xCELLanalyzer - Data Analysis

Processing and analysis of the impedance data generated for *xCellAnalyze: A Framework for the Analysis of Cellular Impedance Measurements for Mode of Action Discovery*

N.B.: Datasets 1 to 10 were generated on xCelligence machine A and datasets 11 to 16 were generated on xCelligence machine B

Load libraries

```
library("tidyverse")
library("stringr")
library("knitr")
library("gtools")
library("gplots")
library("dendsort")
library(pheatmap)
library(RColorBrewer)
```

Source the xCellAnalyze functions:

- **read_xcell function:** reads the tab-delimeted data exported from the RTCA Software Version 1.2. If the naming conventions are followed, only the global my_filepath varible and the experiment ID are used as arguments to the function. The cryptic column names generated by the export from the RTCA Software are fixed to only contain the well identifier (of the E-plate). To match the well labels with the compound IDs an _anno.txt is read containing the annotation of the wells for the appropriate experiment. The column names are then replaced with the corresponding compound IDs.
- **edit_df:**
- **normalize_xcell:**
- **do_median_polish:**
- **calculate_median_curves:**
- **normalize_dmso:**
- **smooth_splines:**

```
source("2xCell_functions.R")
```

Process the 12 xCelligence runs with the xcell_process_data.R script.

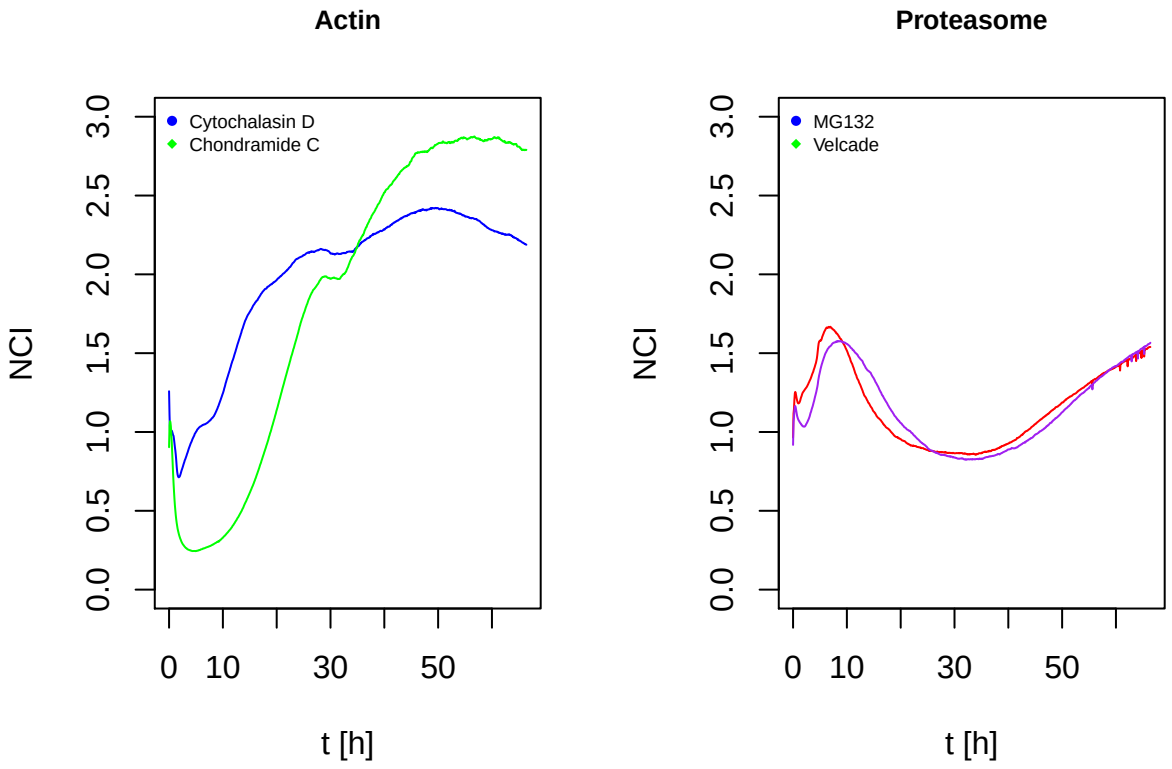
–> write down what the script does, comment on median polish and removal of outliers

