Group 1: RNA-seq (coding) analysis AHTA

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Contents


```
suppressPackageStartupMessages({
  library(ggplot2)
  library(htmltools)
  library(biomaRt)
  library(tximport)
  library(dplyr)
  library(GEOquery)
  library(annotation)
  library(edgeR)
  library(limma)
  library(SummarizedExperiment)
})
```

General info

Platform type: Illumina NextSeq 500

The GEO dataset with accession ID GSE159699 (expression profiling by high-throughput sequencing sequencing of human postmortal hippocampal brain tissues) will be analysed in a case versus control framework for differential gene expression. The sequencing was done with single ends.

Pipeline

Import gene counts and metadata

```
id <- "GSE159699"

gse <- getGEO(id)
gse <- gse[[1]]

annot <- pData(gse)
```

```
unlink(id, recursive = T)
filePath <- rownames(getGEOSuppFiles(id))

for (file in list.files(id, full.names = T)){
  gunzip(file)
}
```

```
counts <- read.delim(list.files(id, full.names = T))

library('org.Hs.eg.db')
ENSIDs <- mapIds(org.Hs.eg.db, counts$refGene, 'ENSEMBL', 'SYMBOL')
counts <- counts[!(duplicated(ENSIDs) | is.na(ENSIDs)),]
rownames(counts) <- ENSIDs[!(duplicated(ENSIDs) | is.na(ENSIDs))]
counts <- dplyr::select(counts, -refGene)
```

```
annot$disease <- "CT"
annot$disease[grep("AD", annot$title)] <- "AD"
annot$disease <- as.factor(annot$disease)

print(annot)
```

```
##                             title geo_accession                status
## GSM4837814   10-8A-Old [RNA-seq]    GSM4837814 Public on Oct 21 2020
## GSM4837815  11-10T-Old [RNA-seq]    GSM4837815 Public on Oct 21 2020
## GSM4837816   12-6A-Old [RNA-seq]    GSM4837816 Public on Oct 21 2020
## GSM4837817  13-11T-Old [RNA-seq]    GSM4837817 Public on Oct 21 2020
## GSM4837818   14-7A-Old [RNA-seq]    GSM4837818 Public on Oct 21 2020
## GSM4837819  15-13T-Old [RNA-seq]    GSM4837819 Public on Oct 21 2020
## GSM4837820  16-14T-Old [RNA-seq]    GSM4837820 Public on Oct 21 2020
## GSM4837821   17-9A-Old [RNA-seq]    GSM4837821 Public on Oct 21 2020
## GSM4837822  18-10A-Old [RNA-seq]    GSM4837822 Public on Oct 21 2020
## GSM4837823  19-11A-Old [RNA-seq]    GSM4837823 Public on Oct 21 2020
## GSM4837824    20-1T-AD [RNA-seq]    GSM4837824 Public on Oct 21 2020
## GSM4837825    21-1A-AD [RNA-seq]    GSM4837825 Public on Oct 21 2020
## GSM4837826 2-12A-Young [RNA-seq]    GSM4837826 Public on Oct 21 2020
## GSM4837827    22-2T-AD [RNA-seq]    GSM4837827 Public on Oct 21 2020
## GSM4837828    23-2A-AD [RNA-seq]    GSM4837828 Public on Oct 21 2020
## GSM4837829    24-3T-AD [RNA-seq]    GSM4837829 Public on Oct 21 2020
## GSM4837830    25-5T-AD [RNA-seq]    GSM4837830 Public on Oct 21 2020
## GSM4837831    26-3A-AD [RNA-seq]    GSM4837831 Public on Oct 21 2020
## GSM4837832    27-5A-AD [RNA-seq]    GSM4837832 Public on Oct 21 2020
## GSM4837833    28-8T-AD [RNA-seq]    GSM4837833 Public on Oct 21 2020
## GSM4837834    29-6T-AD [RNA-seq]    GSM4837834 Public on Oct 21 2020
## GSM4837835    30-9T-AD [RNA-seq]    GSM4837835 Public on Oct 21 2020
## GSM4837836    31-7T-AD [RNA-seq]    GSM4837836 Public on Oct 21 2020
```

```
## GSM4837837 3-17T-Young [RNA-seq]    GSM4837837 Public on Oct 21 2020
## GSM4837838 4-13A-Young [RNA-seq]    GSM4837838 Public on Oct 21 2020
## GSM4837839 5-18T-Young [RNA-seq]    GSM4837839 Public on Oct 21 2020
## GSM4837840 6-14A-Young [RNA-seq]    GSM4837840 Public on Oct 21 2020
## GSM4837841 7-19T-Young [RNA-seq]    GSM4837841 Public on Oct 21 2020
## GSM4837842 8-15A-Young [RNA-seq]    GSM4837842 Public on Oct 21 2020
## GSM4837843 9-16A-Young [RNA-seq]    GSM4837843 Public on Oct 21 2020
##            submission_date last_update_date type channel_count
## GSM4837814     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837815     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837816     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837817     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837818     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837819     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837820     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837821     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837822     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837823     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837824     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837825     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837826     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837827     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837828     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837829     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837830     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837831     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837832     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837833     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837834     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837835     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837836     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837837     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837838     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837839     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837840     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837841     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837842     Oct 20 2020      Oct 21 2020  SRA             1
## GSM4837843     Oct 20 2020      Oct 21 2020  SRA             1
##                    source_name_ch1 organism_ch1
## GSM4837814 CNDR brain bank (Penn) Homo sapiens
## GSM4837815 CNDR brain bank (Penn) Homo sapiens
## GSM4837816 CNDR brain bank (Penn) Homo sapiens
## GSM4837817 CNDR brain bank (Penn) Homo sapiens
## GSM4837818 CNDR brain bank (Penn) Homo sapiens
## GSM4837819 CNDR brain bank (Penn) Homo sapiens
## GSM4837820 CNDR brain bank (Penn) Homo sapiens
## GSM4837821 CNDR brain bank (Penn) Homo sapiens
## GSM4837822 CNDR brain bank (Penn) Homo sapiens
## GSM4837823 CNDR brain bank (Penn) Homo sapiens
## GSM4837824 CNDR brain bank (Penn) Homo sapiens
## GSM4837825 CNDR brain bank (Penn) Homo sapiens
## GSM4837826 CNDR brain bank (Penn) Homo sapiens
## GSM4837827 CNDR brain bank (Penn) Homo sapiens
## GSM4837828 CNDR brain bank (Penn) Homo sapiens
```

