capillaries2))  
hr24 <- grep('24hr', row.names(Capillaries2))  
hr36 <- grep('36hr', row.names(Capillaries2))  
hr48 <- grep('48hr', row.names(Capillaries2))  
  
Capillaries2$TimeInterval <- 'time'  
  
Capillaries2[hr0,13] <- '0 hr'  
Capillaries2[hr12,13] <- '12 hr'  
Capillaries2[hr24,13] <- '24 hr'  
Capillaries2[hr36,13] <- '36 hr'  
Capillaries2[hr48,13] <- '48 hr'  
  
Capillaries2

## ATF3 DUSP1 LHB NEURL3 PCLO C2orf78  
## CoV\_0hr\_A 10.290996 13.901505 9.093671 7.498965 6.468670 5.936451  
## CoV\_0hr\_B 9.780412 13.852933 9.128886 7.446590 6.476326 6.023280  
## CoV\_0hr\_C 9.574148 13.740905 8.662565 7.495092 6.463702 5.909934  
## CoV\_0hr\_D 9.848204 13.863910 8.729845 7.364854 6.572579 5.986079  
## CoV\_0hr\_E 10.114265 13.968982 8.738079 7.436675 6.625125 5.862801  
## ctrl\_0hr\_A 10.173291 14.398733 8.776979 7.267773 6.410249 6.016610  
## ctrl\_0hr\_B 10.132629 14.237192 9.610252 7.015544 6.467982 5.931786  
## ctrl\_0hr\_C 10.308477 14.382699 9.557514 7.440873 6.478339 5.853411  
## ctrl\_0hr\_D 9.888505 14.404923 9.602914 7.102155 6.489396 5.855096  
## ctrl\_0hr\_E 9.892730 14.120833 9.577233 6.936543 6.417981 5.942510  
## CoV\_12hr\_A 9.819186 11.303627 10.795022 12.768140 6.256646 5.865277  
## CoV\_12hr\_B 10.011539 11.577456 11.006393 12.402078 6.327304 5.922540  
## CoV\_12hr\_C 9.783105 11.626722 11.000187 12.532051 6.322820 5.988353  
## CoV\_12hr\_D 9.849858 11.692725 10.938022 12.668202 6.261566 5.901327  
## CoV\_12hr\_E 9.617070 12.220997 10.553798 12.273302 6.333485 5.898912  
## ctrl\_12hr\_A 7.825226 11.488735 9.286872 6.829080 6.528833 5.954890  
## ctrl\_12hr\_B 7.872041 11.710908 8.845744 6.784278 6.532492 5.862801  
## ctrl\_12hr\_C 7.989155 11.468072 9.267328 6.908973 6.489589 5.973506  
## ctrl\_12hr\_D 8.028735 11.407001 9.820556 6.615987 6.412667 5.928711  
## ctrl\_12hr\_E 8.154875 11.042038 9.741747 6.833504 6.431864 5.862305  
## CoV\_24hr\_A 12.356029 14.922819 10.081784 13.713997 6.330955 5.981748  
## CoV\_24hr\_B 12.393863 14.762759 10.125434 13.516154 6.376025 5.938335  
## CoV\_24hr\_C 12.347139 15.286795 9.988253 13.718699 6.398037 6.047165  
## CoV\_24hr\_D 12.280955 15.019195 9.580647 13.576554 6.441270 6.099102  
## CoV\_24hr\_E 12.187980 14.989084 9.508540 13.545156 6.428447 6.044217  
## ctrl\_24hr\_A 7.914153 12.020454 8.926344 6.410178 6.709108 6.033401  
## ctrl\_24hr\_B 8.179651 11.901618 9.159004 6.560892 6.642224 5.909934  
## ctrl\_24hr\_C 8.062523 11.831523 9.275883 6.568645 6.626875 5.938570  
## ctrl\_24hr\_D 8.045721 11.806023 9.273915 6.631753 6.618130 5.997365  
## ctrl\_24hr\_E 8.204591 11.942950 9.125971 6.562419 6.697083 5.919444  
## CoV\_36hr\_A 12.318180 14.508819 9.861903 13.561144 6.548994 6.087523  
## CoV\_36hr\_B 12.173687 14.540567 9.802688 13.549071 6.644295 5.999396  
## CoV\_36hr\_C 12.163530 14.579001 9.872176 13.449660 6.515321 5.933150  
## CoV\_36hr\_D 12.142847 14.514722 9.982218 13.712803 6.671993 6.001650  
## CoV\_36hr\_E 12.297080 14.374295 10.201176 13.521456 6.372439 6.051522  
## ctrl\_36hr\_A 7.940682 11.742312 9.321322 6.730998 6.678982 6.220477  
## ctrl\_36hr\_B 7.783378 11.751105 9.056790 6.621403 6.643658 6.125131  
## ctrl\_36hr\_C 7.810544 11.798201 9.151894 6.822530 6.618794 6.092605  
## ctrl\_36hr\_D 7.731982 11.876269 9.024215 6.685524 6.629717 6.098892  
## ctrl\_36hr\_E 7.734450 11.888111 8.922796 6.630443 6.673160 6.028326  
## CoV\_48hr\_A 11.205349 13.523040 9.679922 12.333937 6.529574 6.049019  
## CoV\_48hr\_B 11.253111 13.511350 9.912659 12.481150 6.549794 5.980606  
## CoV\_48hr\_C 10.944238 13.316529 9.850259 12.260608 6.708351 6.203350  
## CoV\_48hr\_D 10.983900 13.358680 9.899124 11.961065 6.599227 6.142515  
## CoV\_48hr\_E 11.255318 13.367467 10.184716 12.498831 6.679909 6.017946  
## ctrl\_48hr\_A 7.932607 12.174103 9.024090 6.757483 6.552106 6.016387  
## ctrl\_48hr\_B 7.668012 12.449589 8.985262 6.882334 6.700790 5.961156  
## ctrl\_48hr\_C 7.755264 12.365436 9.031925 6.844960 6.455577 6.003225  
## ctrl\_48hr\_D 7.725891 12.415529 8.940948 6.872043 6.533961 5.986534  
## ctrl\_48hr\_E 7.656200 12.455840 8.994880 6.868035 6.479109 6.091125  
## DEFB1 LOC100335030 RASSF7 ZNF610 Class Group  
## CoV\_0hr\_A 7.622403 8.114815 6.822339 7.227249 Coronavirus A  
## CoV\_0hr\_B 7.778352 8.270884 6.700971 7.428115 Coronavirus B  
## CoV\_0hr\_C 7.352772 8.308822 6.966246 7.481717 Coronavirus C  
## CoV\_0hr\_D 7.118591 8.246936 6.875601 7.426565 Coronavirus D  
## CoV\_0hr\_E 7.179596 8.214737 6.952108 7.420473 Coronavirus E  
## ctrl\_0hr\_A 7.331124 8.187333 6.964110 7.403619 control A  
## ctrl\_0hr\_B 7.872561 8.288294 6.910892 7.464914 control B  
## ctrl\_0hr\_C 7.584274 8.147007 6.994899 7.269174 control C  
## ctrl\_0hr\_D 7.650353 8.185575 7.033153 7.359418 control D  
## ctrl\_0hr\_E 7.847725 8.156999 7.056144 7.447995 control E  
## CoV\_12hr\_A 8.059324 7.868801 6.594891 8.147592 Coronavirus A  
## CoV\_12hr\_B 7.843962 7.735502 6.692292 8.178197 Coronavirus B  
## CoV\_12hr\_C 7.985707 7.820541 6.586602 8.121462 Coronavirus C  
## CoV\_12hr\_D 7.995350 7.717794 6.571151 8.224417 Coronavirus D  
## CoV\_12hr\_E 7.418830 7.832236 6.801301 8.247149 Coronavirus E  
## ctrl\_12hr\_A 8.009080 8.069778 6.880927 7.524340 control A  
## ctrl\_12hr\_B 8.055858 7.986788 6.895230 7.537055 control B  
## ctrl\_12hr\_C 7.952662 7.941232 6.903801 7.575149 control C  
## ctrl\_12hr\_D 8.277781 8.181431 6.745836 7.641494 control D  
## ctrl\_12hr\_E 8.235038 8.169354 6.554766 7.782781 control E  
## CoV\_24hr\_A 7.571666 8.536174 6.747448 8.938377 Coronavirus A  
## CoV\_24hr\_B 7.629778 8.509799 6.697222 8.733307 Coronavirus B  
## CoV\_24hr\_C 7.260831 8.425157 6.692222 9.019246 Coronavirus C  
## CoV\_24hr\_D 7.080690 8.584440 6.757083 9.012278 Coronavirus D  
## CoV\_24hr\_E 7.058040 8.736338 6.698612 9.092390 Coronavirus E  
## ctrl\_24hr\_A 7.563681 8.155811 6.789623 7.914991 control A  
## ctrl\_24hr\_B 7.729397 8.138252 6.704019 7.747434 control B  
## ctrl\_24hr\_C 7.946592 8.095640 6.643618 7.788730 control C  
## ctrl\_24hr\_D 7.625182 8.078397 6.716886 7.876311 control D  
## ctrl\_24hr\_E 7.486914 8.005603 6.680610 7.754600 control E  
## CoV\_36hr\_A 8.078504 8.482066 6.721733 8.534288 Coronavirus A  
## CoV\_36hr\_B 7.874253 8.583444 6.770072 8.659518 Coronavirus B  
## CoV\_36hr\_C 7.801655 8.552423 6.862404 8.572155 Coronavirus C  
## CoV\_36hr\_D 7.980233 8.606779 6.846841 8.654873 Coronavirus D  
## CoV\_36hr\_E 7.610937 8.589262 6.822339 8.589262 Coronavirus E  
## ctrl\_36hr\_A 7.737160 8.018402 6.849095 7.846848 control A  
## ctrl\_36hr\_B 7.704646 8.042240 6.771987 7.839025 control B  
## ctrl\_36hr\_C 7.652111 8.124825 6.842196 7.974192 control C  
## ctrl\_36hr\_D 7.564977 8.045657 6.925022 7.847725 control D  
## ctrl\_36hr\_E 7.592967 8.041310 6.908012 7.860321 control E  
## CoV\_48hr\_A 7.328972 8.062943 6.505043 7.678934 Coronavirus A  
## CoV\_48hr\_B 7.354622 8.098275 6.544158 7.742997 Coronavirus B  
## CoV\_48hr\_C 7.478970 8.024786 6.488793 7.725653 Coronavirus C  
## CoV\_48hr\_D 7.584650 7.979318 6.643906 7.822518 Coronavirus D  
## CoV\_48hr\_E 7.345740 8.128902 6.493502 9.374216 Coronavirus E  
## ctrl\_48hr\_A 7.551584 8.234894 6.812821 7.882805 control A  
## ctrl\_48hr\_B 7.634577 8.221036 6.918835 8.076742 control B  
## ctrl\_48hr\_C 7.580736 8.234032 6.851086 8.033925 control C  
## ctrl\_48hr\_D 7.753263 8.230602 6.913527 7.983884 control D  
## ctrl\_48hr\_E 7.731435 8.270651 6.878047 7.998738 control E  
## TimeInterval  
## CoV\_0hr\_A 0 hr  
## CoV\_0hr\_B 0 hr  
## CoV\_0hr\_C 0 hr  
## CoV\_0hr\_D 0 hr  
## CoV\_0hr\_E 0 hr  
## ctrl\_0hr\_A 0 hr  
## ctrl\_0hr\_B 0 hr  
## ctrl\_0hr\_C 0 hr  
## ctrl\_0hr\_D 0 hr  
## ctrl\_0hr\_E 0 hr  
## CoV\_12hr\_A 12 hr  
## CoV\_12hr\_B 12 hr  
## CoV\_12hr\_C 12 hr  
## CoV\_12hr\_D 12 hr  
## CoV\_12hr\_E 12 hr  
## ctrl\_12hr\_A 12 hr  
## ctrl\_12hr\_B 12 hr  
## ctrl\_12hr\_C 12 hr  
## ctrl\_12hr\_D 12 hr  
## ctrl\_12hr\_E 12 hr  
## CoV\_24hr\_A 24 hr  
## CoV\_24hr\_B 24 hr  
## CoV\_24hr\_C 24 hr  
## CoV\_24hr\_D 24 hr  
## CoV\_24hr\_E 24 hr  
## ctrl\_24hr\_A 24 hr  
## ctrl\_24hr\_B 24 hr  
## ctrl\_24hr\_C 24 hr  
## ctrl\_24hr\_D 24 hr  
## ctrl\_24hr\_E 24 hr  
## CoV\_36hr\_A 36 hr  
## CoV\_36hr\_B 36 hr  
## CoV\_36hr\_C 36 hr  
## CoV\_36hr\_D 36 hr  
## CoV\_36hr\_E 36 hr  
## ctrl\_36hr\_A 36 hr  
## ctrl\_36hr\_B 36 hr  
## ctrl\_36hr\_C 36 hr  
## ctrl\_36hr\_D 36 hr  
## ctrl\_36hr\_E 36 hr  
## CoV\_48hr\_A 48 hr  
## CoV\_48hr\_B 48 hr  
## CoV\_48hr\_C 48 hr  
## CoV\_48hr\_D 48 hr  
## CoV\_48hr\_E 48 hr  
## ctrl\_48hr\_A 48 hr  
## ctrl\_48hr\_B 48 hr  
## ctrl\_48hr\_C 48 hr  
## ctrl\_48hr\_D 48 hr  
## ctrl\_48hr\_E 48 hr

write.csv(Capillaries2,'FC\_10\_capillaries\_CoV.csv', row.names=TRUE)

The above table has 10 genes as the columns with the added Class (Coronavirus or control), Group (A,B,C,D,E), and TimeInterval (0,12,24,36,48 hours) fields to filter by and plot.