Plot figure 2

```
par(mfrow = c(1,2))

plot(x=rownames(xcell_median_7), y=xcell_median_7[,"7_CytochalasinD"], type="l", col="blue", main = "Ac
       cex.main=0.8, ylim=c(0,3), ylab="NCI", xlab="t [h]")
lines(x=rownames(xcell_median_7), y=xcell_median_7[,"7_ChondramidC"], type="l", col="green")
legend("topleft",legend=c("Cytochalasin D", "Chondramide C"),
         col= c("blue", "green"),pch=c(16,18),bty="n",ncol=1,cex=0.6,pt.cex=0.7)
```

```
plot(x=rownames(xcell_median_7), y=xcell_median_7[,"7_MG132"], type="l", col="red", main = "Proteasome"
     cex.main=0.8, ylim=c(0,3), ylab="NCI", xlab="t [h]")
lines(x=rownames(xcell_median_7), y=xcell_median_7[,"7_Velcade"], type="l", col="purple")
legend("topleft",legend=c("MG132", "Velcade"),
       col= c("blue", "green"),pch=c(16,18),bty="n",ncol=1,cex=0.6,pt.cex=0.7)
```



Combine all matrices containing the normalized median TCRP data from each run in one big matrix and reorder the column names alphabetically

```
median.combined <- cbind(xcell_median_norm_1, xcell_median_norm_2, xcell_median_norm_3,
                         xcell_median_norm_4, xcell_median_norm_5, xcell_median_norm_6,
                         xcell_median_norm_7, xcell_median_norm_8, xcell_median_norm_9,
                         xcell_median_norm_10, xcell_median_norm_11, xcell_median_norm_12,
                         xcell_median_norm_13, xcell_median_norm_14, xcell_median_norm_15,
                         xcell_median_norm_16)


for (i in 1 : length(median.combined[1,])){
  temp <- unlist(strsplit(toString(colnames(median.combined)[i]), "_"))
  colnames(median.combined)[i] <- paste(temp[2], temp[1], sep="_")
}


median.combined.ordered <- median.combined[,mixedorder(colnames(median.combined))]
```

Generate an analogous matrix without the DMSO normalization

```
median.combined_notnorm <- cbind(
                          xcell_median_notnorm_1, xcell_median_notnorm_2, xcell_median_notnorm_3,
                          xcell_median_notnorm_4, xcell_median_notnorm_5, xcell_median_notnorm_6,
                          xcell_median_notnorm_7, xcell_median_notnorm_8, xcell_median_notnorm_9,
                          xcell_median_notnorm_10, xcell_median_notnorm_11, xcell_median_notnorm_12,
                          xcell_median_notnorm_13, xcell_median_notnorm_14, xcell_median_notnorm_15,
                          xcell_median_notnorm_16)

for (i in 1 : length(median.combined_notnorm[1,])){
  temp <- unlist(strsplit(toString(colnames(median.combined_notnorm)[i]), "_"))
  colnames(median.combined_notnorm)[i] <- paste(temp[2], temp[1], sep="_")
}

median.combined_notnorm.ordered <- median.combined_notnorm[,mixedorder(colnames(median.combined_notnorm
```

Calculate smoothing splines

```
newrownames <- read.delim("newrownames.txt", header=F, stringsAsFactors = FALSE)

#smoothing splines with new rownames
median.sp<-matrix(ncol=22, nrow=219)
row.names(median.sp)<-newrownames$V1
t<-rownames(median.combined.ordered)
t<-as.numeric(t)

i<-0
repeat{
  i<-i+1
  temp<-smooth.spline(x=t, y= median.combined.ordered[,i], nknots=20)
  median.sp[i,]<-temp$fit$coef
  if (i==219) break
}

#analogous for the data without local normalization
median.sp.notnorm<-matrix(ncol=22, nrow=219)
row.names(median.sp.notnorm)<-newrownames$V1
t<-rownames(median.combined_notnorm.ordered)
t<-as.numeric(t)

i<-0
repeat{
  i<-i+1
  temp<-smooth.spline(x=t, y= median.combined_notnorm.ordered[,i], nknots=20)
  median.sp.notnorm[i,]<-temp$fit$coef
  if (i==219) break
}
```

Calculate score for biological replicates

The goal is to evalutate reproducibility for each compound and to judge which compounds are well reproducible and which not so much. For this purpose a rank-based score is calculated for each compound, the closer to one the better. In addition an overall score is calculated, which is a single number to judge how the

experiments and the data analysis overall performed. Again it is a rank-based score, the closer to one the better.