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## GSM4837829 CNDR brain bank (Penn) Homo sapiens
## GSM4837830 CNDR brain bank (Penn) Homo sapiens
## GSM4837831 CNDR brain bank (Penn) Homo sapiens
## GSM4837832 CNDR brain bank (Penn) Homo sapiens
## GSM4837833 CNDR brain bank (Penn) Homo sapiens
## GSM4837834 CNDR brain bank (Penn) Homo sapiens
## GSM4837835 CNDR brain bank (Penn) Homo sapiens
## GSM4837836 CNDR brain bank (Penn) Homo sapiens
## GSM4837837 CNDR brain bank (Penn) Homo sapiens
## GSM4837838 CNDR brain bank (Penn) Homo sapiens
## GSM4837839 CNDR brain bank (Penn) Homo sapiens
## GSM4837840 CNDR brain bank (Penn) Homo sapiens
## GSM4837841 CNDR brain bank (Penn) Homo sapiens
## GSM4837842 CNDR brain bank (Penn) Homo sapiens
## GSM4837843 CNDR brain bank (Penn) Homo sapiens
##                                                                 characteristics_ch1
## GSM4837814 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837815 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837816 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837817 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837818 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837819 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837820 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837821 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837822 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837823 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837824 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837825 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837826 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837827 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837828 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837829 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837830 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837831 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837832 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837833 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837834 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837835 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837836 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837837 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837838 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837839 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837840 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837841 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837842 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
## GSM4837843 tissue: Lateral temporal lobe from Frozen postmortem brain tissue
##            characteristics_ch1.1 molecule_ch1
## GSM4837814              age: old    total RNA
## GSM4837815              age: old    total RNA
## GSM4837816              age: old    total RNA
## GSM4837817              age: old    total RNA
## GSM4837818              age: old    total RNA
## GSM4837819              age: old    total RNA
## GSM4837820              age: old    total RNA
```

```
## GSM4837821              age: old    total RNA
## GSM4837822              age: old    total RNA
## GSM4837823              age: old    total RNA
## GSM4837824                          total RNA
## GSM4837825                          total RNA
## GSM4837826            age: young    total RNA
## GSM4837827                          total RNA
## GSM4837828                          total RNA
## GSM4837829                          total RNA
## GSM4837830                          total RNA
## GSM4837831                          total RNA
## GSM4837832                          total RNA
## GSM4837833                          total RNA
## GSM4837834                          total RNA
## GSM4837835                          total RNA
## GSM4837836                          total RNA
## GSM4837837            age: young    total RNA
## GSM4837838            age: young    total RNA
## GSM4837839            age: young    total RNA
## GSM4837840            age: young    total RNA
## GSM4837841            age: young    total RNA
## GSM4837842            age: young    total RNA
## GSM4837843            age: young    total RNA
##
## GSM4837814 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837815 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837816 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837817 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837818 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837819 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837820 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837821 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837822 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837823 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837824 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837825 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837826 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837827 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837828 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837829 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837830 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837831 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837832 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837833 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837834 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837835 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837836 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837837 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837838 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837839 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837840 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837841 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837842 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
## GSM4837843 Total RNA was isolated from 20 mg frozen brain tissue using the RNAeasy Mini kit (Qiagen)
```

```
##
## GSM4837814 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837815 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837816 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837817 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837818 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837819 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837820 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837821 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837822 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837823 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837824 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837825 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837826 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837827 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837828 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837829 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837830 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837831 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837832 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837833 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837834 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837835 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837836 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837837 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837838 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837839 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837840 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837841 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837842 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
## GSM4837843 Ribosomal RNA was removed using the rRNA Depletion kit (NEB) and the resulting RNA was use
##            taxid_ch1            description
## GSM4837814      9606 summary_count.star.txt
## GSM4837815      9606 summary_count.star.txt
## GSM4837816      9606 summary_count.star.txt
## GSM4837817      9606 summary_count.star.txt
## GSM4837818      9606 summary_count.star.txt
## GSM4837819      9606 summary_count.star.txt
## GSM4837820      9606 summary_count.star.txt
## GSM4837821      9606 summary_count.star.txt
## GSM4837822      9606 summary_count.star.txt
## GSM4837823      9606 summary_count.star.txt
## GSM4837824      9606 summary_count.star.txt
## GSM4837825      9606 summary_count.star.txt
## GSM4837826      9606 summary_count.star.txt
## GSM4837827      9606 summary_count.star.txt
## GSM4837828      9606 summary_count.star.txt
## GSM4837829      9606 summary_count.star.txt
## GSM4837830      9606 summary_count.star.txt
## GSM4837831      9606 summary_count.star.txt
## GSM4837832      9606 summary_count.star.txt
## GSM4837833      9606 summary_count.star.txt
## GSM4837834      9606 summary_count.star.txt
## GSM4837835      9606 summary_count.star.txt
```

```
## GSM4837836      9606 summary_count.star.txt
## GSM4837837      9606 summary_count.star.txt
## GSM4837838      9606 summary_count.star.txt
## GSM4837839      9606 summary_count.star.txt
## GSM4837840      9606 summary_count.star.txt
## GSM4837841      9606 summary_count.star.txt
## GSM4837842      9606 summary_count.star.txt
## GSM4837843      9606 summary_count.star.txt
##
## GSM4837814 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837815 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837816 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837817 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837818 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837819 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837820 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837821 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837822 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837823 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837824 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837825 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837826 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837827 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837828 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837829 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837830 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837831 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837832 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837833 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837834 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837835 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837836 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837837 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837838 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837839 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837840 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837841 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837842 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
## GSM4837843 RNA-seq tags reads were aligned to the human reference genome (assembly GRCh37.75/hg19) us
##
## GSM4837814 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837815 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837816 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837817 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837818 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837819 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837820 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837821 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837822 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837823 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837824 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837825 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837826 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837827 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
```