Lets make these group tables for the corona virus and see how they compare over time.

library(dplyr)  
  
A\_group <- filter(Capillaries2, Group=='A' & Class == 'Coronavirus')  
B\_group <- filter(Capillaries2, Group=='B' & Class == 'Coronavirus')  
C\_group <- filter(Capillaries2, Group=='C' & Class == 'Coronavirus')  
D\_group <- filter(Capillaries2, Group=='D' & Class == 'Coronavirus')  
E\_group <- filter(Capillaries2, Group=='E' & Class == 'Coronavirus')

Lets use the tidyr package to put the 10 genes into one Gene field.

library(tidyr)

We will do this for the A\_group table and ignore the Group and Class fields, because we made it only the A group of the Coronavirus class.

A\_group2 <- A\_group[,c(1,3,5,7,9,11:13)]  
A\_tidy <- gather(A\_group2, 'Gene','GeneExpression',1:5)

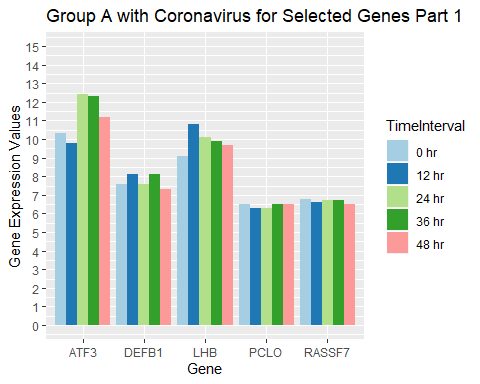
## Warning: attributes are not identical across measure variables;  
## they will be dropped

A\_tidy$GeneExpression <- round(as.numeric(A\_tidy$GeneExpression),1)  
A\_tidy$TimeInterval <- as.factor(A\_tidy$TimeInterval)  
A\_tidy$Gene <- as.factor(A\_tidy$Gene)  
A\_tidy

## Class Group TimeInterval Gene GeneExpression  
## 1 Coronavirus A 0 hr ATF3 10.3  
## 2 Coronavirus A 12 hr ATF3 9.8  
## 3 Coronavirus A 24 hr ATF3 12.4  
## 4 Coronavirus A 36 hr ATF3 12.3  
## 5 Coronavirus A 48 hr ATF3 11.2  
## 6 Coronavirus A 0 hr LHB 9.1  
## 7 Coronavirus A 12 hr LHB 10.8  
## 8 Coronavirus A 24 hr LHB 10.1  
## 9 Coronavirus A 36 hr LHB 9.9  
## 10 Coronavirus A 48 hr LHB 9.7  
## 11 Coronavirus A 0 hr PCLO 6.5  
## 12 Coronavirus A 12 hr PCLO 6.3  
## 13 Coronavirus A 24 hr PCLO 6.3  
## 14 Coronavirus A 36 hr PCLO 6.5  
## 15 Coronavirus A 48 hr PCLO 6.5  
## 16 Coronavirus A 0 hr DEFB1 7.6  
## 17 Coronavirus A 12 hr DEFB1 8.1  
## 18 Coronavirus A 24 hr DEFB1 7.6  
## 19 Coronavirus A 36 hr DEFB1 8.1  
## 20 Coronavirus A 48 hr DEFB1 7.3  
## 21 Coronavirus A 0 hr RASSF7 6.8  
## 22 Coronavirus A 12 hr RASSF7 6.6  
## 23 Coronavirus A 24 hr RASSF7 6.7  
## 24 Coronavirus A 36 hr RASSF7 6.7  
## 25 Coronavirus A 48 hr RASSF7 6.5

library(ggplot2)

ggplot(data = A\_tidy, aes(x=Gene, y=GeneExpression, fill=TimeInterval)) +  
 geom\_bar(stat='identity', position=position\_dodge())+  
 scale\_y\_continuous(breaks = seq(0, 15, by=1), limits=c(0,15))+  
 scale\_fill\_brewer(palette='Paired') +   
 ggtitle('Group A with Coronavirus for Selected Genes Part 1')+  
 xlab('Gene')+  
 ylab('Gene Expression Values')



The genes above for Part 1 of the group A samples of coronavirus in blood capillaries show some variation in gene expression values for some of these genes that had the most change in the liver tumor samples. Starting at the initial hour up to 48 hours after being inoculated in vitro, there is an increase then decrease for ATF3 and LHB genes, while a decrease then increase close to initial value with PCLO and slightly with RASSF7. For DEFB1, it has a cyclical increase, decrease, increase, then decrease to stabilize closer to the initial gene expressio value.

Now lets find the other five genes in the group A set of ten genes found to have the most change in the liver tumor samples, and examined here in the blood capillary samples.

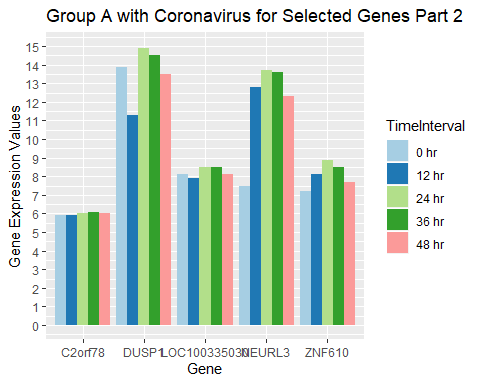
A\_group3 <- A\_group[,c(2,4,6,8,10,11:13)]  
A\_tidy1 <- gather(A\_group3, 'Gene','GeneExpression',1:5)

## Warning: attributes are not identical across measure variables;  
## they will be dropped

A\_tidy1$GeneExpression <- round(as.numeric(A\_tidy1$GeneExpression),1)  
A\_tidy1$TimeInterval <- as.factor(A\_tidy1$TimeInterval)  
A\_tidy1$Gene <- as.factor(A\_tidy1$Gene)  
A\_tidy1

## Class Group TimeInterval Gene GeneExpression  
## 1 Coronavirus A 0 hr DUSP1 13.9  
## 2 Coronavirus A 12 hr DUSP1 11.3  
## 3 Coronavirus A 24 hr DUSP1 14.9  
## 4 Coronavirus A 36 hr DUSP1 14.5  
## 5 Coronavirus A 48 hr DUSP1 13.5  
## 6 Coronavirus A 0 hr NEURL3 7.5  
## 7 Coronavirus A 12 hr NEURL3 12.8  
## 8 Coronavirus A 24 hr NEURL3 13.7  
## 9 Coronavirus A 36 hr NEURL3 13.6  
## 10 Coronavirus A 48 hr NEURL3 12.3  
## 11 Coronavirus A 0 hr C2orf78 5.9  
## 12 Coronavirus A 12 hr C2orf78 5.9  
## 13 Coronavirus A 24 hr C2orf78 6.0  
## 14 Coronavirus A 36 hr C2orf78 6.1  
## 15 Coronavirus A 48 hr C2orf78 6.0  
## 16 Coronavirus A 0 hr LOC100335030 8.1  
## 17 Coronavirus A 12 hr LOC100335030 7.9  
## 18 Coronavirus A 24 hr LOC100335030 8.5  
## 19 Coronavirus A 36 hr LOC100335030 8.5  
## 20 Coronavirus A 48 hr LOC100335030 8.1  
## 21 Coronavirus A 0 hr ZNF610 7.2  
## 22 Coronavirus A 12 hr ZNF610 8.1  
## 23 Coronavirus A 24 hr ZNF610 8.9  
## 24 Coronavirus A 36 hr ZNF610 8.5  
## 25 Coronavirus A 48 hr ZNF610 7.7

ggplot(data = A\_tidy1, aes(x=Gene, y=GeneExpression, fill=TimeInterval)) +  
 geom\_bar(stat='identity', position=position\_dodge())+  
 scale\_y\_continuous(breaks = seq(0, 15, by=1), limits=c(0,15))+  
 scale\_fill\_brewer(palette='Paired') +   
 ggtitle('Group A with Coronavirus for Selected Genes Part 2')+  
 xlab('Gene')+  
 ylab('Gene Expression Values')



The above genes in part 2 of the group A Coronavirus samples over 48 hours, shows that the gene expression values increase up to 24 hours then decrease to 48 hours for most of the genes above.

Lets look back at the platforms and the features removed. The sequence field is an interesting field because it can show copy number variants of genes by the genes that are duplicates at other probes from the samples.

Platform13497 <- read.csv('GPL13497-9755-forSequenceFeature-GSE100509.csv', sep=',',  
 na.strings=c('',' '), header=TRUE)  
Platform16699 <- read.csv('GPL16699-forSequenceFeatureGSE89166\_GSE89160.csv', sep=',',  
 na.strings=c('',' '), header=TRUE)

The features in Platform13497 and the first five listed ID values for this platform:

colnames(Platform13497)

## [1] "ID" "SPOT\_ID" "CONTROL\_TYPE"   
## [4] "REFSEQ" "GB\_ACC" "GENE"   
## [7] "GENE\_SYMBOL" "GENE\_NAME" "UNIGENE\_ID"   
## [10] "ENSEMBL\_ID" "TIGR\_ID" "ACCESSION\_STRING"   
## [13] "CHROMOSOMAL\_LOCATION" "CYTOBAND" "DESCRIPTION"   
## [16] "GO\_ID" "SEQUENCE"

head(Platform13497$SPOT\_ID)[1:5]

## [1] (+)E1A\_r60\_1 (+)E1A\_r60\_3 (+)E1A\_r60\_a104 (+)E1A\_r60\_a107  
## [5] (+)E1A\_r60\_a135  
## 34184 Levels: (-)3xSLv1 (+)E1A\_r60\_1 (+)E1A\_r60\_3 ... NA

The features in Platform16699 and the first five listed ID values of that platform:

colnames(Platform16699)

## [1] "ID" "COL" "ROW"   
## [4] "NAME" "SPOT\_ID" "CONTROL\_TYPE"   
## [7] "REFSEQ" "GB\_ACC" "LOCUSLINK\_ID"   
## [10] "GENE\_SYMBOL" "GENE\_NAME" "UNIGENE\_ID"   
## [13] "ENSEMBL\_ID" "ACCESSION\_STRING" "CHROMOSOMAL\_LOCATION"  
## [16] "CYTOBAND" "DESCRIPTION" "GO\_ID"   
## [19] "SEQUENCE"

head(Platform16699$SPOT\_ID)[1:5]

## [1] CONTROL CONTROL CONTROL A\_23\_P117082 A\_33\_P3246448  
## 50491 Levels: A\_19\_P00315452 A\_19\_P00315459 A\_19\_P00315482 ... tc|THC2788944

Lets keep only the ID (Platform16699) or SPOT\_ID (Platform13497), GENE\_SYMBOL, DESCRIPTION, and SEQUENCE features of both platforms.

P16699 <- Platform16699[,c(1,10,17,19)]  
P13497 <- Platform13497[,c(2,7,15,17)]

Lets also remove the incomplete cases in both platforms.

work16699 <- P16699[complete.cases(P16699),]  
work13497 <- P13497[complete.cases(P13497),]

Now merge these data sets to their corresponding samples by SPOT\_ID.First read in the samples data for each platform and series.