Here we also want to optimize certain parameters for the data analysis, namely the distance meassure and data scaling / centering.

Distance measures (source: https://stat.ethz.ch/R-manual/R-devel/library/stats/html/dist.html) compared are (written for two vectors x and y):

euclidean: Usual distance between the two vectors (2 norm aka L_2), sqrt(sum((x_i - y_i)^2)).

maximum: Maximum distance between two components of x and y (supremum norm)

manhattan: Absolute distance between the two vectors (1 norm aka L_1).

Scaling and Centering of the matrices using the scale function of R base: R documentation: "The value of center determines how column centering is performed. If center is a numeric vector with length equal to the number of columns of x, then each column of x has the corresponding value from center subtracted from it. If center is TRUE then centering is done by subtracting the column means of x from their corresponding columns, and if center is FALSE, no centering is done.

The value of scale determines how column scaling is performed (after centering). If scale is a numeric vector with length equal to the number of columns of x, then each column of x is divided by the corresponding value from scale. If scale is TRUE then scaling is done by dividing the (centered) columns of x by their root-mean-square, and if scale is FALSE, no scaling is done.

The root-mean-square for a column is obtained by computing the square-root of the sum-of-squares of the non-missing values in the column divided by the number of non-missing values minus one."

```
#criterion how the overall procedure scored
res <- score1.function(median.sp, "euclidean")
euclidean <- sum(res$normscore)/i

median.sp.scaled <- scale(median.sp, center = FALSE, scale = TRUE)
res <- score1.function(median.sp.scaled, "euclidean")
euclidean.scaled <- sum(res$normscore)/i

median.sp.centered.scaled <- scale(median.sp, center = TRUE, scale = TRUE)
res <- score1.function(median.sp.centered.scaled, "euclidean")
euclidean.centered.scaled <- sum(res$normscore)/i
###

res <- score1.function(median.sp, "maximum")
maximum <- sum(res$normscore)/i

res <- score1.function(median.sp.scaled, "maximum")
maximum.scaled <- sum(res$normscore)/i

res <- score1.function(median.sp.centered.scaled, "maximum")
maximum.centered.scaled <- sum(res$normscore)/i
###

res <- score1.function(median.sp, "manhattan")
manhattan <- sum(res$normscore)/i

res <- score1.function(median.sp.scaled, "manhattan")
manhattan.scaled <- sum(res$normscore)/i
```

```
res <- score1.function(median.sp.centered.scaled, "manhattan")
manhattan.centered.scaled <- sum(res$normscore)/i
###

not_scaled <- c(euclidean, maximum, manhattan)
scaled <- c(euclidean.scaled, maximum.scaled, manhattan.scaled)
cent_scaled <- c(euclidean.centered.scaled, maximum.centered.scaled, manhattan.centered.scaled)

tab1 <- rbind(not_scaled, scaled, cent_scaled)
colnames(tab1) <- c("euclidean", "maximum", "manhattan")
tab1 <- as.data.frame(tab1)

#grid.table(round(tab1, 3))
kable(round(tab1, 3), caption = "scores for 5 distance measures +/- scaling and centering")
```

Table 1: scores for 5 distance measures +/- scaling and centering

	euclidean	maximum	manhattan
not_scaled	0.378	0.404	0.342
scaled	0.479	0.473	0.412
cent_scaled	0.479	0.473	0.410
Result: Euclid	ean distance	with scal	ed (not centred) data performed best.
Mögliche Ergän	zung/Erweite	rung: corr	elation nehmen: Pearson, Spearman, Kendall

alternative: use correlation

mydata <- t(median.sp.scaled.centered) samples.cor.spearman <- cor(mydata,use="pairwise.complete.obs", method="spearman") samples.cor.spearman.dist <- as.dist(1-samples.cor.spearman) my.distmat <- as.matrix(samples.cor.spearman.dist) samples.tree <- hclust(samples.cor.spearman.dist,method='average')

1-cor is not optimal for hierarchical clustering: http://research.stowers.org/mcm/efg/R/Visualization/cor-cluster/index.htm hclust with a dissimilarity measure 1-Abs(Correlation) works fine.