```
## GSM4837828 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837829 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837830 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837831 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837832 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837833 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837834 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837835 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837836 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837837 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837838 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837839 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837840 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837841 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837842 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
## GSM4837843 FeatureCounts was used to generate a matrix of mapped fragments per RefSeq annotated gene
##              data_processing.2
## GSM4837814 Genome_build: hg19
## GSM4837815 Genome_build: hg19
## GSM4837816 Genome_build: hg19
## GSM4837817 Genome_build: hg19
## GSM4837818 Genome_build: hg19
## GSM4837819 Genome_build: hg19
## GSM4837820 Genome_build: hg19
## GSM4837821 Genome_build: hg19
## GSM4837822 Genome_build: hg19
## GSM4837823 Genome_build: hg19
## GSM4837824 Genome_build: hg19
## GSM4837825 Genome_build: hg19
## GSM4837826 Genome_build: hg19
## GSM4837827 Genome_build: hg19
## GSM4837828 Genome_build: hg19
## GSM4837829 Genome_build: hg19
## GSM4837830 Genome_build: hg19
## GSM4837831 Genome_build: hg19
## GSM4837832 Genome_build: hg19
## GSM4837833 Genome_build: hg19
## GSM4837834 Genome_build: hg19
## GSM4837835 Genome_build: hg19
## GSM4837836 Genome_build: hg19
## GSM4837837 Genome_build: hg19
## GSM4837838 Genome_build: hg19
## GSM4837839 Genome_build: hg19
## GSM4837840 Genome_build: hg19
## GSM4837841 Genome_build: hg19
## GSM4837842 Genome_build: hg19
## GSM4837843 Genome_build: hg19
##                                                 data_processing.3
## GSM4837814 Supplementary_files_format_and_content: read count per gene
## GSM4837815 Supplementary_files_format_and_content: read count per gene
## GSM4837816 Supplementary_files_format_and_content: read count per gene
## GSM4837817 Supplementary_files_format_and_content: read count per gene
## GSM4837818 Supplementary_files_format_and_content: read count per gene
## GSM4837819 Supplementary_files_format_and_content: read count per gene
```

```
## GSM4837820 Supplementary_files_format_and_content: read count per gene
## GSM4837821 Supplementary_files_format_and_content: read count per gene
## GSM4837822 Supplementary_files_format_and_content: read count per gene
## GSM4837823 Supplementary_files_format_and_content: read count per gene
## GSM4837824 Supplementary_files_format_and_content: read count per gene
## GSM4837825 Supplementary_files_format_and_content: read count per gene
## GSM4837826 Supplementary_files_format_and_content: read count per gene
## GSM4837827 Supplementary_files_format_and_content: read count per gene
## GSM4837828 Supplementary_files_format_and_content: read count per gene
## GSM4837829 Supplementary_files_format_and_content: read count per gene
## GSM4837830 Supplementary_files_format_and_content: read count per gene
## GSM4837831 Supplementary_files_format_and_content: read count per gene
## GSM4837832 Supplementary_files_format_and_content: read count per gene
## GSM4837833 Supplementary_files_format_and_content: read count per gene
## GSM4837834 Supplementary_files_format_and_content: read count per gene
## GSM4837835 Supplementary_files_format_and_content: read count per gene
## GSM4837836 Supplementary_files_format_and_content: read count per gene
## GSM4837837 Supplementary_files_format_and_content: read count per gene
## GSM4837838 Supplementary_files_format_and_content: read count per gene
## GSM4837839 Supplementary_files_format_and_content: read count per gene
## GSM4837840 Supplementary_files_format_and_content: read count per gene
## GSM4837841 Supplementary_files_format_and_content: read count per gene
## GSM4837842 Supplementary_files_format_and_content: read count per gene
## GSM4837843 Supplementary_files_format_and_content: read count per gene
##            platform_id contact_name          contact_institute
## GSM4837814    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837815    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837816    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837817    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837818    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837819    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837820    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837821    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837822    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837823    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837824    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837825    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837826    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837827    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837828    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837829    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837830    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837831    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837832    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837833    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837834    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837835    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837836    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837837    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837838    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837839    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837840    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837841    GPL18573   Yemin,,Lan University of Pennsylvania
## GSM4837842    GPL18573   Yemin,,Lan University of Pennsylvania
```

```
## GSM4837843    GPL18573   Yemin,,Lan University of Pennsylvania
##                   contact_address contact_city contact_state
## GSM4837814 3400 Civic Center Blvd Philadelphia            PA
## GSM4837815 3400 Civic Center Blvd Philadelphia            PA
## GSM4837816 3400 Civic Center Blvd Philadelphia            PA
## GSM4837817 3400 Civic Center Blvd Philadelphia            PA
## GSM4837818 3400 Civic Center Blvd Philadelphia            PA
## GSM4837819 3400 Civic Center Blvd Philadelphia            PA
## GSM4837820 3400 Civic Center Blvd Philadelphia            PA
## GSM4837821 3400 Civic Center Blvd Philadelphia            PA
## GSM4837822 3400 Civic Center Blvd Philadelphia            PA
## GSM4837823 3400 Civic Center Blvd Philadelphia            PA
## GSM4837824 3400 Civic Center Blvd Philadelphia            PA
## GSM4837825 3400 Civic Center Blvd Philadelphia            PA
## GSM4837826 3400 Civic Center Blvd Philadelphia            PA
## GSM4837827 3400 Civic Center Blvd Philadelphia            PA
## GSM4837828 3400 Civic Center Blvd Philadelphia            PA
## GSM4837829 3400 Civic Center Blvd Philadelphia            PA
## GSM4837830 3400 Civic Center Blvd Philadelphia            PA
## GSM4837831 3400 Civic Center Blvd Philadelphia            PA
## GSM4837832 3400 Civic Center Blvd Philadelphia            PA
## GSM4837833 3400 Civic Center Blvd Philadelphia            PA
## GSM4837834 3400 Civic Center Blvd Philadelphia            PA
## GSM4837835 3400 Civic Center Blvd Philadelphia            PA
## GSM4837836 3400 Civic Center Blvd Philadelphia            PA
## GSM4837837 3400 Civic Center Blvd Philadelphia            PA
## GSM4837838 3400 Civic Center Blvd Philadelphia            PA
## GSM4837839 3400 Civic Center Blvd Philadelphia            PA
## GSM4837840 3400 Civic Center Blvd Philadelphia            PA
## GSM4837841 3400 Civic Center Blvd Philadelphia            PA
## GSM4837842 3400 Civic Center Blvd Philadelphia            PA
## GSM4837843 3400 Civic Center Blvd Philadelphia            PA
##            contact_zip/postal_code contact_country data_row_count
## GSM4837814                   19104             USA              0
## GSM4837815                   19104             USA              0
## GSM4837816                   19104             USA              0
## GSM4837817                   19104             USA              0
## GSM4837818                   19104             USA              0
## GSM4837819                   19104             USA              0
## GSM4837820                   19104             USA              0
## GSM4837821                   19104             USA              0
## GSM4837822                   19104             USA              0
## GSM4837823                   19104             USA              0
## GSM4837824                   19104             USA              0
## GSM4837825                   19104             USA              0
## GSM4837826                   19104             USA              0
## GSM4837827                   19104             USA              0
## GSM4837828                   19104             USA              0
## GSM4837829                   19104             USA              0
## GSM4837830                   19104             USA              0
## GSM4837831                   19104             USA              0
## GSM4837832                   19104             USA              0
## GSM4837833                   19104             USA              0
## GSM4837834                   19104             USA              0
```