GSE89166\_89160 <- read.csv('GSE89166\_GSE89160.csv',sep=',', na.strings=c('',' '),  
 header=TRUE)  
GSE100509 <- read.csv('GSE100509.csv', sep=',', header=TRUE,   
 na.strings=c('',' '))

Now merge the series data sets to their respective platforms of gene informational meta features.

Series100509 <- merge(work13497,GSE100509,by.x='SPOT\_ID', by.y='ID\_REF')  
Series89166\_89160 <- merge(work16699,GSE89166\_89160,by.x='ID', by.y='ID\_REF')

Rename the columns of the Series100509 to the 5 groups for each of CoV and Ctrl over 0,12,24,36, and 48 hours.

colnames(Series100509)

## [1] "SPOT\_ID" "GENE\_SYMBOL"   
## [3] "DESCRIPTION" "SEQUENCE"   
## [5] "GSM2685693\_MERS\_CoV\_0hr" "GSM2685694\_MERS\_CoV\_0hr"   
## [7] "GSM2685695\_MERS\_CoV\_0hr" "GSM2685696\_MERS\_CoV\_0hr"   
## [9] "GSM2685697\_MERS\_CoV\_0hr" "GSM2685698\_ctrl\_0hr"   
## [11] "GSM2685699\_ctrl\_0hr" "GSM2685700\_ctrl\_0hr"   
## [13] "GSM2685701\_ctrl\_0hr" "GSM2685702\_ctrl\_0hr"   
## [15] "GSM2685703\_MERS\_CoV\_12hr" "GSM2685704\_MERS\_CoV\_12hr"  
## [17] "GSM2685705\_MERS\_CoV\_12hr" "GSM2685706\_MERS\_CoV\_12hr"  
## [19] "GSM2685707\_MERS\_CoV\_12hr" "GSM2685708\_ctrl\_12hr"   
## [21] "GSM2685709\_ctrl\_12hr" "GSM2685710\_ctrl\_12hr"   
## [23] "GSM2685711\_ctrl\_12hr" "GSM2685712\_ctrl\_12hr"   
## [25] "GSM2685713\_MERS\_CoV\_24hr" "GSM2685714\_MERS\_CoV\_24hr"  
## [27] "GSM2685715\_MERS\_CoV\_24hr" "GSM2685716\_MERS\_CoV\_24hr"  
## [29] "GSM2685717\_MERS\_CoV\_24hr" "GSM2685718\_ctrl\_24hr"   
## [31] "GSM2685719\_ctrl\_24hr" "GSM2685720\_ctrl\_24hr"   
## [33] "GSM2685721\_ctrl\_24hr" "GSM2685722\_ctrl\_24hr"   
## [35] "GSM2685723\_MERS\_CoV\_36hr" "GSM2685724\_MERS\_CoV\_36hr"  
## [37] "GSM2685725\_MERS\_CoV\_36hr" "GSM2685726\_MERS\_CoV\_36hr"  
## [39] "GSM2685727\_MERS\_CoV\_36hr" "GSM2685728\_ctrl\_36hr"   
## [41] "GSM2685729\_ctrl\_36hr" "GSM2685730\_ctrl\_36hr"   
## [43] "GSM2685731\_ctrl\_36hr" "GSM2685732\_ctrl\_36hr"   
## [45] "GSM2685733\_MERS\_CoV\_48hr" "GSM2685734\_MERS\_CoV\_48hr"  
## [47] "GSM2685735\_MERS\_CoV\_48hr" "GSM2685736\_MERS\_CoV\_48hr"  
## [49] "GSM2685737\_MERS\_CoV\_48hr" "GSM2685738\_ctrl\_48hr"   
## [51] "GSM2685739\_ctrl\_48hr" "GSM2685740\_ctrl\_48hr"   
## [53] "GSM2685741\_ctrl\_48hr" "GSM2685742\_ctrl\_48hr"

group <- rep(1:5,10)  
Group <- gsub('1','Group\_A',group)  
Group <- gsub('2','Group\_B',Group)  
Group <- gsub('3','Group\_C',Group)  
Group <- gsub('4','Group\_D',Group)  
Group <- gsub('5','Group\_E',Group)  
  
names <- colnames(Series100509)[5:54]  
  
Names <- paste(names,Group,sep='\_')  
  
newNames <- gsub('\_MERS','', Names)  
newNames

## [1] "GSM2685693\_CoV\_0hr\_Group\_A" "GSM2685694\_CoV\_0hr\_Group\_B"   
## [3] "GSM2685695\_CoV\_0hr\_Group\_C" "GSM2685696\_CoV\_0hr\_Group\_D"   
## [5] "GSM2685697\_CoV\_0hr\_Group\_E" "GSM2685698\_ctrl\_0hr\_Group\_A"   
## [7] "GSM2685699\_ctrl\_0hr\_Group\_B" "GSM2685700\_ctrl\_0hr\_Group\_C"   
## [9] "GSM2685701\_ctrl\_0hr\_Group\_D" "GSM2685702\_ctrl\_0hr\_Group\_E"   
## [11] "GSM2685703\_CoV\_12hr\_Group\_A" "GSM2685704\_CoV\_12hr\_Group\_B"   
## [13] "GSM2685705\_CoV\_12hr\_Group\_C" "GSM2685706\_CoV\_12hr\_Group\_D"   
## [15] "GSM2685707\_CoV\_12hr\_Group\_E" "GSM2685708\_ctrl\_12hr\_Group\_A"  
## [17] "GSM2685709\_ctrl\_12hr\_Group\_B" "GSM2685710\_ctrl\_12hr\_Group\_C"  
## [19] "GSM2685711\_ctrl\_12hr\_Group\_D" "GSM2685712\_ctrl\_12hr\_Group\_E"  
## [21] "GSM2685713\_CoV\_24hr\_Group\_A" "GSM2685714\_CoV\_24hr\_Group\_B"   
## [23] "GSM2685715\_CoV\_24hr\_Group\_C" "GSM2685716\_CoV\_24hr\_Group\_D"   
## [25] "GSM2685717\_CoV\_24hr\_Group\_E" "GSM2685718\_ctrl\_24hr\_Group\_A"  
## [27] "GSM2685719\_ctrl\_24hr\_Group\_B" "GSM2685720\_ctrl\_24hr\_Group\_C"  
## [29] "GSM2685721\_ctrl\_24hr\_Group\_D" "GSM2685722\_ctrl\_24hr\_Group\_E"  
## [31] "GSM2685723\_CoV\_36hr\_Group\_A" "GSM2685724\_CoV\_36hr\_Group\_B"   
## [33] "GSM2685725\_CoV\_36hr\_Group\_C" "GSM2685726\_CoV\_36hr\_Group\_D"   
## [35] "GSM2685727\_CoV\_36hr\_Group\_E" "GSM2685728\_ctrl\_36hr\_Group\_A"  
## [37] "GSM2685729\_ctrl\_36hr\_Group\_B" "GSM2685730\_ctrl\_36hr\_Group\_C"  
## [39] "GSM2685731\_ctrl\_36hr\_Group\_D" "GSM2685732\_ctrl\_36hr\_Group\_E"  
## [41] "GSM2685733\_CoV\_48hr\_Group\_A" "GSM2685734\_CoV\_48hr\_Group\_B"   
## [43] "GSM2685735\_CoV\_48hr\_Group\_C" "GSM2685736\_CoV\_48hr\_Group\_D"   
## [45] "GSM2685737\_CoV\_48hr\_Group\_E" "GSM2685738\_ctrl\_48hr\_Group\_A"  
## [47] "GSM2685739\_ctrl\_48hr\_Group\_B" "GSM2685740\_ctrl\_48hr\_Group\_C"  
## [49] "GSM2685741\_ctrl\_48hr\_Group\_D" "GSM2685742\_ctrl\_48hr\_Group\_E"

Change the column names in Series100509 to the new column names identifying which group the samples is from in A:E.

colnames(Series100509)[5:54] <- newNames  
colnames(Series100509)

## [1] "SPOT\_ID" "GENE\_SYMBOL"   
## [3] "DESCRIPTION" "SEQUENCE"   
## [5] "GSM2685693\_CoV\_0hr\_Group\_A" "GSM2685694\_CoV\_0hr\_Group\_B"   
## [7] "GSM2685695\_CoV\_0hr\_Group\_C" "GSM2685696\_CoV\_0hr\_Group\_D"   
## [9] "GSM2685697\_CoV\_0hr\_Group\_E" "GSM2685698\_ctrl\_0hr\_Group\_A"   
## [11] "GSM2685699\_ctrl\_0hr\_Group\_B" "GSM2685700\_ctrl\_0hr\_Group\_C"   
## [13] "GSM2685701\_ctrl\_0hr\_Group\_D" "GSM2685702\_ctrl\_0hr\_Group\_E"   
## [15] "GSM2685703\_CoV\_12hr\_Group\_A" "GSM2685704\_CoV\_12hr\_Group\_B"   
## [17] "GSM2685705\_CoV\_12hr\_Group\_C" "GSM2685706\_CoV\_12hr\_Group\_D"   
## [19] "GSM2685707\_CoV\_12hr\_Group\_E" "GSM2685708\_ctrl\_12hr\_Group\_A"  
## [21] "GSM2685709\_ctrl\_12hr\_Group\_B" "GSM2685710\_ctrl\_12hr\_Group\_C"  
## [23] "GSM2685711\_ctrl\_12hr\_Group\_D" "GSM2685712\_ctrl\_12hr\_Group\_E"  
## [25] "GSM2685713\_CoV\_24hr\_Group\_A" "GSM2685714\_CoV\_24hr\_Group\_B"   
## [27] "GSM2685715\_CoV\_24hr\_Group\_C" "GSM2685716\_CoV\_24hr\_Group\_D"   
## [29] "GSM2685717\_CoV\_24hr\_Group\_E" "GSM2685718\_ctrl\_24hr\_Group\_A"  
## [31] "GSM2685719\_ctrl\_24hr\_Group\_B" "GSM2685720\_ctrl\_24hr\_Group\_C"  
## [33] "GSM2685721\_ctrl\_24hr\_Group\_D" "GSM2685722\_ctrl\_24hr\_Group\_E"  
## [35] "GSM2685723\_CoV\_36hr\_Group\_A" "GSM2685724\_CoV\_36hr\_Group\_B"   
## [37] "GSM2685725\_CoV\_36hr\_Group\_C" "GSM2685726\_CoV\_36hr\_Group\_D"   
## [39] "GSM2685727\_CoV\_36hr\_Group\_E" "GSM2685728\_ctrl\_36hr\_Group\_A"  
## [41] "GSM2685729\_ctrl\_36hr\_Group\_B" "GSM2685730\_ctrl\_36hr\_Group\_C"  
## [43] "GSM2685731\_ctrl\_36hr\_Group\_D" "GSM2685732\_ctrl\_36hr\_Group\_E"  
## [45] "GSM2685733\_CoV\_48hr\_Group\_A" "GSM2685734\_CoV\_48hr\_Group\_B"   
## [47] "GSM2685735\_CoV\_48hr\_Group\_C" "GSM2685736\_CoV\_48hr\_Group\_D"   
## [49] "GSM2685737\_CoV\_48hr\_Group\_E" "GSM2685738\_ctrl\_48hr\_Group\_A"  
## [51] "GSM2685739\_ctrl\_48hr\_Group\_B" "GSM2685740\_ctrl\_48hr\_Group\_C"  
## [53] "GSM2685741\_ctrl\_48hr\_Group\_D" "GSM2685742\_ctrl\_48hr\_Group\_E"

Remove the ID and SPOT\_ID fields of the probe labels that won’t be needed for the analysis.

Series89 <- Series89166\_89160[,-1]  
Series100 <- Series100509[,-c(1,3,4)]

Now combine the series together by genes in common.

ComboLiverCapillarySequences <- merge(Series89,Series100, by.x='GENE\_SYMBOL',  
 by.y='GENE\_SYMBOL')

There should be different genotypes or copy number variations in the SEQUENCE feature column, which will identify which nucleotide jumps, is deleted, rearranged in the gene expressions. This time around lets group by SEQUENCE to see how many genotypes there are in all the genes. This could give more information in the analysis of any genotypes of genes could be more susceptible to pathogenesis of CoV or immunity to it. \*\*\*

library(dplyr)

This next portion of this analysis shows the top five genes in the data, the number of genotypes or copy number variations of the nucleotide sequences are in each gene, and the gene name. This could be useful to determine how well the genotypes within these five genes that were expressed more than the other 65k genes were when analyzing the effects of CoV, inactive CoV, CoV treated with an interleukin, and the control samples.