Now we want to investigate if the local normalization with the TCRP from DMSO treated cells for each run lead to an improvement of reproducibility.

```
median.sp.notnorm.scaled <- scale(median.sp.notnorm, center = FALSE, scale = TRUE)
res <- score1.function(median.sp.notnorm.scaled, "euclidean")
euclidean.scaled.notnorm <- sum(res$normscore)/i

median.sp.scaled <- scale(median.sp, center = FALSE, scale = TRUE)
res <- score1.function(median.sp.scaled, "euclidean")
euclidean.scaled <- sum(res$normscore)/i
cat(paste0("without local normalization: ", round(euclidean.scaled.notnorm, 3), "\nwith local normaliza
```

```
## without local normalization: 0.274
## with local normalization: 0.479
```

Clearly the local normalization has lead to a strong improvement: 0.476 >> 0.266.

Evaluate reproducibility of biological replicates group-wise, calculate a score for each group of replicates

```
res <- score1.function(median.sp, "euclidean")
groupmatch <- read.delim("groupmatch.txt", header=F)$V1
```

```
group.score <- c()

for(i in 1:length(groupmatch)){

  ma <- grep(groupmatch[i], res$rep)
  gscore <- sum(res$normscore[ma])/length(ma)
  group.score <- c(group.score, gscore)

}
group.result <- data.frame(groupmatch,group.score)
group.result <- group.result[order(-group.result$group.score),]
kable(group.result)
```

	groupmatch	group.score
14	Chelerythrine	1.0000000
27	H89	1.0000000
47	SaframycinMx1	1.0000000
53	Staurosporine	1.0000000
60	Wortmannin	1.0000000
18	Cycloheximide	0.9250000
13	Cerulenin	0.9166667
7	Apicidin	0.8333333
56	TubulysinB	0.7857143
2	ActinomycinD	0.7555556
5	Anisomycin	0.6807359
31	Mevastatin	0.6750000
44	Rapamycin	0.6427947
46	Rhizopodin	0.5454259
20	Cytochalasin	0.5416667
22	Emetine	0.5000000
40	PD169316	0.4908789
19	CyclosporinA	0.4810458
15	ChondramidC	0.4530303
32	MG132	0.4431241
43	PurvalanolA	0.4395161
4	Amanitin	0.4377358
41	Podophyllotoxin	0.4328454
57	Velcade	0.4243003
58	Vinblastin	0.4202786
42	Puromycin	0.4164809
28	Indirubin3monoxime	0.3968689
16	Colchicine	0.3932894
3	Alsterpaullone	0.3887535
1	A23187	0.3631470
8	Apicularen	0.3248723
33	Myriaporone	0.2915516
34	MyxothiazolA	0.2776854
49	SB203580	0.2615083
50	Scriptaid	0.2605042
55	Trichostatin	0.2388983
36	Nocodazol	0.2386498
59	Vioprolide	0.2304310
24	Etoposide	0.1995340

	groupmatch	group.score
26	Griseofulvin	0.1931039
12	CCCP	0.1835840
48	SB202190	0.1775103
52	Soraphen	0.1771044
10	ArgyrinA	0.1745614
6	Aphidicolin	0.1530034
51	Simvastatin	0.1428155
23	EpothiloneB	0.1351025
25	GephyronicAcidA	0.1312164
37	OkadaicAcid	0.1064823
30	Methotrexate	0.1038177
11	Camptothecin	0.1002997
45	RatjadonC	0.0859606
54	Taxol	0.0708859
29	LY294002	0.0632620
21	Doxorubicin	0.0558336
17	CruentarenA	0.0545505
38	Oligomycin	0.0538105
39	Oxamflatin	0.0514741
35	Neopeltolide	0.0459717
9	ArchazolidB	0.0348333