```
## GSM4837835                   19104             USA              0
## GSM4837836                   19104             USA              0
## GSM4837837                   19104             USA              0
## GSM4837838                   19104             USA              0
## GSM4837839                   19104             USA              0
## GSM4837840                   19104             USA              0
## GSM4837841                   19104             USA              0
## GSM4837842                   19104             USA              0
## GSM4837843                   19104             USA              0
##                instrument_model library_selection library_source
## GSM4837814 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837815 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837816 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837817 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837818 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837819 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837820 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837821 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837822 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837823 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837824 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837825 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837826 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837827 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837828 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837829 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837830 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837831 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837832 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837833 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837834 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837835 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837836 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837837 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837838 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837839 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837840 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837841 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837842 Illumina NextSeq 500              cDNA transcriptomic
## GSM4837843 Illumina NextSeq 500              cDNA transcriptomic
##            library_strategy
## GSM4837814          RNA-Seq
## GSM4837815          RNA-Seq
## GSM4837816          RNA-Seq
## GSM4837817          RNA-Seq
## GSM4837818          RNA-Seq
## GSM4837819          RNA-Seq
## GSM4837820          RNA-Seq
## GSM4837821          RNA-Seq
## GSM4837822          RNA-Seq
## GSM4837823          RNA-Seq
## GSM4837824          RNA-Seq
## GSM4837825          RNA-Seq
## GSM4837826          RNA-Seq
```

```
## GSM4837827          RNA-Seq
## GSM4837828          RNA-Seq
## GSM4837829          RNA-Seq
## GSM4837830          RNA-Seq
## GSM4837831          RNA-Seq
## GSM4837832          RNA-Seq
## GSM4837833          RNA-Seq
## GSM4837834          RNA-Seq
## GSM4837835          RNA-Seq
## GSM4837836          RNA-Seq
## GSM4837837          RNA-Seq
## GSM4837838          RNA-Seq
## GSM4837839          RNA-Seq
## GSM4837840          RNA-Seq
## GSM4837841          RNA-Seq
## GSM4837842          RNA-Seq
## GSM4837843          RNA-Seq
##                                                                    relation
## GSM4837814 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486067
## GSM4837815 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486065
## GSM4837816 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486064
## GSM4837817 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486063
## GSM4837818 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486062
## GSM4837819 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486061
## GSM4837820 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486060
## GSM4837821 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486059
## GSM4837822 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486058
## GSM4837823 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486057
## GSM4837824 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486056
## GSM4837825 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486055
## GSM4837826 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486054
## GSM4837827 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486053
## GSM4837828 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486052
## GSM4837829 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486082
## GSM4837830 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486081
## GSM4837831 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486080
## GSM4837832 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486079
## GSM4837833 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486078
## GSM4837834 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486077
## GSM4837835 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486076
## GSM4837836 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486075
## GSM4837837 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486074
## GSM4837838 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486073
## GSM4837839 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486072
## GSM4837840 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486071
## GSM4837841 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486070
## GSM4837842 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486069
## GSM4837843 BioSample: https://www.ncbi.nlm.nih.gov/biosample/SAMN16486068
##                                                                  relation.1
## GSM4837814 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317798
## GSM4837815 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317799
## GSM4837816 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317800
## GSM4837817 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317801
## GSM4837818 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317802
```

```
## GSM4837819 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317803
## GSM4837820 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317804
## GSM4837821 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317805
## GSM4837822 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317806
## GSM4837823 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317807
## GSM4837824 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317808
## GSM4837825 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317809
## GSM4837826 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317810
## GSM4837827 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317811
## GSM4837828 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317812
## GSM4837829 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317813
## GSM4837830 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317814
## GSM4837831 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317815
## GSM4837832 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317816
## GSM4837833 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317817
## GSM4837834 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317818
## GSM4837835 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317819
## GSM4837836 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317820
## GSM4837837 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317821
## GSM4837838 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317822
## GSM4837839 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317823
## GSM4837840 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317824
## GSM4837841 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317825
## GSM4837842 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317826
## GSM4837843 SRA: https://www.ncbi.nlm.nih.gov/sra?term=SRX9317827
##            supplementary_file_1 age:ch1
## GSM4837814                 NONE     old
## GSM4837815                 NONE     old
## GSM4837816                 NONE     old
## GSM4837817                 NONE     old
## GSM4837818                 NONE     old
## GSM4837819                 NONE     old
## GSM4837820                 NONE     old
## GSM4837821                 NONE     old
## GSM4837822                 NONE     old
## GSM4837823                 NONE     old
## GSM4837824                 NONE    <NA>
## GSM4837825                 NONE    <NA>
## GSM4837826                 NONE   young
## GSM4837827                 NONE    <NA>
## GSM4837828                 NONE    <NA>
## GSM4837829                 NONE    <NA>
## GSM4837830                 NONE    <NA>
## GSM4837831                 NONE    <NA>
## GSM4837832                 NONE    <NA>
## GSM4837833                 NONE    <NA>
## GSM4837834                 NONE    <NA>
## GSM4837835                 NONE    <NA>
## GSM4837836                 NONE    <NA>
## GSM4837837                 NONE   young
## GSM4837838                 NONE   young
## GSM4837839                 NONE   young
## GSM4837840                 NONE   young
## GSM4837841                 NONE   young
```