SeqGroup <- ComboLiverCapillarySequences %>% group\_by(GENE\_SYMBOL) %>% count(n=n())  
SeqGroup <- SeqGroup[order(SeqGroup$n, decreasing=TRUE),-3]  
  
SeqGroup5 <- SeqGroup[1:5,]  
  
genes5sequences <- merge(SeqGroup5,ComboLiverCapillarySequences,  
 by.x='GENE\_SYMBOL', by.y='GENE\_SYMBOL')  
  
genotypes5 <- genes5sequences %>% group\_by(SEQUENCE) %>% count(n=n)  
  
genotypes5$n <- as.factor(genotypes5$n)  
SeqGroup5$n <- as.factor(SeqGroup5$n)  
  
genotypes5\_1 <- merge(genotypes5, SeqGroup5, by.x='n', by.y='n')  
colnames(genotypes5\_1)[c(1,3)] <- c('geneCount','genotypeCount')  
head(genotypes5\_1)

## geneCount SEQUENCE  
## 1 255 AAACTTACTCCAGAGCTCCTTGTGCATCTGACCAGCACCATCGACAGAATAAACACAGAA  
## 2 255 AACAGAGTCCTCAGGGAAGAAAATCGAAGACTTCAGGCTCAACTGAGTCATGTTTCCAGA  
## 3 255 GCACCTGTGTTCTTTGAGTTCACATCATGAATGTGGTGATTTCCCAGATACCATCTCAGG  
## 4 255 ATGGGGTGCTCTGGGGAAATATTGGAGGGTCATCCATTCCACATTAAAAGAGCAAGTTGT  
## 5 255 AAGTGCTTGGAAATACTTGGGTGAATGTTACCAGACTCCTTCTCTCTCAGCTTACAGCCT  
## 6 255 AATCTACGAGGCACTTTATGGCAATTCCAAGAAGGGGCTGAAAGGTATGTGTTCTTCTCC  
## genotypeCount GENE\_SYMBOL  
## 1 15 PDE4DIP  
## 2 15 PDE4DIP  
## 3 15 PDE4DIP  
## 4 15 PDE4DIP  
## 5 15 PDE4DIP  
## 6 15 PDE4DIP

Write the files above out to csv.

write.csv(ComboLiverCapillarySequences, 'SequencesBothCleaned.csv',row.names=FALSE)  
write.csv(genotypes5\_1, 'Genotypes\_5\_1.csv', row.names=FALSE)

ComboCNV <- ComboLiverCapillarySequences[,-c(1,2)]  
copynumbers <- merge(genotypes5\_1,ComboCNV,  
 by.x='SEQUENCE', by.y='SEQUENCE')  
CNV <- copynumbers[!duplicated(copynumbers$SEQUENCE),]  
write.csv(CNV, 'copyNumbers.csv', row.names=FALSE)