What we can do now is to use the score calculated for each biological replicate and define a threshold to remove replicates which are outliers. And then calculate the groupwise scores and the overall score again to check the improvement.

```
#Filter reference set
#normailzed score < 0.1 is defined as outlier
res <- score1.function(median.sp, "euclidean")

my_hitlist <- res$rep[res$normscore < 0.1]
my_outliers <- c()

for (i in 1: length(my_hitlist)) {
temp <- unlist(strsplit(toString(my_hitlist[i]), "_"))
new_name <- paste0(temp[2], "_", temp[3])
my_outliers <- c(my_outliers, new_name)
}

print(my_outliers)
```

```
##  [1] "Apicularen_1"          "ArchazolidB_3"         "ArchazolidB_6"
##  [4] "ArchazolidB_13"        "ArgyrinA_4"            "Camptothecin_4"
##  [7] "Camptothecin_12"       "Colchicine_16"         "CruentarenA_4"
## [10] "CruentarenA_7"         "CruentarenA_14"        "Doxorubicin_2"
## [13] "Doxorubicin_9"         "Doxorubicin_10"        "Doxorubicin_11"
## [16] "Doxorubicin_12"        "EpothiloneB_13"        "Etoposide_3"
## [19] "Etoposide_15"          "GephyronicAcidA_9"     "GephyronicAcidA_10"
## [22] "GephyronicAcidA_13"    "Indirubin3monoxime_3" "LY294002_2"
## [25] "LY294002_5"            "LY294002_11"           "LY294002_13"
## [28] "Methotrexate_1"        "Myriaporone_16"        "Neopeltolide_2"
## [31] "Neopeltolide_6"        "Neopeltolide_16"       "Nocodazole_15"
```

```
## [34] "OkadaicAcid_2"        "Oligomycin_1"         "Oligomycin_7"
## [37] "Oligomycin_15"        "Oligomycin_16"        "Oxamflatin_4"
## [40] "Oxamflatin_8"         "Oxamflatin_16"        "PD169316_9"
## [43] "RatjadonC_2"          "RatjadonC_9"          "RatjadonC_11"
## [46] "RatjadonC_12"         "Simvastatin_9"        "Taxol_1"
## [49] "Taxol_6"              "Taxol_7"              "Taxol_13"
## [52] "Taxol_14"             "Velcade_9"            "Vioprolide_10"
```