```
## GSM4837842                 NONE   young
## GSM4837843                 NONE   young
##                                                                tissue:ch1 disease
## GSM4837814 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837815 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837816 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837817 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837818 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837819 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837820 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837821 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837822 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837823 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837824 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837825 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837826 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837827 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837828 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837829 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837830 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837831 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837832 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837833 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837834 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837835 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837836 Lateral temporal lobe from Frozen postmortem brain tissue      AD
## GSM4837837 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837838 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837839 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837840 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837841 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837842 Lateral temporal lobe from Frozen postmortem brain tissue      CT
## GSM4837843 Lateral temporal lobe from Frozen postmortem brain tissue      CT
```

Differential expression analysis

```
dge <- DGEList(counts)
colnames(dge) <- substring(gsub('\\.', '-', colnames(dge)), 2)
annot <- annot[order(annot$disease), ]

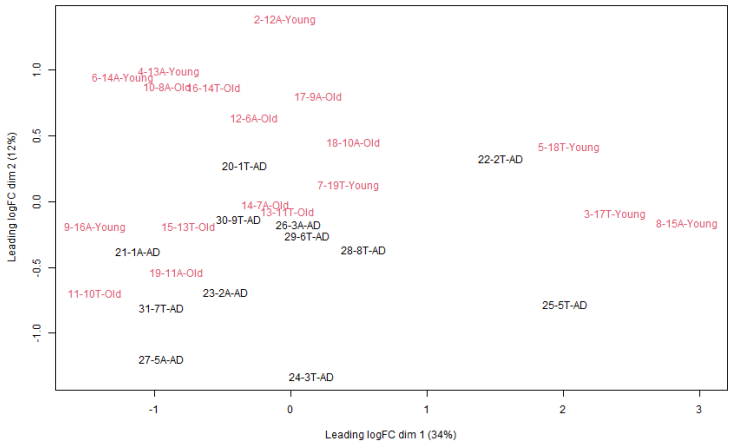
design <- model.matrix(~disease, annot)
keep <- filterByExpr(dge, design)
table(keep)
```

```
## keep
## FALSE  TRUE
##  7280 15991
```

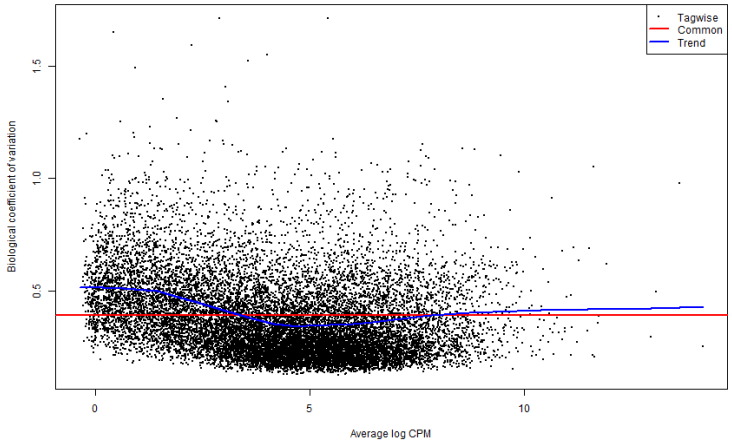
```
dge <- dge[keep, ,keep.lib.sizes=FALSE]

dge <- calcNormFactors(dge)
```

```
plotMDS(dge, top = 500, col=as.double(annot$disease))
```




```
dge <- estimateDisp(dge, design, robust=TRUE)
plotBCV(dge)
```




```
fit = glmQLFit(dge,design)
LRT <- glmQLFTest(fit)
topTags(LRT)
```

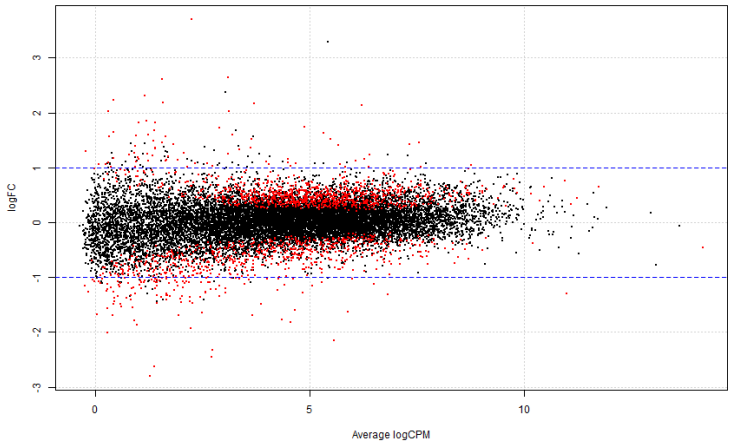
```
## Coefficient:  diseaseCT
##                      logFC   logCPM        F       PValue         FDR
## ENSG00000136933  0.5893419 3.701181 44.27497 1.780250e-07 0.00123596
## ENSG00000105877 -1.2620152 2.564962 43.31467 2.185691e-07 0.00123596
## ENSG00000109016  0.5762048 3.430957 41.20348 3.465148e-07 0.00123596
## ENSG00000002016 -0.7626227 4.869323 41.10910 3.538413e-07 0.00123596
## ENSG00000100348  0.3944258 5.353248 38.70849 6.083446e-07 0.00123596
## ENSG00000170043  0.5775731 4.890728 38.18764 6.859832e-07 0.00123596
## ENSG00000063322  0.6167025 6.522888 38.06898 7.051046e-07 0.00123596
```