CNV

## SEQUENCE geneCount  
## 1 AAACTTACTCCAGAGCTCCTTGTGCATCTGACCAGCACCATCGACAGAATAAACACAGAA 255  
## 16 AACAGAGTCCTCAGGGAAGAAAATCGAAGACTTCAGGCTCAACTGAGTCATGTTTCCAGA 255  
## 31 AAGGATTTGCTTATAAGGGTTCCTGCTTTCACAAAATTATTCCAGGTTTTATGTGTCAGG 70  
## 41 AAGGATTTGGTTGTAAGGGCTCCCGCTTTCACAGAATTATTCCAGGGTTTATGTGTCAGG 70  
## 51 AAGTGCTTGGAAATACTTGGGTGAATGTTACCAGACTCCTTCTCTCTCAGCTTACAGCCT 255  
## 66 AATCTACGAGGCACTTTATGGCAATTCCAAGAAGGGGCTGAAAGGTATGTGTTCTTCTCC 255  
## 81 AATGATCAGAAAAAGAAAGAAGCCAAAGAGAAAGGTACCTGGGTTCAACTGAAGTGCCAG 81  
## 90 ACAAGTGTTACCATGGCAAAACTGGAAGAGTCTACAATGTTACCCAGCATGCTGTTGGCA 81  
## 99 ACCCTACAGCTCTTCCAAATATGCCACTGACCTTTTGAGTGTGGCTTTGAACAGGAACTT 70  
## 109 ACGCTGTTGATGCCGGCAATATTGCTACTTCGCTTTTTTGCAAATGCATTCACTTTGACA 70  
## 209 AGGTCAAGTTTATACATCTTAATTATGGTGGAATTCCTATGTAGAGTCTAAAAAGCCAGG 70  
## 219 ATATGTAAAGGGCCATTCTTAAGTTCTCTCCTTAAACTTAATGCTGTCAAGTGTTAGATG 90  
## 279 ATCCGGGACATGATCCGCAGGGCCCAGAGTTACCGAGTCCTCACTACTTTTCTTCCAGAC 90  
## 285 ATCTTGTCCATGGCAAATGCTGGACCCAACACAAATGGTTCCCAGTTTTTCATCTGCACT 70  
## 385 ATGGAGATTACAACTGCTTGTTGGAGACGATCCTGTGTGATCAGCTTCATAAAAGGGCTT 90  
## 391 ATGGATGACACAAACAGCGAGCAGCAGTTTAGAGTCTTCAGAGACTTCGACTTCCTAGAT 90  
## 397 ATGGGGTGCTCTGGGGAAATATTGGAGGGTCATCCATTCCACATTAAAAGAGCAAGTTGT 255  
## 412 ATTTGCCTTGTTTATTGTGAGCATGGAATACTTCTGGAAGCTTTCCTAGTAGATTTTTCT 70  
## 422 CAAAAAATGGACTAGAAGAGAAGCTGGCTGAGGAGCTGAGATCAGCCTCGTGGCCTGGGT 255  
## 437 CAAAAACTGGGAAGATGTACCAGGAGACCAGGTCAAGCCCGACCAATACACTGAGGCCCT 255  
## 452 CAGGACAAGTTCCTTCTAAAATCAATCCTTTGCTTTGGCCTGGAAGACCGAACATATTAG 255  
## 467 CCTTTCTGACAGCTATGGAATACCGTTAGCCAAGGTCCACTTGGCCCAGCACTAAGAAAA 255  
## 482 CTACCAAAGCTGTGTATTTTTCATTTCTTCATGGCACTGTGCTGTTAATTTCTGTTAACA 255  
## 497 CTATGGAATACGATTAGCCAAGGTCCACTTGGCCCAGCACTAAGAAGAAGATGCATAGTT 255  
## 512 CTGTTCCTTTGGCGACGTATATGCGAATCTATAAGAAAGGTGATATTGTAGACATCAAGG 81  
## 521 GAACACAAAGAGAAAGAGGAGGGGCACCCGATATATGTTCTTTAGGCCTTTTAGAAAACA 81  
## 530 GAAGCTGCTGCTATCAGAAGCCACTGTCTTTGCTCAGGCGAACGAGCTGGAGAAATACAG 255  
## 545 GAGGTTTCTTCGTTTTGGAAAAGTAGAGGTATAAAATAACCTTTTTTGCTGGATACTGTC 90  
## 551 GCACCTGTGTTCTTTGAGTTCACATCATGAATGTGGTGATTTCCCAGATACCATCTCAGG 255  
## 566 GGAAGGAGTCTGAGCTGCTGGAACCTATTCCCTATGAATTCATGGCATAATAGGTGTTAA 81  
## 575 GGCCACATATATGCTAATCTATAAGAAAGGTGATATTGCAGACATCAAGGGAAGGGGTAC 81  
## 584 GTGGACAACTCGAATAAGTTTGACTTGTGTTTTATCTTAACCACCAGATCATTCCTTCTG 70  
## 594 GTGTTGAGTCAGTGGGGACCAGCCTGCCCACAGGAGAAAATTAAAAGACACAAAAACAAA 255  
## 609 GTTACCCAGCATGCTGTTGGCATTGTTGTAAACAAACAAGTTAAAGGCAAGATTCTTGCC 81  
## 618 GTTGTAAACAAACAAGTTAAGGGCAAGATTCTTGCCAAGAGAATTAATGTGCGTATTGAG 81  
## 627 TCCCAGATACCATTTCAGGCTTAACCTAGCACATCCTATTTCTTTTCTTCTATGATATCC 255  
## 642 TGGTATAAAAGGCAAAATGGCATTGAGGATGAATCACATGAATACAGACCAAGAACAAGC 90  
## 648 TTAAGCACTCTAAGAGCCGAGATAGCTTCCTGAAATGTGTGAAGGAAAATGATCAGAAAA 81  
## 657 TTCCATCACCTTTCCTTGAAAATATATCTTCAGCTTTGGGTAGGAGGAATCTTGGTGTAT 255  
## 672 TTGAGGAAGTCTGTATAGGGTGACCCATTGTGTCTCAGTACCACGTTTTCTTTCTTTTTT 70  
## 682 TTTGGCGTGCAGGAATATGAGCAAGGCAGAAGCTGTCTGTGCTGCTCTGCTGGCCTCTCA 70  
## 692 TTTTAAAGAAGGCAAGCACTAACTTAGAGGAACCATGCAAGAAGCGCAGCCACCAGAAGT 255  
## genotypeCount GENE\_SYMBOL GSM2359851\_CoV1 GSM2359853\_CoV2 GSM2359910\_CoV3  
## 1 15 PDE4DIP 27.80000 12.33750 3.696339  
## 16 15 PDE4DIP 14.38750 20.88750 2.637107  
## 31 5 HSD17B7 5145.79000 5373.31250 12.672146  
## 41 5 HSD17B7 11934.96500 10287.10500 13.095230  
## 51 15 PDE4DIP 32.27375 16.51000 3.847676  
## 66 15 PDE4DIP 16.67250 23.47500 3.444825  
## 81 9 RPL21 13038.30250 11010.62750 13.528036  
## 90 9 RPL21 30119.53750 30572.70750 14.712802  
## 99 5 HSD17B7 371.82000 322.18250 8.134598  
## 109 50 HSD17B7 213.67500 195.09500 7.177490  
## 209 5 HSD17B7 268.28000 198.08250 7.012814  
## 219 60 FRY 271.65250 357.92000 8.202159  
## 279 6 FRY 58.96375 84.71000 5.671111  
## 285 50 HSD17B7 17904.94250 19128.75750 13.734397  
## 385 6 FRY 9.06500 20.70250 3.829277  
## 391 6 FRY 32.45750 23.73000 4.310822  
## 397 15 PDE4DIP 75.22875 90.13250 5.752750  
## 412 5 HSD17B7 15.40250 19.88250 4.420457  
## 422 15 PDE4DIP 10.65000 12.76750 2.504837  
## 437 15 PDE4DIP 91.41000 103.70750 6.408463  
## 452 15 PDE4DIP 237.00000 63.49250 7.746742  
## 467 15 PDE4DIP 30.81875 39.75750 4.488047  
## 482 15 PDE4DIP 125.58750 134.66250 5.723797  
## 497 15 PDE4DIP 29.16750 11.06750 3.676894  
## 512 9 RPL21 5280.45750 3875.71750 12.254249  
## 521 9 RPL21 6381.22250 6865.95250 12.451731  
## 530 15 PDE4DIP 19.30000 36.25375 3.989351  
## 545 6 FRY 22.37500 36.61625 5.296403  
## 551 15 PDE4DIP 104.62875 85.94500 5.821977  
## 566 9 RPL21 46392.50000 45883.44000 15.416743  
## 575 9 RPL21 3746.36500 2738.23500 12.059480  
## 584 5 HSD17B7 43078.28000 35250.26250 15.063675  
## 594 15 PDE4DIP 18.22125 34.20625 5.068949  
## 609 9 RPL21 24563.01000 27131.15750 14.494375  
## 618 9 RPL21 6638.93000 6876.98250 12.970757  
## 627 15 PDE4DIP 63.95375 61.22750 5.621959  
## 642 6 FRY 32.43250 19.90500 4.781334  
## 648 9 RPL21 28633.13750 35054.02500 14.760531  
## 657 15 PDE4DIP 70.56500 45.82500 5.832804  
## 672 5 HSD17B7 23.60250 12.80875 3.931491  
## 682 5 HSD17B7 119.60500 123.33000 6.507425  
## 692 15 PDE4DIP 18.62250 18.30500 3.088424  
## GSM2359913\_CoV4 GSM2359850\_ctrl1 GSM2359852\_ctrl2 GSM2359911\_ctrl3  
## 1 3.790725 16.5200 17.73000 3.578243  
## 16 3.344586 11.3625 18.11250 3.551566  
## 31 11.573693 9277.9550 8067.56500 12.808809  
## 41 11.838288 17429.8675 16112.38250 13.205094  
## 51 4.423909 18.1100 13.44125 4.284877  
## 66 4.177188 18.1550 17.48000 3.766645  
## 81 13.571143 13483.4400 9879.27000 13.472757  
## 90 14.614834 34445.3250 28827.18500 14.702680  
## 99 8.181267 154.2550 220.73750 6.715907  
## 109 7.729111 121.7325 172.01750 6.576652  
## 209 6.513342 553.5950 301.95250 7.412307  
## 219 8.706800 97.3250 202.96750 7.429588  
## 279 6.315514 31.9675 48.28000 4.905673  
## 285 12.522699 21680.6475 27867.61750 13.917649  
## 385 3.968947 12.5900 13.29000 4.006208  
## 391 3.833337 13.9325 16.31500 3.619992  
## 397 6.626211 78.0075 68.24750 6.160618  
## 412 4.407728 19.2275 30.75000 5.107143  
## 422 4.583563 8.9625 14.71000 4.094687  
## 437 6.654450 138.3750 138.58000 6.012364  
## 452 7.233624 16.8675 11.08500 4.309826  
## 467 4.560705 16.7325 30.56750 3.631049  
## 482 6.186636 118.2613 77.22250 5.631851  
## 497 3.528587 13.5300 15.50500 4.189106  
## 512 12.136696 7492.1175 4175.44000 12.504104  
## 521 12.137630 8573.3300 6704.05500 12.609506  
## 530 3.853302 23.2675 22.38500 4.161641  
## 545 5.767478 37.2500 51.34750 4.881077  
## 551 5.744729 58.5300 35.14000 5.162767  
## 566 15.387552 47613.6350 44025.17500 15.357757  
## 575 11.973380 5260.6125 3136.01000 12.295686  
## 584 14.145177 49908.4750 42313.35750 15.161325  
## 594 4.875253 31.3550 26.55875 5.163443  
## 609 14.396291 25395.2325 27531.33250 14.490896  
## 618 12.907781 9555.7550 7781.74500 13.138377  
## 627 5.613410 33.8425 60.97500 4.944435  
## 642 5.524324 20.2175 18.00625 4.146513  
## 648 14.719929 30448.7650 30448.76500 14.784022  
## 657 5.556593 33.6350 46.85125 4.272972  
## 672 3.564095 17.3825 28.25250 4.269237  
## 682 6.579500 67.2175 90.32750 5.815040  
## 692 3.260962 29.7900 11.46000 3.011269  
## GSM2359914\_ctrl4 GSM2359912\_Il1 GSM2359917\_IL2 GSM2359915\_inactiveHeatCoV1  
## 1 3.624038 3.140928 3.670410 3.546095  
## 16 4.151561 2.785070 2.552815 4.287654  
## 31 12.783884 13.140587 12.767002 13.136716  
## 41 12.949140 13.434763 13.042793 13.454729  
## 51 3.420708 3.601485 3.039668 3.450441  
## 66 4.254487 4.957138 3.629882 3.956468  
## 81 13.614149 13.633448 13.630940 13.430600  
## 90 14.702680 14.750075 14.688661 14.633296  
## 99 6.808397 6.558839 6.755108 6.888168  
## 109 6.391192 6.560465 6.498674 6.666895  
## 209 7.243844 7.590200 7.424797 7.242360  
## 219 6.633365 7.263232 7.037296 7.826073  
## 279 4.654331 5.951235 5.315131 5.197742  
## 285 13.530332 13.984778 13.664711 14.101873  
## 385 4.078738 3.198799 3.613910 4.292263  
## 391 2.635114 4.035037 3.496328 5.051240  
## 397 5.843770 6.207442 6.010504 6.287897  
## 412 4.780039 5.136244 3.083101 4.441393  
## 422 3.395185 3.520729 4.372599 3.739993  
## 437 6.430275 5.891864 6.410106 6.434970  
## 452 2.912074 3.819033 4.434493 2.699398  
## 467 3.428464 3.873689 4.308965 3.544474  
## 482 6.086149 5.750065 5.901224 5.722239  
## 497 3.798390 3.882634 3.369441 4.407039  
## 512 12.605234 12.523691 12.559814 12.367516  
## 521 12.586550 12.674812 12.614916 12.498591  
## 530 3.876763 3.252636 3.868612 3.849681  
## 545 5.088791 5.049082 5.006710 5.221105  
## 551 5.219856 4.821215 5.311027 5.561438  
## 566 15.331644 15.416743 15.309413 15.230848  
## 575 12.471203 12.359393 12.492727 12.373389  
## 584 14.933096 15.247829 14.906973 15.262285  
## 594 6.126075 4.908142 5.656664 5.879604  
## 609 14.451526 14.423394 14.512645 14.388731  
## 618 13.191864 13.159157 13.149836 13.099425  
## 627 5.193310 5.223439 5.285965 4.153434  
## 642 4.469801 4.652000 4.351019 4.885096  
## 648 14.876129 14.859144 14.836318 14.767892  
## 657 5.027764 5.223439 4.305323 4.621451  
## 672 5.066429 3.447057 4.335341 3.690485  
## 682 5.849889 5.674321 5.635349 6.016112  
## 692 3.249961 3.208008 3.379703 3.524824  
## GSM2359916\_inactiveHeatCoV2 GSM2685693\_CoV\_0hr\_Group\_A  
## 1 3.478594 6.046074  
## 16 3.088424 6.844269  
## 31 12.926635 13.743911  
## 41 13.390188 13.354586  
## 51 3.302000 6.558291  
## 66 3.372408 6.123684  
## 81 13.564872 15.471859  
## 90 14.805995 13.952961  
## 99 6.090212 7.760966  
## 109 6.421314 7.760966  
## 209 7.501435 9.039621  
## 219 7.244399 5.959534  
## 279 5.555414 11.322402  
## 285 13.863342 9.039621  
## 385 2.960501 11.322402  
## 391 2.435691 10.206249  
## 397 6.065265 6.558291  
## 412 3.771957 7.443340  
## 422 3.962144 6.642102  
## 437 6.320798 6.642102  
## 452 3.481031 6.141494  
## 467 2.245824 7.494292  
## 482 5.751764 6.642102  
## 497 3.064070 6.558291  
## 512 12.608269 14.216561  
## 521 12.717626 14.379203  
## 530 4.276882 6.141494  
## 545 5.310430 10.206249  
## 551 4.847402 6.642102  
## 566 15.381582 12.710011  
## 575 12.473387 14.379203  
## 584 15.137849 9.039621  
## 594 5.326159 7.494292  
## 609 14.530418 13.952961  
## 618 13.191864 13.952961  
## 627 4.898910 6.141494  
## 642 4.637404 11.322402  
## 648 14.915921 15.209228  
## 657 5.464345 6.141494  
## 672 3.477792 6.585250  
## 682 5.770293 7.760966  
## 692 3.860184 