Plot the biological replicates of each compound (generated by the medians of the technical replicates on each E-plate) with and without local normalization.

```
par(mfrow = c(1,2))
i<-0
repeat{
  i<-i+1


  ma<-grep(groupmatch[i], colnames(median.combined_notnorm.ordered))
  z<-median.combined_notnorm.ordered[,ma]
  z<-as.data.frame(z)
  z<-z[,mixedorder(names(z))]


  plot(x=rownames(z), y=z[,1], type="l", col="blue", main = "not normalized",
       cex.main=0.8, ylim=c(0,3), ylab="NCI", xlab="t [h]")



  myC <- length(ma)
  myColor <- c("green", "red", "black", "orange")

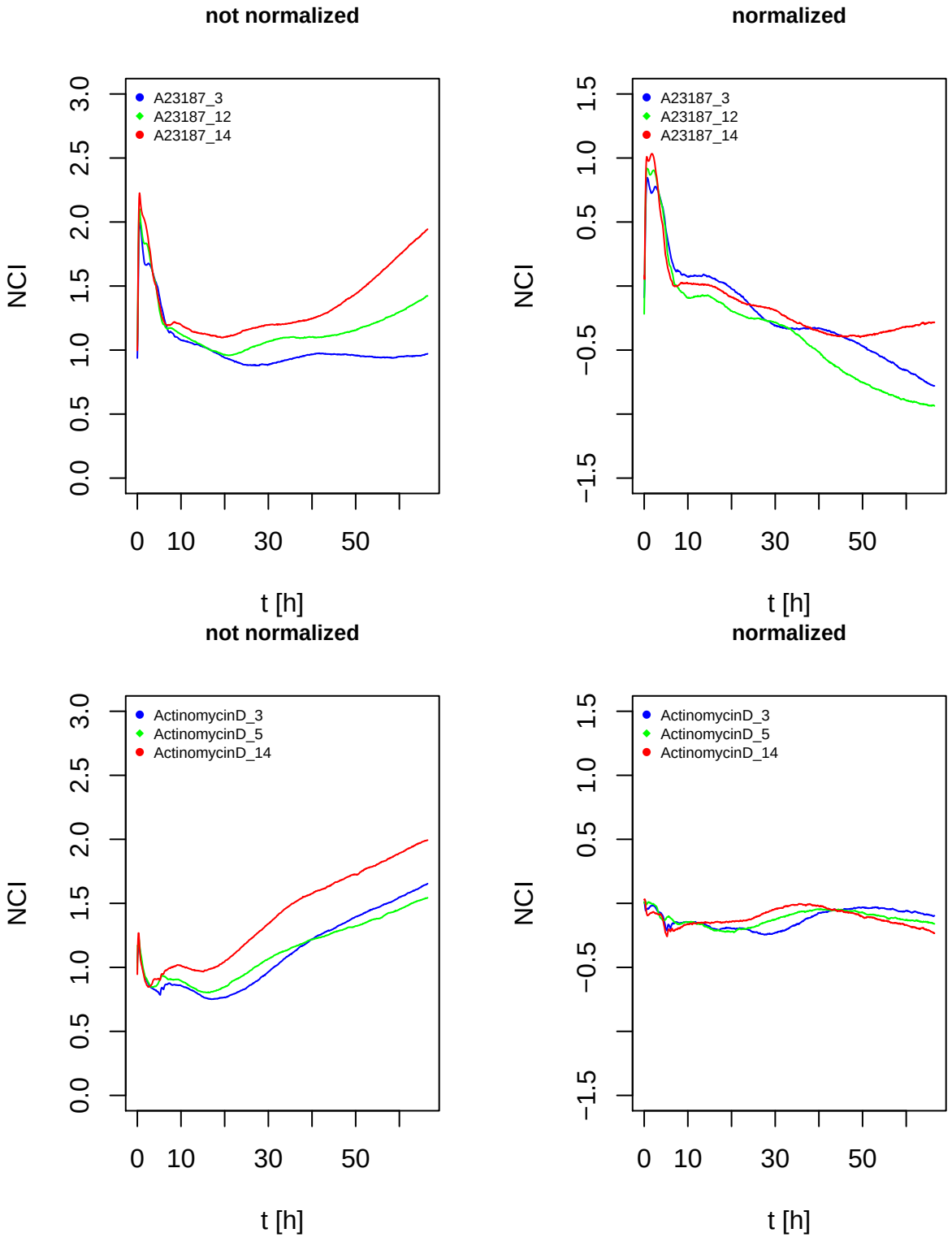
  for (n in 1:(myC-1))
  {
    lines(x=rownames(z), y=z[,n+1], type="l", col=myColor[n])