```
## ENSG00000231889 -0.5807385 4.691997 37.83752 7.440575e-07 0.00123596
## ENSG00000092850 -1.0310797 1.390662 37.34583 8.346117e-07 0.00123596
## ENSG00000239306 -0.8849709 6.265442 37.34170 8.354204e-07 0.00123596
```

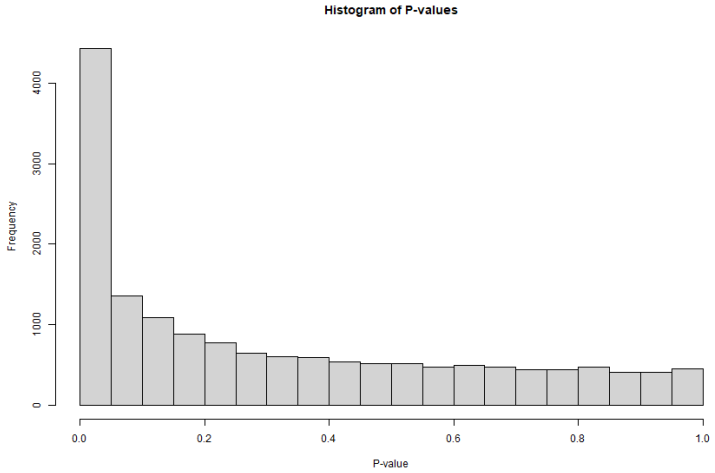
```
summary(dt <- decideTestsDGE(LRT))
```

```
##        diseaseCT
## Down         747
## NotSig     14263
## Up           981
```

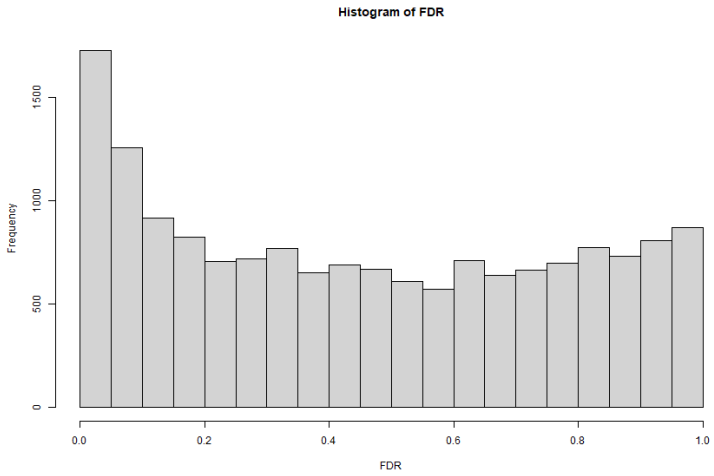
```
plotSmear(LRT,de.tags=rownames(dge)[as.logical(dt)])
abline(h=c(1,-1), col=c("blue", "blue"), lty=c(2,2))
```




```
hist(LRT$table$PValue, xlab="P-value", main="Histogram of P-values")
```



```
FDR <- p.adjust(LRT$table$PValue, "fdr")
hist(FDR)
```




```
LRT$table$FDR <- FDR
sign_genes <- LRT$table[FDR<0.05,]
sign_genes <- sign_genes[order(sign_genes$FDR),]

topHits <- LRT$table[order(LRT$table$FDR, decreasing=F),]
GeneSymbols <- mapIds(org.Hs.eg.db, rownames(topHits), 'SYMBOL', 'ENSEMBL')

topHits <- topHits[1:10,c("logFC", "FDR")]
topHits
```

```
##                      logFC        FDR
## ENSG00000092850 -1.0310797 0.00123596
## ENSG00000174132  0.7477023 0.00123596
## ENSG00000231889 -0.5807385 0.00123596
## ENSG00000105877 -1.2620152 0.00123596
## ENSG00000136933  0.5893419 0.00123596
## ENSG00000166295 -0.5812867 0.00123596
## ENSG00000239306 -0.8849709 0.00123596
## ENSG00000002016 -0.7626227 0.00123596
## ENSG00000170043  0.5775731 0.00123596
## ENSG00000109016  0.5762048 0.00123596
```

Gene set analysis

```
EntrezIDs <- mapIds(org.Hs.eg.db, rownames(sign_genes), 'ENTREZID', 'ENSEMBL')

#subset for non duplicated and mapped genes
sign_genes_entrez <- sign_genes[!(duplicated(EntrezIDs) | is.na(EntrezIDs)),]
#make rownames the Entrez gene ID
rownames(sign_genes_entrez) <- EntrezIDs[!(duplicated(EntrezIDs) | is.na(EntrezIDs))]
```

```
library(limma)
goanaOut <- goana(de=rownames(sign_genes_entrez), species="Hs", trend=T)
goanaOut <- goanaOut[order(goanaOut$P.DE, decreasing=FALSE),]
goanaOut$FDR.DE <- p.adjust(goanaOut$P.DE, method="BH")
topGORNA <- topGO(goanaOut, ontology="BP", number=50)
topGORNA
```

```
##                                                                 Term Ont     N
## GO:0044237                                cellular metabolic process  BP 10271
## GO:0006996                                    organelle organization  BP  3556
## GO:0006807                      nitrogen compound metabolic process  BP 10310
## GO:0044238                                primary metabolic process  BP 10825
## GO:0009060                                      aerobic respiration  BP   194
## GO:0045333                                   cellular respiration  BP   240
## GO:0034641            cellular nitrogen compound metabolic process  BP  7053
## GO:0006091          generation of precursor metabolites and energy  BP   505
## GO:0009199           ribonucleoside triphosphate metabolic process  BP   249
## GO:0009205    purine ribonucleoside triphosphate metabolic process  BP   242
## GO:0007005                                mitochondrion organization  BP   542
## GO:0009144        purine nucleoside triphosphate metabolic process  BP   247
## GO:0009141              nucleoside triphosphate metabolic process  BP   267
## GO:0046034                                   ATP metabolic process  BP   217
## GO:0042773               ATP synthesis coupled electron transport  BP   101
## GO:0042775  mitochondrial ATP synthesis coupled electron transport  BP   101
## GO:0046483                           heterocycle metabolic process  BP  6336
## GO:0015980     energy derivation by oxidation of organic compounds  BP   333
## GO:1901360              organic cyclic compound metabolic process  BP  6632
## GO:0006119                            oxidative phosphorylation  BP   147
## GO:0006139       nucleobase-containing compound metabolic process  BP  6165
## GO:0008152                                    metabolic process  BP 12433
## GO:0006725           cellular aromatic compound metabolic process  BP  6392
## GO:0009987                                     cellular process  BP 17266
## GO:1901575                   organic substance catabolic process  BP  2120
## GO:1901564              organonitrogen compound metabolic process  BP  6535
## GO:0019693                    ribose phosphate metabolic process  BP   475
## GO:0019646                      aerobic electron transport chain  BP    93
## GO:0009150                purine ribonucleotide metabolic process  BP   447
## GO:0009056                                    catabolic process  BP  2579
## GO:0009259                       ribonucleotide metabolic process  BP   466
## GO:0046907                                intracellular transport  BP  1587
## GO:0022904                  respiratory electron transport chain  BP   122
## GO:0044260               cellular macromolecule metabolic process  BP  3266
## GO:0033108       mitochondrial respiratory chain complex assembly  BP    99
## GO:1901576                  organic substance biosynthetic process  BP  5877
## GO:0009117                       nucleotide metabolic process  BP   597
## GO:0009058                                biosynthetic process  BP  5962
## GO:0044085                      cellular component biogenesis  BP  3273
## GO:0006163                   purine nucleotide metabolic process  BP   476
## GO:0071840          cellular component organization or biogenesis  BP  6601
## GO:0006753                nucleoside phosphate metabolic process  BP   605
## GO:0043933                protein-containing complex organization  BP  1845
## GO:0072521           purine-containing compound metabolic process  BP   507
## GO:0044271        cellular nitrogen compound biosynthetic process  BP  4865
```