6.558291  
## GSM2685694\_CoV\_0hr\_Group\_B GSM2685695\_CoV\_0hr\_Group\_C  
## 1 5.934566 5.909934  
## 16 6.971307 7.045377  
## 31 14.112591 13.731221  
## 41 13.772142 13.242660  
## 51 6.538601 6.586001  
## 66 6.109128 6.141085  
## 81 15.541398 15.753597  
## 90 13.758973 13.253953  
## 99 7.679814 7.857275  
## 109 7.679814 7.857275  
## 209 9.012739 8.926670  
## 219 5.955123 6.360556  
## 279 11.419858 11.426284  
## 285 9.012739 8.926670  
## 385 11.419858 11.426284  
## 391 10.558187 10.338125  
## 397 6.538601 6.586001  
## 412 7.360626 7.568523  
## 422 6.488311 6.650799  
## 437 6.488311 6.650799  
## 452 6.146797 6.177145  
## 467 7.657015 7.460948  
## 482 6.488311 6.650799  
## 497 6.538601 6.586001  
## 512 14.150090 13.748373  
## 521 14.347845 14.203153  
## 530 6.146797 6.177145  
## 545 10.558187 10.338125  
## 551 6.488311 6.650799  
## 566 12.681303 12.567839  
## 575 14.347845 14.203153  
## 584 9.012739 8.926670  
## 594 7.657015 7.460948  
## 609 13.758973 13.253953  
## 618 13.758973 13.253953  
## 627 6.180332 6.177145  
## 642 11.419858 11.426284  
## 648 15.162455 15.081966  
## 657 6.146797 6.177145  
## 672 6.552001 6.801947  
## 682 7.679814 7.857275  
## 692 6.538601 6.586001  
## GSM2685696\_CoV\_0hr\_Group\_D GSM2685697\_CoV\_0hr\_Group\_E  
## 1 5.928474 6.049563  
## 16 7.000706 7.075463  
## 31 13.879932 13.711439  
## 41 13.423286 13.239789  
## 51 6.563639 6.563182  
## 66 6.181922 6.206088  
## 81 15.743156 15.721350  
## 90 13.545156 13.621073  
## 99 7.798678 7.866392  
## 109 7.798678 7.866392  
## 209 8.949465 8.842747  
## 219 5.958143 6.037140  
## 279 11.359374 11.441523  
## 285 8.949465 8.842747  
## 385 11.359374 11.441523  
## 391 10.330821 10.326638  
## 397 6.563639 6.563182  
## 412 7.419171 7.472914  
## 422 6.697222 6.627382  
## 437 6.697222 6.627382  
## 452 6.137030 6.250091  
## 467 7.350873 7.432630  
## 482 6.697222 6.627382  
## 497 6.563639 6.563182  
## 512 14.150090 14.144609  
## 521 14.358264 14.321305  
## 530 6.137030 6.250091  
## 545 10.330821 10.326638  
## 551 6.697222 6.627382  
## 566 12.706625 12.736276  
## 575 14.358264 14.321305  
## 584 8.949465 8.842747  
## 594 7.350873 7.432630  
## 609 13.545156 13.621073  
## 618 13.545156 13.621073  
## 627 6.088795 6.182121  
## 642 11.359374 11.441523  
## 648 15.220710 15.204887  
## 657 6.137030 6.250091  
## 672 6.764389 6.805821  
## 682 7.798678 7.866392  
## 692 6.563639 6.563182  
## GSM2685698\_ctrl\_0hr\_Group\_A GSM2685699\_ctrl\_0hr\_Group\_B  
## 1 5.968496 5.917775  
## 16 7.021435 6.877443  
## 31 13.679609 13.690249  
## 41 13.189063 13.052863  
## 51 6.640295 6.454374  
## 66 6.130249 6.183511  
## 81 15.721350 15.550718  
## 90 13.582989 13.866949  
## 99 7.742188 7.684730  
## 109 7.742188 7.684730  
## 209 8.900764 8.808501  
## 219 5.887260 5.873911  
## 279 11.517387 11.472704  
## 285 8.900764 8.808501  
## 385 11.517387 11.472704  
## 391 10.480783 10.308663  
## 397 6.640295 6.454374  
## 412 7.415712 7.155158  
## 422 6.564249 6.732084  
## 437 6.564249 6.732084  
## 452 6.236379 6.226813  
## 467 7.430458 7.661405  
## 482 6.564249 6.732084  
## 497 6.640295 6.454374  
## 512 14.113341 14.273581  
## 521 14.361286 14.343081  
## 530 6.236379 6.226813  
## 545 10.480783 10.308663  
## 551 6.564249 6.732084  
## 566 12.748984 12.847926  
## 575 14.361286 14.343081  
## 584 8.900764 8.808501  
## 594 7.430458 7.661405  
## 609 13.582989 13.866949  
## 618 13.582989 13.866949  
## 627 6.142107 6.213495  
## 642 11.517387 11.472704  
## 648 15.239825 15.250367  
## 657 6.236379 6.226813  
## 672 6.694174 6.657960  
## 682 7.742188 7.684730  
## 692 6.640295 6.454374  
## GSM2685700\_ctrl\_0hr\_Group\_C GSM2685701\_ctrl\_0hr\_Group\_D  
## 1 5.900602 5.973161  
## 16 6.843578 7.033153  
## 31 13.961256 14.155264  
## 41 13.405484 13.621073  
## 51 6.529181 6.591771  
## 66 6.192774 6.209796  
## 81 15.560146 15.569952  
## 90 13.842350 13.774116  
## 99 7.532076 7.701530  
## 109 7.532076 7.701530  
## 209 8.868502 8.890951  
## 219 5.946961 6.347886  
## 279 11.495049 11.440057  
## 285 8.868502 8.890951  
## 385 11.495049 11.440057  
## 391 10.169702 10.282719  
## 397 6.529181 6.591771  
## 412 7.145501 7.226388  
## 422 6.588402 6.522684  
## 437 6.588402 6.522684  
## 452 6.124304 6.158761  
## 467 7.544183 7.562423  
## 482 6.588402 6.522684  
## 497 6.529181 6.591771  
## 512 14.298329 14.214335  
## 521 14.338710 14.413252  
## 530 6.124304 6.158761  
## 545 10.169702 10.282719  
## 551 6.588402 6.522684  
## 566 12.755767 12.755081  
## 575 14.338710 14.413252  
## 584 8.868502 8.890951  
## 594 7.544183 7.562423  
## 609 13.842350 13.774116  
## 618 13.842350 13.774116  
## 627 6.192774 6.258751  
## 642 11.495049 11.440057  
## 648 15.315381 15.310287  
## 657 6.124304 6.158761  
## 672 6.664146 6.663506  
## 682 7.532076 7.701530  
## 692 6.529181 6.591771  
## GSM2685702\_ctrl\_0hr\_Group\_E GSM2685703\_CoV\_12hr\_Group\_A  
## 1 5.965960 6.034281  
## 16 6.998620 6.550617  
## 31 13.806404 12.563610  
## 41 13.289162 12.293758  
## 51 6.439847 6.361784  
## 66 6.250186 6.078798  
## 81 15.486730 15.791166  
## 90 13.715296 13.793138  
## 99 7.715531 7.140323  
## 109 7.715531 7.140323  
## 209 8.866401 8.389528  
## 219 5.979920 5.940803  
## 279 11.482451 9.984313  
## 285 8.866401 8.389528  
## 385 11.482451 9.984313  
## 391 10.311346 11.123686  
## 397 6.439847 6.361784  
## 412 7.227923 6.437373  
## 422 6.730183 6.617164  
## 437 6.730183 6.617164  
## 452 6.122752 6.218734  
## 467 7.728887 7.959343  
## 482 6.730183 6.617164  
## 497 6.439847 6.361784  
## 512 14.176559 14.214335  
## 521 14.272338 14.427768  
## 530 6.122752 6.218734  
## 545 10.311346 11.123686  
## 551 6.730183 6.617164  
## 566 12.780676 12.710683  
## 575 14.272338 14.427768  
## 584 8.866401 8.389528  
## 594 7.728887 7.959343  
## 609 13.715296 13.793138  
## 618 13.715296 13.793138  
## 627 6.200249 6.120370  
## 642 11.482451 9.984313  
## 648 15.204887 15.384111  
## 657 6.122752 6.218734  
## 672 6.672430 6.539512  
## 682 7.715531 7.140323  
## 692 6.439847 6.361784  
## GSM2685704\_CoV\_12hr\_Group\_B GSM2685705\_CoV\_12hr\_Group\_C  
## 1 5.986079 5.976717  
## 16 6.692292 7.076586  
## 31 12.931461 12.725504  
## 41 12.506969 12.484960  
## 51 6.351778 6.239437  
## 66 5.986079 6.136415  
## 81 15.989759 15.811264  
## 90 13.756643 13.821900  
## 99 7.179646 7.139658  
## 109 7.179646 7.139658  
## 209 8.009192 7.905606  
## 219 5.996914 5.926815  
## 279 10.224721 9.970963  
## 285 8.009192 7.905606  
## 385 10.224721 9.970963  
## 391 11.205396 11.354632  
## 397 6.351778 6.239437  
## 412 6.385745 6.401408  
## 422 6.501226 6.364588  
## 437 6.501226 6.364588  
## 452 6.117671 6.081783  
## 467 8.018902 7.924227  
## 482 6.501226 6.364588  
## 497 6.351778 6.239437  
## 512 14.194950 14.194950  
## 521 14.444955 14.410594  
## 530 6.117671 6.081783  
## 545 11.205396 11.354632  
## 551 6.501226 6.364588  
## 566 12.707371 12.707371  
## 575 14.444955 14.410594  
## 584 8.009192 7.905606  
## 594 8.018902 7.924227  
## 609 13.756643 13.821900  
## 618 13.756643 13.821900  
## 627 6.093028 6.136415  
## 642 10.224721 9.970963  
## 648 15.418299 15.310287  
## 657 6.117671 6.081783  
## 672 6.578775 6.465496  
## 682 7.179646 7.139658  
## 692 6.351778 6.239437  
## GSM2685706\_CoV\_12hr\_Group\_D GSM2685707\_CoV\_12hr\_Group\_E  
## 1 5.856839 5.976717  
## 16 6.551540 6.801301  
## 31 12.735467 13.112807  
## 41 12.449308 12.457226  
## 51 6.289630 6.313741  
## 66 6.123684 6.140472  
## 81 15.943282 16.123661  
## 90 13.931108 13.637411  
## 99 7.096637 7.207673  
## 109 7.096637 7.207673  
## 209 7.834892 8.052411  
## 219 5.914191 5.929894  
## 279 9.965923 9.961133  
## 285 7.834892 8.052411  
## 385 9.965923 9.961133  
## 391 11.237178 12.011102  
## 397 6.289630 6.313741  
## 412 6.341379 6.788131  
## 422 6.471339 6.454703  
## 437 6.471339 6.454703  
## 452 6.183709 6.237144  
## 467 8.058512 7.772063  
## 482 6.471339 6.454703  
## 497 6.289630 6.313741  
## 512 14.266920 14.212112  
## 521 14.501147 14.459021  
## 530 6.183709 6.237144  
## 545 11.237178 12.011102  
## 551 6.471339 6.454703  
## 566 12.828171 12.789918  
## 575 14.501147 14.459021  
## 584 7.834892 8.052411  
## 594 8.058512 7.772063  
## 609 13.931108 13.637411  
## 618 13.931108 13.637411  
## 627 6.143740 6.182915  
## 642 9.965923 9.961133  
## 648 15.427256 15.815665  
## 657 6.183709 6.237144  
## 672 6.511225 6.687345  
## 682 7.096637 7.207673  
## 692 6.289630 6.313741  
## GSM2685708\_ctrl\_12hr\_Group\_A GSM2685709\_ctrl\_12hr\_Group\_B  
## 1 6.101625 6.054130  
## 16 7.304274 7.267867  
## 31 13.469030 13.714536  
## 41 13.045695 12.976714  
## 51 6.556913 6.581489  
## 66 6.319955 6.301538  
## 81 15.617498 15.684402  
## 90 13.461204 13.242660  
## 99 7.879929 7.815682  
## 109 7.879929 7.815682  
## 209 9.474104 9.384559  
## 219 6.375403 5.919921  
## 279 11.347625 11.309167  
## 285 9.474104 9.384559  
## 385 11.347625 11.309167  
## 391 11.198476 11.681931  
## 397 6.556913 6.581489  
## 412 7.353212 7.733486  
## 422 6.677654 6.524879  
## 437 6.677654 6.524879  
## 452 6.556913 6.658103  
## 467 8.266159 8.119336  
## 482 6.677654 6.524879  
## 497 6.556913 6.581489  
## 512 13.906088 13.848895  
## 521 14.079932 14.111086  
## 530 6.556913 6.658103  
## 545 11.198476 11.681931  
## 551 6.677654 6.524879  
## 566 12.471825 12.287010  
## 575 14.079932 14.111086  
## 584 9.474104 9.384559  
## 594 8.266159 8.119336  
## 609 13.461204 13.242660  
## 618 13.461204 13.242660  
## 627 6.239819 6.132205  
## 642 11.347625 11.309167  
## 648 15.152809 15.320354  
## 657 6.556913 6.658103  
## 672 6.844834 6.907652  
## 682 7.879929 7.815682  
## 692 6.556913 6.581489  
## GSM2685710\_ctrl\_12hr\_Group\_C GSM2685711\_ctrl\_12hr\_Group\_D  
## 1 6.056733 6.073452  
## 16 7.233682 7.044011  
## 31 13.529718 13.383898  
## 41 12.970346 13.184021  
## 51 6.587802 6.601072  
## 66 6.278182 6.040386  
## 81 15.651198 15.595299  
## 90 13.642893 13.710017  
## 99 7.818273 7.596400  
## 109 7.818273 7.596400  
## 209 9.389666 9.595884  
## 219 5.837683 5.928711  
## 279 11.282345 11.381308  
## 285 9.389666 9.595884  
## 385 11.282345 11.381308  
## 391 11.098940 11.147201  
## 397 6.587802 6.601072  
## 412 7.306484 7.133544  
## 422 6.604914 7.049685  
## 437 6.604914 7.049685  
## 452 6.579152 