  }
  legend("topleft",legend=colnames(z),
         col= c("blue", myColor),pch=c(16,18),bty="n",ncol=1,cex=0.6,pt.cex=0.7)

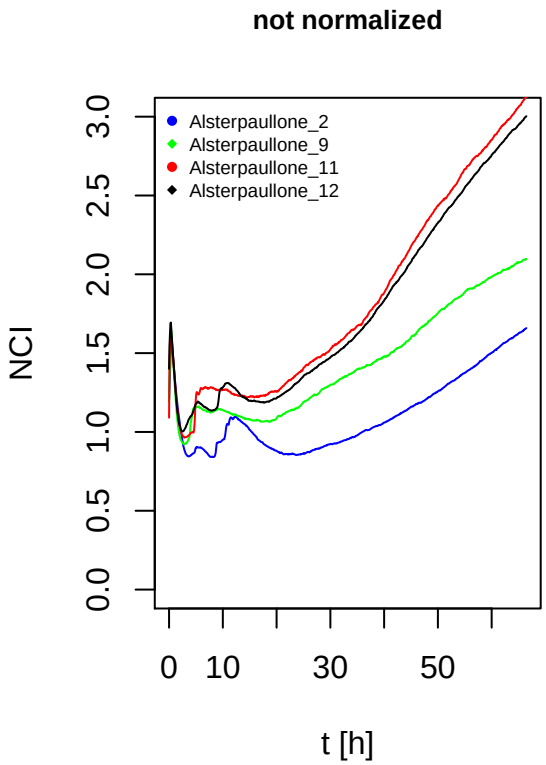
  z<-median.combined.ordered[,ma]
  z<-as.data.frame(z)
  z<-z[,mixedorder(names(z))]

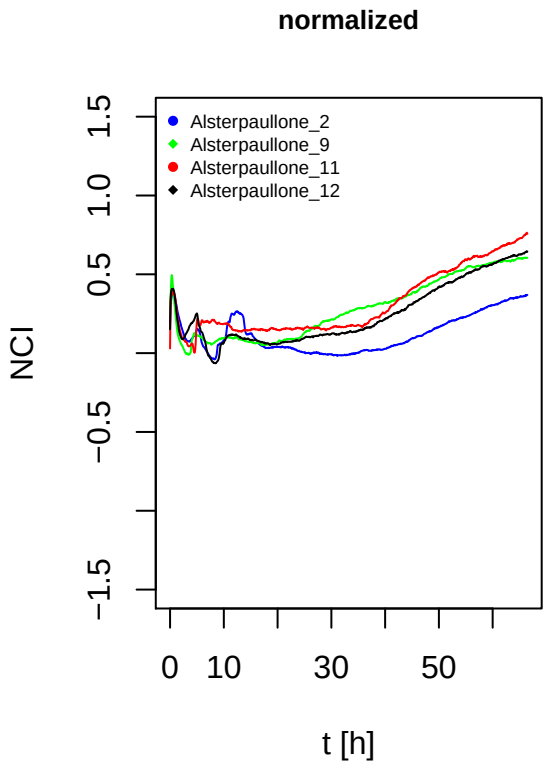

  plot(x=rownames(z), y=z[,1], type="l", col="blue", main = "normalized",
       cex.main=0.8, ylim=c(-1.5,1.5), ylab="NCI", xlab="t [h]")

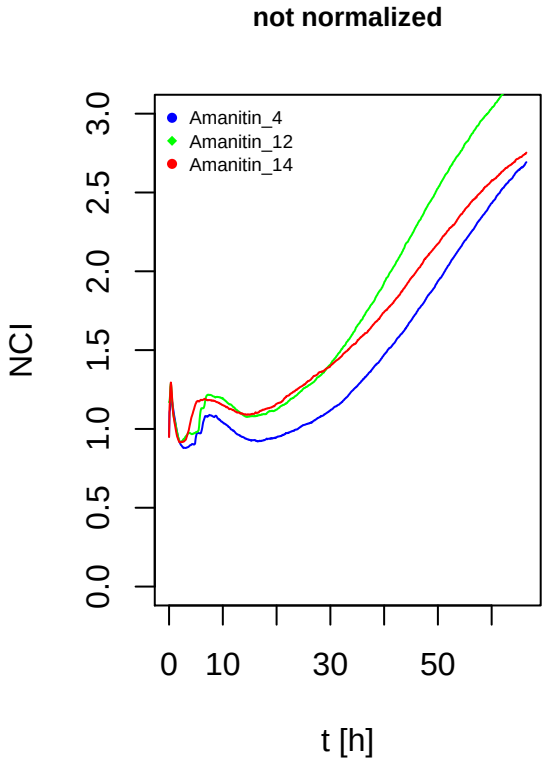

  for (n in 1:(myC-1))
  {
    lines(x=rownames(z), y=z[,n+1], type="l", col=myColor[n])
  }
  legend("topleft",legend=colnames(z),
         col= c("blue", myColor),pch=c(16,18),bty="n",ncol=1,cex=0.6,pt.cex=0.7)
```