```
## GO:0009057                          macromolecule catabolic process  BP  1385
## GO:0009201        ribonucleoside triphosphate biosynthetic process  BP   123
## GO:0022607                             cellular component assembly  BP  3011
## GO:0009206 purine ribonucleoside triphosphate biosynthetic process  BP   117
## GO:0032543                               mitochondrial translation  BP   131
##              DE         P.DE       FDR.DE
## GO:0044237  965 4.271072e-20 6.538442e-17
## GO:0006996  397 2.397043e-16 2.117050e-13
## GO:0006807  947 6.055583e-16 5.039696e-13
## GO:0044238  986 6.145168e-16 5.039696e-13
## GO:0009060   51 3.098510e-15 2.371703e-12
## GO:0045333   56 3.671179e-14 2.634415e-11
## GO:0034641  681 4.234797e-14 2.946777e-11
## GO:0006091   89 1.060211e-13 7.160480e-11
## GO:0009199   56 1.912262e-13 1.254608e-10
## GO:0009205   55 1.985360e-13 1.266384e-10
## GO:0007005   92 3.908133e-13 2.361643e-10
## GO:0009144   55 4.836249e-13 2.847559e-10
## GO:0009141   57 1.175566e-12 6.748629e-10
## GO:0046034   50 1.423809e-12 7.974370e-10
## GO:0042773   32 1.894553e-12 9.855029e-10
## GO:0042775   32 1.894553e-12 9.855029e-10
## GO:0046483  613 1.974182e-12 9.855029e-10
## GO:0015980   65 2.317697e-12 1.132367e-09
## GO:1901360  636 3.032329e-12 1.421048e-09
## GO:0006119   39 4.071429e-12 1.869844e-09
## GO:0006139  596 6.255495e-12 2.782741e-09
## GO:0008152 1083 6.301552e-12 2.782741e-09
## GO:0006725  614 7.700635e-12 3.274624e-09
## GO:0009987 1421 7.990243e-12 3.335999e-09
## GO:1901575  245 1.832012e-11 7.130254e-09
## GO:1901564  623 2.049681e-11 7.757276e-09
## GO:0019693   80 2.060680e-11 7.757276e-09
## GO:0019646   29 3.185009e-11 1.179635e-08
## GO:0009150   76 4.145639e-11 1.420840e-08
## GO:0009056  285 4.676394e-11 1.579177e-08
## GO:0009259   78 5.019944e-11 1.670623e-08
## GO:0046907  193 5.259017e-11 1.725183e-08
## GO:0022904   33 1.029992e-10 3.331226e-08
## GO:0044260  344 1.127885e-10 3.597170e-08
## GO:0033108   29 1.728907e-10 5.293453e-08
## GO:1901576  563 1.995961e-10 5.952370e-08
## GO:0009117   91 2.197180e-10 6.386563e-08
## GO:0009058  569 2.809006e-10 8.062899e-08
## GO:0044085  342 3.424318e-10 9.707731e-08
## GO:0006163   77 3.488002e-10 9.767681e-08
## GO:0071840  620 3.954915e-10 1.094177e-07
## GO:0006753   91 4.440621e-10 1.213928e-07
## GO:0043933  213 5.339682e-10 1.442531e-07
## GO:0072521   79 1.240783e-09 3.094531e-07
## GO:0044271  473 1.909195e-09 4.566755e-07
## GO:0009057  167 2.299665e-09 5.444041e-07
## GO:0009201   31 2.500253e-09 5.858502e-07
## GO:0022607  314 2.884279e-09 6.660888e-07
```

```
## GO:0009206   30 2.900705e-09 6.660888e-07
## GO:0032543   32 3.215364e-09 7.225843e-07
```

```
goanaOut_BP <- goanaOut[goanaOut$Ont == "BP",]
print(paste("Amount of significant GO Biological Process terms:",
as.character(sum(goanaOut_BP$FDR.DE < 0.05))))
```