6.367561  
## 467 8.186986 8.135535  
## 482 6.604914 7.049685  
## 497 6.587802 6.601072  
## 512 14.033361 14.051589  
## 521 14.260434 14.250394  
## 530 6.579152 6.367561  
## 545 11.098940 11.147201  
## 551 6.604914 7.049685  
## 566 12.569342 12.463613  
## 575 14.260434 14.250394  
## 584 9.389666 9.595884  
## 594 8.186986 8.135535  
## 609 13.642893 13.710017  
## 618 13.642893 13.710017  
## 627 6.298242 6.040386  
## 642 11.282345 11.381308  
## 648 15.271108 15.134904  
## 657 6.579152 6.367561  
## 672 6.834263 6.810573  
## 682 7.818273 7.596400  
## 692 6.587802 6.601072  
## GSM2685712\_ctrl\_12hr\_Group\_E GSM2685713\_CoV\_24hr\_Group\_A  
## 1 5.943683 5.852162  
## 16 7.003569 6.871181  
## 31 13.331293 11.921824  
## 41 13.078701 11.600564  
## 51 6.452728 6.771657  
## 66 6.066732 6.237144  
## 81 15.753597 15.727376  
## 90 13.871693 13.644290  
## 99 7.567679 7.437216  
## 109 7.567679 7.437216  
## 209 9.422309 7.967724  
## 219 6.042577 5.981748  
## 279 11.504963 8.847859  
## 285 9.422309 7.967724  
## 385 11.504963 8.847859  
## 391 11.269751 11.056136  
## 397 6.452728 6.771657  
## 412 7.036521 6.781927  
## 422 7.036124 6.689429  
## 437 7.036124 6.689429  
## 452 6.269044 6.237144  
## 467 8.242917 7.835208  
## 482 7.036124 6.689429  
## 497 6.452728 6.771657  
## 512 14.164148 14.073373  
## 521 14.394424 14.290879  
## 530 6.269044 6.237144  
## 545 11.269751 11.056136  
## 551 7.036124 6.689429  
## 566 12.603593 12.505019  
## 575 14.394424 14.290879  
## 584 9.422309 7.967724  
## 594 8.242917 7.835208  
## 609 13.871693 13.644290  
## 618 13.871693 13.644290  
## 627 6.145983 7.148629  
## 642 11.504963 8.847859  
## 648 15.191398 15.334556  
## 657 6.269044 6.237144  
## 672 6.781657 6.595712  
## 682 7.567679 7.437216  
## 692 6.452728 6.771657  
## GSM2685714\_CoV\_24hr\_Group\_B GSM2685715\_CoV\_24hr\_Group\_C  
## 1 5.994476 5.975571  
## 16 6.762131 7.027862  
## 31 11.927784 11.939520  
## 41 11.648884 11.386459  
## 51 6.554766 6.962202  
## 66 6.217184 6.279483  
## 81 15.684402 15.989759  
## 90 13.645558 13.465904  
## 99 7.360648 7.359945  
## 109 7.360648 7.359945  
## 209 7.845939 7.896977  
## 219 5.840833 5.837683  
## 279 8.801857 8.940537  
## 285 7.845939 7.896977  
## 385 8.801857 8.940537  
## 391 11.164641 11.167653  
## 397 6.554766 6.962202  
## 412 6.727406 6.858181  
## 422 6.582995 6.700971  
## 437 6.582995 6.700971  
## 452 6.207846 6.556300  
## 467 7.793875 7.589638  
## 482 6.582995 6.700971  
## 497 6.554766 6.962202  
## 512 14.033361 13.983045  
## 521 14.200832 14.115127  
## 530 6.207846 6.556300  
## 545 11.164641 11.167653  
## 551 6.582995 6.700971  
## 566 12.564091 12.663837  
## 575 14.200832 14.115127  
## 584 7.845939 7.896977  
## 594 7.793875 7.589638  
## 609 13.645558 13.465904  
## 618 13.645558 13.465904  
## 627 7.006153 7.128624  
## 642 8.801857 8.940537  
## 648 15.310287 15.537292  
## 657 6.207846 6.556300  
## 672 6.582995 6.743885  
## 682 7.360648 7.359945  
## 692 6.554766 6.962202  
## GSM2685716\_CoV\_24hr\_Group\_D GSM2685717\_CoV\_24hr\_Group\_E  
## 1 6.113093 6.081570  
## 16 7.096057 7.274542  
## 31 12.099577 12.317984  
## 41 11.575374 11.876350  
## 51 6.900674 6.827556  
## 66 6.339209 6.214855  
## 81 15.950377 15.955840  
## 90 13.553828 13.536745  
## 99 7.465240 7.550122  
## 109 7.465240 7.550122  
## 209 7.999472 8.024288  
## 219 5.982204 6.329555  
## 279 8.960830 8.883563  
## 285 7.999472 8.024288  
## 385 8.960830 8.883563  
## 391 11.197719 11.185996  
## 397 6.900674 6.827556  
## 412 7.019623 7.078983  
## 422 6.728551 6.627090  
## 437 6.728551 6.627090  
## 452 6.601369 6.523155  
## 467 7.550776 7.513327  
## 482 6.728551 6.627090  
## 497 6.900674 6.827556  
## 512 14.147362 14.130915  
## 521 14.069355 14.099160  
## 530 6.601369 6.523155  
## 545 11.197719 11.185996  
## 551 6.728551 6.627090  
## 566 12.709173 12.825505  
## 575 14.069355 14.099160  
## 584 7.999472 8.024288  
## 594 7.550776 7.513327  
## 609 13.553828 13.536745  
## 618 13.553828 13.536745  
## 627 7.188175 7.254043  
## 642 8.960830 8.883563  
## 648 15.556080 15.605467  
## 657 6.601369 6.523155  
## 672 6.738571 6.763061  
## 682 7.465240 7.550122  
## 692 6.900674 6.827556  
## GSM2685718\_ctrl\_24hr\_Group\_A GSM2685719\_ctrl\_24hr\_Group\_B  
## 1 5.971028 6.006996  
## 16 7.236172 7.108756  
## 31 13.648472 13.539470  
## 41 13.110465 13.124500  
## 51 6.716954 6.591846  
## 66 6.136825 6.274459  
## 81 15.908781 15.698081  
## 90 13.711263 13.752605  
## 99 7.841700 7.824587  
## 109 7.841700 7.824587  
## 209 8.907840 8.912668  
## 219 5.822295 5.874648  
## 279 11.936456 11.941699  
## 285 8.907840 8.912668  
## 385 11.936456 11.941699  
## 391 11.162259 11.112189  
## 397 6.716954 6.591846  
## 412 7.566727 7.559356  
## 422 6.689709 6.704019  
## 437 6.689709 6.704019  
## 452 6.533938 6.482192  
## 467 7.825446 7.853444  
## 482 6.689709 6.704019  
## 497 6.716954 6.591846  
## 512 14.166197 14.210078  
## 521 14.203153 14.316351  
## 530 6.533938 6.482192  
## 545 11.162259 11.112189  
## 551 6.689709 6.704019  
## 566 12.718928 12.526797  
## 575 14.203153 14.316351  
## 584 8.907840 8.912668  
## 594 7.825446 7.853444  
## 609 13.711263 13.752605  
## 618 13.711263 13.752605  
## 627 6.181525 6.087523  
## 642 11.936456 11.941699  
## 648 15.507334 15.519886  
## 657 6.533938 6.482192  
## 672 6.944874 6.829460  
## 682 7.841700 7.824587  
## 692 6.716954 6.591846  
## GSM2685720\_ctrl\_24hr\_Group\_C GSM2685721\_ctrl\_24hr\_Group\_D  
## 1 6.054347 6.016164  
## 16 7.072893 7.111257  
## 31 13.625575 13.478230  
## 41 13.292808 13.190435  
## 51 6.568645 6.576811  
## 66 6.116008 6.084124  
## 81 15.569952 15.591344  
## 90 13.777280 13.791536  
## 99 7.783632 7.805239  
## 109 7.783632 7.805239  
## 209 9.091769 8.998199  
## 219 6.383866 5.961156  
## 279 12.027264 11.940062  
## 285 9.091769 8.998199  
## 385 12.027264 11.940062  
## 391 11.039873 11.061724  
## 397 6.568645 6.576811  
## 412 7.551625 7.509755  
## 422 6.740191 6.801430  
## 437 6.740191 6.801430  
## 452 6.414388 6.366862  
## 467 7.939793 7.793160  
## 482 6.740191 6.801430  
## 497 6.568645 6.576811  
## 512 14.245321 14.178808  
## 521 14.216561 14.062458  
## 530 6.414388 6.366862  
## 545 11.039873 11.061724  
## 551 6.740191 6.801430  
## 566 12.521572 12.518281  
## 575 14.216561 14.062458  
## 584 9.091769 8.998199  
## 594 7.939793 7.793160  
## 609 13.777280 13.791536  
## 618 13.777280 13.791536  
## 627 6.116008 6.100574  
## 642 12.027264 11.940062  
## 648 15.239825 15.262706  
## 657 6.414388 6.366862  
## 672 6.996312 6.968890  
## 682 7.783632 7.805239  
## 692 6.568645 6.576811  
## GSM2685722\_ctrl\_24hr\_Group\_E GSM2685723\_CoV\_36hr\_Group\_A  
## 1 6.065871 6.037753  
## 16 7.153700 7.290151  
## 31 13.511865 12.155727  
## 41 13.198260 11.842594  
## 51 6.596607 7.031230  
## 66 6.189750 6.508058  
## 81 15.575092 15.928588  
## 90 13.818910 13.565265  
## 99 7.700074 7.075356  
## 109 7.700074 7.075356  
## 209 9.018607 8.415451  
## 219 5.946259 6.354954  
## 279 11.842310 9.547340  
## 285 9.018607 8.415451  
## 385 11.842310 9.547340  
## 391 11.162237 10.390335  
## 397 6.596607 7.031230  
## 412 7.483871 6.848334  
## 422 6.601666 6.813655  
## 437 6.601666 6.813655  
## 452 6.306285 6.793453  
## 467 7.728207 8.067333  
## 482 6.601666 6.813655  
## 497 6.596607 7.031230  
## 512 14.167395 14.075771  
## 521 14.060533 14.212112  
## 530 6.306285 6.793453  
## 545 11.162237 10.390335  
## 551 6.601666 6.813655  
## 566 12.560602 12.502460  
## 575 14.060533 14.212112  
## 584 9.018607 8.415451  
## 594 7.728207 8.067333  
## 609 13.818910 13.565265  
## 618 13.818910 13.565265  
## 627 6.158761 7.258195  
## 642 11.842310 9.547340  
## 648 15.217024 15.330807  
## 657 6.306285 6.793453  
## 672 6.891355 6.508058  
## 682 7.700074 7.075356  
## 692 6.596607 7.031230  
## GSM2685724\_CoV\_36hr\_Group\_B GSM2685725\_CoV\_36hr\_Group\_C  
## 1 6.075165 6.035602  
## 16 7.038979 7.256969  
## 31 12.263597 12.424504  
## 41 11.984688 12.033150  
## 51 6.920563 7.063761  
## 66 6.419116 6.501226  
## 81 15.963635 15.983105  
## 90 13.673362 13.633552  
## 99 7.076960 7.301533  
## 109 7.076960 7.301533  
## 209 8.349640 8.680838  
## 219 5.813953 6.057816  
## 279 9.470814 9.856731  
## 285 8.349640 8.680838  
## 385 9.470814 9.856731  
## 391 10.657755 10.350293  
## 397 6.920563 7.063761  
## 412 6.838491 6.904409  
## 422 6.648788 6.671737  
## 437 6.648788 6.671737  
## 452 6.564707 6.796636  
## 467 8.033099 8.012799  
## 482 6.648788 6.671737  
## 497 6.920563 7.063761  
## 512 14.151924 14.171229  
## 521 14.264767 14.295878  
## 530 6.564707 6.796636  
## 545 10.657755 10.350293  
## 551 6.648788 6.671737  
## 566 12.621199 12.500993  
## 575 14.264767 14.295878  
## 584 8.349640 8.680838  
## 594 8.033099 8.012799  
## 609 13.673362 13.633552  
## 618 13.673362 13.633552  
## 627 7.091198 6.988153  
## 642 9.470814 9.856731  
## 648 15.410491 15.437017  
## 657 6.564707 6.796636  
## 672 6.540443 6.609427  
## 682 7.076960 7.301533  
## 692 6.920563 7.063761  
## GSM2685726\_CoV\_36hr\_Group\_D GSM2685727\_CoV\_36hr\_Group\_E  
## 1 6.040386 6.130249  
## 16 7.247512 7.275706  
## 31 12.440354 12.351661  
## 41 12.082020 11.793496  
## 51 6.929104 7.136585  
## 66 6.419622 6.452728  
## 81 15.943282 15.823487  
## 90 13.520099 13.440834  
## 99 7.613149 7.419926  
## 109 7.613149 7.419926  
## 209 8.576810 8.465203  
## 219 5.894553 6.025496  
## 279 9.696370 9.585969  
## 285 8.576810 8.465203  
## 385 9.696370 9.585969  
## 391 10.378994 10.490391  
## 397 6.929104 7.136585  
## 412 6.833708 6.954109  
## 422 6.626798 6.763061  
## 437 6.626798 6.763061  
## 452 6.671737 6.726782  
## 467 8.166043 8.051814  
## 482 6.626798 6.763061  
## 497 6.929104 7.136585  
## 512 14.097307 13.856158  
## 521 14.230680 14.194950  
## 530 6.671737 6.726782  
## 545 10.378994 10.490391  
## 551 6.626798 6.763061  
## 566 12.440331 12.523054  
## 575 14.230680 14.194950  
## 584 8.576810 8.465203  
## 594 8.166043 8.051814  
## 609 13.520099 13.440834  
## 618 13.520099 13.440834  
## 627 7.194883 7.223682  
## 642 9.696370 9.585969  
## 648 15.315381 15.372981  
## 657 6.671737 6.726782  
## 672 6.615693 6.350894  
## 682 7.613149 7.419926  
## 692 6.929104 7.136585  
## GSM2685728\_ctrl\_36hr\_Group\_A GSM2685729\_ctrl\_36hr\_Group\_B  
## 1 6.026382 6.192380  
## 16 7.224261 7.247512  
## 31 13.717610 13.768831  
## 41 13.315157 13.328181  
## 51 6.797545 6.722416  
## 66 6.220477 6.297905  
## 81 15.705959 15.786439  
## 90 13.530735 13.575280  
## 99 7.815874 7.751624  
## 109 7.815874 7.751624  
## 209 8.793558 8.893911  
## 219 6.125711 5.970798  
## 279 12.382962 12.326271  
## 285 8.793558 8.893911  
## 385 12.382962 12.326271  
## 391 11.308817 11.352996  
## 397 6.797545 6.722416  
## 412 7.509502 7.556387  
## 422 6.478637 6.545394  
## 437 6.478637 6.545394  
## 452 6.437685 6.461104  
## 467 8.036592 7.952603  
## 482 6.478637 6.545394  
## 497 6.797545 6.722416  
## 512 14.084852 14.200832  
## 521 14.176559 14.341048  
## 530 6.437685 6.461104  
## 545 11.308817 11.352996  
## 551 6.478637 6.545394  
## 566 12.611342 12.621199  
## 575 14.176559 14.341048  
## 584 8.793558 8.893911  
## 594 8.036592 7.952603  
## 609 13.530735 13.575280  
## 618 13.530735 13.575280  
## 627 6.235422 6.186089  
## 642 12.382962 12.326271  
## 648 15.213389 15.217024  
## 657 6.437685 6.461104  
## 672 6.815439 6.832745  
## 682 7.815874 7.751624  
## 692 6.797545 6.722416  
## GSM2685730\_ctrl\_36hr\_Group\_C GSM2685731\_ctrl\_36hr\_Group\_D  
## 1 6.083912 6.013710  
## 16 7.135662 7.204644  
## 31 13.867985 13.830899  
## 41 13.379796 13.341531  
## 51 6.836527 6.763127  
## 66 6.236570 6.174351  
## 81 15.807433 15.781413  
## 90 13.536745 13.535802  
## 99 7.830082 7.789513  
## 109 7.830082 7.789513  
## 209 8.814025 8.812357  
## 219 5.881211 5.946493  
## 279 12.428664 12.362715  
## 285 8.814025 8.812357  
## 385 12.428664 12.362715  
## 391 11.305894 11.262485  
## 397 6.836527 6.763127  
## 412 7.571243 7.522806  
## 422 6.544776 6.608540  
## 437 6.544776 6.608540  
## 452 6.321218 6.506314  
## 467 7.977058 7.960183  
## 482 6.544776 6.608540  
## 497 6.836527 6.763127  
## 512 14.082690 14.103762  
## 521 14.264767 14.302531  
## 530 6.321218 6.506314  
## 545 11.305894 11.262485  
## 551 6.544776 6.608540  
## 566 12.570815 12.623629  
## 575 14.264767 14.302531  
## 584 8.814025 8.812357  
## 594 7.977058 7.960183  
## 609 13.536745 13.535802  
## 618 13.536745 13.535802  
## 627 6.282822 6.118087  
## 642 12.428664 12.362715  
## 648 15.330807 15.320354  
## 657 6.321218 6.506314  
## 672 6.870133 6.829460  
## 682 7.830082 7.789513  
## 692 6.836527 6.763127  
## GSM2685732\_ctrl\_36hr\_Group\_E GSM2685733\_CoV\_48hr\_Group\_A  
## 1 5.996010 6.245535  
## 16 7.221895 7.588102  
## 31 13.814027 13.145100  
## 41 13.283499 12.611342  
## 51 6.748119 7.418830  
## 66 6.206479 6.421979  
## 81 15.863114 15.770868  
## 90 13.505737 13.308149  
## 99 7.876741 7.615284  
## 109 7.876741 7.615284  
## 209 8.907780 8.896563  
## 219 5.986761 5.952795  
## 279 12.360358 11.238626  
## 285 8.907780 8.896563  
## 385 12.360358 11.238626  
## 391 11.386529 9.754081  
## 397 6.748119 7.418830  
## 412 7.549440 7.106147  
## 422 6.522449 6.655672  
## 437 6.522449 6.655672  
## 452 6.511225 6.737557  
## 467 7.931425 8.121772  
## 482 6.522449 6.655672  
## 497 6.748119 7.418830  
## 512 14.155982 13.910041  
## 521 14.330268 14.161250  
## 530 6.511225 6.737557  
## 545 11.386529 9.754081  
## 551 6.522449 6.655672  
## 566 12.655145 12.470038  
## 575 14.330268 14.161250  
## 584 8.907780 8.896563  
## 594 7.931425 8.121772  
## 609 13.505737 13.308149  
## 618 13.505737 13.308149  
## 627 6.206479 6.885510  
## 642 12.360358 11.238626  
## 648 15.405375 15.169967  
## 657 6.511225 6.737557  
## 672 6.856325 6.516730  
## 682 7.876741 7.615284  
## 692 6.748119 7.418830  
## GSM2685734\_CoV\_48hr\_Group\_B GSM2685735\_CoV\_48hr\_Group\_C  
## 1 6.171151 6.220090  
## 16 7.624817 7.440707  
## 31 12.930745 13.184153  
## 41 12.477358 12.738455  
## 51 7.609460 7.428115  
## 66 6.675679 6.538291  
## 81 15.811264 15.943282  
## 90 13.268812 12.955313  
## 99 7.377139 7.650819  
## 109 7.377139 7.650819  
## 209 8.807600 8.831738  
## 219 5.916103 5.924204  
## 279 11.011476 11.453377  
## 285 8.807600 8.831738  
## 385 11.011476 11.453377  
## 391 9.813139 9.731903  
## 397 7.609460 7.428115  
## 412 7.060422 7.233038  
## 422 6.824505 6.832745  
## 437 6.824505 6.832745  
## 452 6.675679 6.895957  
## 467 8.274663 8.323442  
## 482 6.824505 6.832745  
## 497 7.609460 7.428115  
## 512 13.891601 13.584385  
## 521 14.260434 14.084852  
## 530 6.675679 6.895957  
## 545 9.813139 9.731903  
## 551 6.824505 6.832745  
## 566 12.385422 12.066142  
## 575 14.260434 14.084852  
## 584 8.807600 8.831738  
## 594 8.274663 8.323442  
## 609 13.268812 12.955313  
## 618 13.268812 12.955313  
## 627 7.301030 6.822849  
## 642 11.011476 11.453377  
## 648 15.204887 15.148994  
## 657 6.675679 6.895957  
## 672 6.489574 6.563411  
## 682 7.377139 7.650819  
## 692 7.609460 7.428115  
## GSM2685736\_CoV\_48hr\_Group\_D GSM2685737\_CoV\_48hr\_Group\_E  
## 1 6.193563 6.168183  
## 16 7.487355 7.538375  
## 31 13.418502 13.056731  
## 41 12.884399 12.555566  
## 51 7.451626 7.479294  
## 66 6.562724 6.449183  
## 81 15.943282 15.770868  
## 90 12.889978 13.048290  
## 99 7.822518 7.494732  
## 109 7.822518 7.494732  
## 209 8.962595 8.838498  
## 219 5.724779 5.929894  
## 279 11.408702 11.297811  
## 285 8.962595 8.838498  
## 385 11.408702 11.297811  
## 391 9.693743 9.734166  
## 397 7.451626 7.479294  
## 412 7.263597 7.147329  
## 422 7.032002 6.806906  
## 437 7.032002 6.806906  
## 452 6.819596 6.878967  
## 467 8.479178 8.383752  
## 482 7.032002 6.806906  
## 497 7.451626 7.479294  
## 512 13.594991 13.642893  
## 521 14.281527 14.103762  
## 530 6.819596 6.878967  
## 545 9.693743 9.734166  
## 551 7.032002 6.806906  
## 566 12.290165 12.237340  
## 575 14.281527 14.103762  
## 584 8.962595 8.838498  
## 594 8.479178 8.383752  
## 609 12.889978 13.048290  
## 618 12.889978 13.048290  
## 627 7.001776 6.854082  
## 642 11.408702 11.297811  
## 648 15.181885 15.077245  
## 657 6.819596 6.878967  
## 672 6.604914 6.551078  
## 682 7.822518 7.494732  
## 692 7.451626 7.479294  
## GSM2685738\_ctrl\_48hr\_Group\_A GSM2685739\_ctrl\_48hr\_Group\_B  
## 1 6.113510 6.118294  
## 16 7.351580 7.255082  
## 31 13.479785 13.809171  
## 41 12.913809 13.272047  
## 51 6.884900 6.755348  
## 66 6.132513 6.191788  
## 81 15.840441 15.823487  
## 90 13.642893 13.424247  
## 99 7.822295 7.826527  
## 109 7.822295 7.826527  
## 209 8.661194 8.709415  
## 219 5.805983 6.059503  
## 279 12.087007 12.095376  
## 285 8.661194 8.709415  
## 385 12.087007 12.095376  
## 391 11.252360 11.380947  
## 397 6.884900 6.755348  
## 412 7.482716 7.507635  
## 422 6.651517 6.676103  
## 437 6.651517 6.676103  
## 452 6.429698 6.527384  
## 467 7.880480 7.940615  
## 482 6.651517 6.676103  
## 497 6.884900 6.755348  
## 512 14.218930 14.054635  
## 521 14.335814 14.307798  
## 530 6.429698 6.527384  
## 545 11.252360 11.380947  
## 551 6.651517 6.676103  
## 566 12.669945 12.641231  
## 575 14.335814 14.307798  
## 584 8.661194 8.709415  
## 594 7.880480 7.940615  
## 609 13.642893 13.424247  
## 618 13.642893 13.424247  
## 627 6.229315 6.288708  
## 642 12.087007 12.095376  
## 648 15.478388 15.289801  
## 657 6.429698 6.527384  
## 672 6.768088 6.790796  
## 682 7.822295 7.826527  
## 692 6.884900 6.755348  
## GSM2685740\_ctrl\_48hr\_Group\_C GSM2685741\_ctrl\_48hr\_Group\_D  
## 1 6.178938 6.181525  
## 16 7.147917 7.127182  
## 31 13.768155 13.649614  
## 41 13.290203 13.167372  
## 51 6.925081 6.742202  
## 66 6.108500 6.154514  
## 81 15.770868 15.786439  
## 90 13.695565 13.390078  
## 99 7.672054 7.855158  
## 109 7.672054 7.855158  
## 209 8.469137 8.748683  
## 219 5.850421 6.065332  
## 279 12.205447 12.108098  
## 285 8.469137 8.748683  
## 385 12.205447 12.108098  
## 391 11.440833 11.395297  
## 397 6.925081 6.742202  
## 412 7.413660 7.568577  
## 422 6.617604 6.551694  
## 437 6.617604 6.551694  
## 452 6.314647 6.477990  
## 467 7.844684 7.929474  
## 482 6.617604 6.551694  
## 497 6.925081 6.742202  
## 512 14.253092 13.973822  
## 521 14.345264 14.221843  
## 530 6.314647 6.477990  
## 545 11.440833 11.395297  
## 551 6.617604 6.551694  
## 566 12.795429 12.503914  
## 575 14.345264 14.221843  
## 584 8.469137 8.748683  
## 594 7.844684 7.929474  
## 609 13.695565 13.390078  
## 618 13.695565 13.390078  
## 627 6.225850 6.136620  
## 642 12.205447 12.108098  
## 648 15.471859 15.279920  
## 657 6.314647 6.477990  
## 672 6.867602 6.882945  
## 682 7.672054 7.855158  
## 692 6.925081 6.742202  
## GSM2685742\_ctrl\_48hr\_Group\_E  
## 1 6.050870  
## 16 7.342277  
## 31 13.621482  
## 41 13.121641  
## 51 6.787927  
## 66 6.120162  
## 81 15.815665  
## 90 13.471967  
## 99 7.714570  
## 109 7.714570  
## 209 8.781281  
## 219 5.903015  
## 279 12.159429  
## 285 8.781281  
## 385 12.159429  
## 391 11.449781  
## 397 6.787927  
## 412 7.398872  
## 422 6.586001  
## 437 6.586001  
## 452 6.458481  
## 467 7.953244  
## 482 6.586001  
## 497 6.787927  
## 512 14.119631  
## 521 14.228603  
## 530 6.458481  
## 545 11.449781  
## 551 6.586001  
## 566 12.656605  
## 575 14.228603  
## 584 8.781281  
## 594 7.953244  
## 609 13.471967  
## 618 13.471967  
## 627 6.282451  
## 642 12.159429  
## 648 15.275427  
## 657 6.458481  
## 672 6.783099  
## 682 7.714570  
## 692 6.787927

The above table shows the five genes that had the highest count and then the genotypes within those five genes by number or count of those genotypes of DNA copy number variations in the SEQUENCE.

It would be interesting to analyze those sequences of copy number variations within the top 5 genes expressed the most number of times in this data. Comparing networks of genes associated with processes in the body like immune response, pathogenesis of disease onset, networks of human processes in the body associated with cancer or subsequent diseases like autoimmune, celiac disease, hemochromatosis, anemia, etc. To see how well any of those genotypes fair. We could also detect patterns in the fold change values between genotypes of the genes expressed in comparing the capillary samples all within 1 hour after being inoculated with CoV, inactive CoV, CoV and an interleukin alpha, or control group. Then compare the liver tumor samples of each group A through E that was monitored after being inoculated with CoV at 0,12,24,36, and 48 hours side by side with the control groups of groups A through E.