```
## [1] "Amount of significant GO Biological Process terms: 242"
```

```
topGORNA[order(topGORNA$N),]
```

```
##                                                          Term Ont     N
## GO:0019646                        aerobic electron transport chain  BP    93
## GO:0033108       mitochondrial respiratory chain complex assembly  BP    99
## GO:0042773              ATP synthesis coupled electron transport  BP   101
## GO:0042775 mitochondrial ATP synthesis coupled electron transport  BP   101
## GO:0009206 purine ribonucleoside triphosphate biosynthetic process  BP   117
## GO:0022904                   respiratory electron transport chain  BP   122
## GO:0009201       ribonucleoside triphosphate biosynthetic process  BP   123
## GO:0032543                            mitochondrial translation  BP   131
## GO:0006119                            oxidative phosphorylation  BP   147
## GO:0009060                                 aerobic respiration  BP   194
## GO:0046034                              ATP metabolic process  BP   217
## GO:0045333                               cellular respiration  BP   240
## GO:0009205   purine ribonucleoside triphosphate metabolic process  BP   242
## GO:0009144       purine nucleoside triphosphate metabolic process  BP   247
## GO:0009199          ribonucleoside triphosphate metabolic process  BP   249
## GO:0009141             nucleoside triphosphate metabolic process  BP   267
## GO:0015980    energy derivation by oxidation of organic compounds  BP   333
## GO:0009150             purine ribonucleotide metabolic process  BP   447
## GO:0009259                    ribonucleotide metabolic process  BP   466
## GO:0019693                  ribose phosphate metabolic process  BP   475
## GO:0006163                 purine nucleotide metabolic process  BP   476
## GO:0006091        generation of precursor metabolites and energy  BP   505
## GO:0072521          purine-containing compound metabolic process  BP   507
## GO:0007005                          mitochondrion organization  BP   542
## GO:0009117                       nucleotide metabolic process  BP   597
## GO:0006753             nucleoside phosphate metabolic process  BP   605
## GO:0009057                    macromolecule catabolic process  BP  1385
## GO:0046907                          intracellular transport  BP  1587
## GO:0043933           protein-containing complex organization  BP  1845
## GO:1901575               organic substance catabolic process  BP  2120
## GO:0009056                                  catabolic process  BP  2579
## GO:0022607                       cellular component assembly  BP  3011
## GO:0044260           cellular macromolecule metabolic process  BP  3266
## GO:0044085                     cellular component biogenesis  BP  3273
## GO:0006996                           organelle organization  BP  3556
## GO:0044271    cellular nitrogen compound biosynthetic process  BP  4865
## GO:1901576             organic substance biosynthetic process  BP  5877
## GO:0009058                               biosynthetic process  BP  5962
## GO:0006139   nucleobase-containing compound metabolic process  BP  6165
## GO:0046483                     heterocycle metabolic process  BP  6336
## GO:0006725       cellular aromatic compound metabolic process  BP  6392
```

```
## GO:1901564               organonitrogen compound metabolic process  BP  6535
## GO:0071840           cellular component organization or biogenesis  BP  6601
## GO:1901360               organic cyclic compound metabolic process  BP  6632
## GO:0034641            cellular nitrogen compound metabolic process  BP  7053
## GO:0044237                              cellular metabolic process  BP 10271
## GO:0006807                    nitrogen compound metabolic process  BP 10310
## GO:0044238                               primary metabolic process  BP 10825
## GO:0008152                                       metabolic process  BP 12433
## GO:0009987                                        cellular process  BP 17266
##              DE         P.DE       FDR.DE
## GO:0019646   29 3.185009e-11 1.179635e-08
## GO:0033108   29 1.728907e-10 5.293453e-08
## GO:0042773   32 1.894553e-12 9.855029e-10
## GO:0042775   32 1.894553e-12 9.855029e-10
## GO:0009206   30 2.900705e-09 6.660888e-07
## GO:0022904   33 1.029992e-10 3.331226e-08
## GO:0009201   31 2.500253e-09 5.858502e-07
## GO:0032543   32 3.215364e-09 7.225843e-07
## GO:0006119   39 4.071429e-12 1.869844e-09
## GO:0009060   51 3.098510e-15 2.371703e-12
## GO:0046034   50 1.423809e-12 7.974370e-10
## GO:0045333   56 3.671179e-14 2.634415e-11
## GO:0009205   55 1.985360e-13 1.266384e-10
## GO:0009144   55 4.836249e-13 2.847559e-10
## GO:0009199   56 1.912262e-13 1.254608e-10
## GO:0009141   57 1.175566e-12 6.748629e-10
## GO:0015980   65 2.317697e-12 1.132367e-09
## GO:0009150   76 4.145639e-11 1.420840e-08
## GO:0009259   78 5.019944e-11 1.670623e-08
## GO:0019693   80 2.060680e-11 7.757276e-09
## GO:0006163   77 3.488002e-10 9.767681e-08
## GO:0006091   89 1.060211e-13 7.160480e-11
## GO:0072521   79 1.240783e-09 3.094531e-07
## GO:0007005   92 3.908133e-13 2.361643e-10
## GO:0009117   91 2.197180e-10 6.386563e-08
## GO:0006753   91 4.440621e-10 1.213928e-07
## GO:0009057  167 2.299665e-09 5.444041e-07
## GO:0046907  193 5.259017e-11 1.725183e-08
## GO:0043933  213 5.339682e-10 1.442531e-07
## GO:1901575  245 1.832012e-11 7.130254e-09
## GO:0009056  285 4.676394e-11 1.579177e-08
## GO:0022607  314 2.884279e-09 6.660888e-07
## GO:0044260  344 1.127885e-10 3.597170e-08
## GO:0044085  342 3.424318e-10 9.707731e-08
## GO:0006996  397 2.397043e-16 2.117050e-13
## GO:0044271  473 1.909195e-09 4.566755e-07
## GO:1901576  563 1.995961e-10 5.952370e-08
## GO:0009058  569 2.809006e-10 8.062899e-08
## GO:0006139  596 6.255495e-12 2.782741e-09
## GO:0046483  613 1.974182e-12 9.855029e-10
## GO:0006725  614 7.700635e-12 3.274624e-09
## GO:1901564  623 2.049681e-11 7.757276e-09
## GO:0071840  620 3.954915e-10 1.094177e-07
## GO:1901360  636 3.032329e-12 1.421048e-09
```

```
## GO:0034641  681 4.234797e-14 2.946777e-11
## GO:0044237  965 4.271072e-20 6.538442e-17
## GO:0006807  947 6.055583e-16 5.039696e-13
## GO:0044238  986 6.145168e-16 5.039696e-13
## GO:0008152 1083 6.301552e-12 2.782741e-09
## GO:0009987 1421 7.990243e-12 3.335999e-09
```

```
edgeR_res <- LRT$table[order(LRT$table$FDR, decreasing=F),]
write.table(edgeR_res, sep= "\t", file="C:/Users/Luca Visser/Documents/1st master/AHTA/Practica/Project/
RNAseq_GSA_res <- topGO(goanaOut, ontology="BP", number=100)
write.table(RNAseq_GSA_res, sep= "\t", file="C:/Users/Luca Visser/Documents/1st master/AHTA/Practica/Pr
```