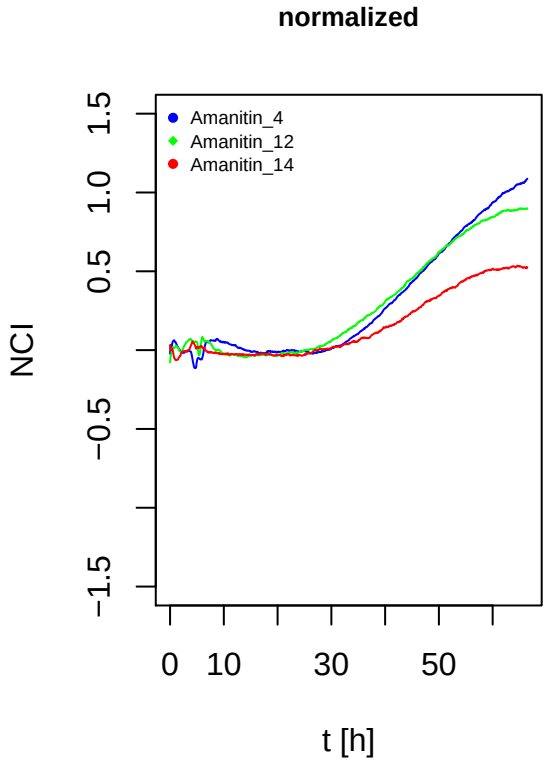
```
  if (i==60) break
}
```

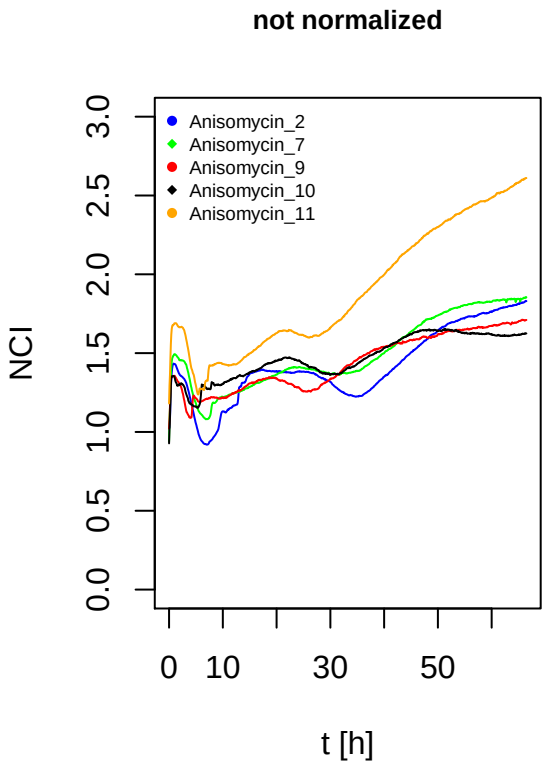

not normalized
normalized
A23187_3
A23187_12
A23187_14
ActinomycinD_3
ActinomycinD_5
ActinomycinD_14
NCI
t [h]
0
10
30
50
0.0
0.5
1.0
1.5
2.0
2.5
3.0
−1.5
−0.5

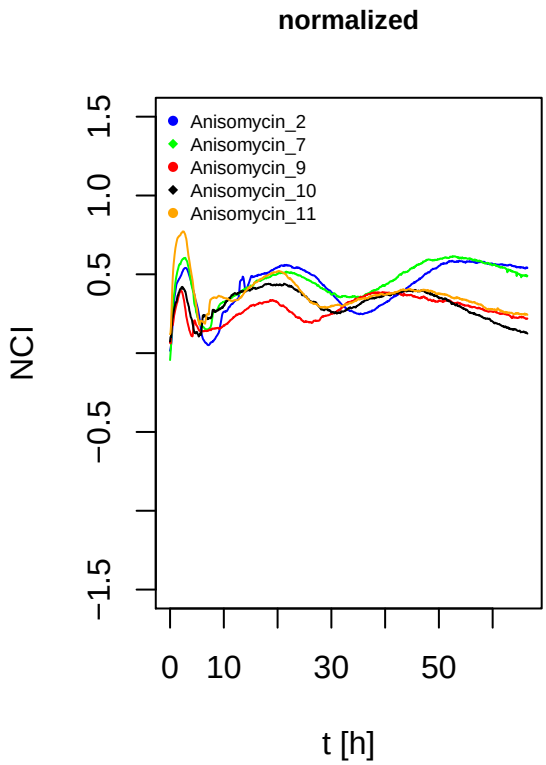

not normalized
Alsterpaullone_2
Alsterpaullone_9
Alsterpaullone_11
Alsterpaullone_12
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

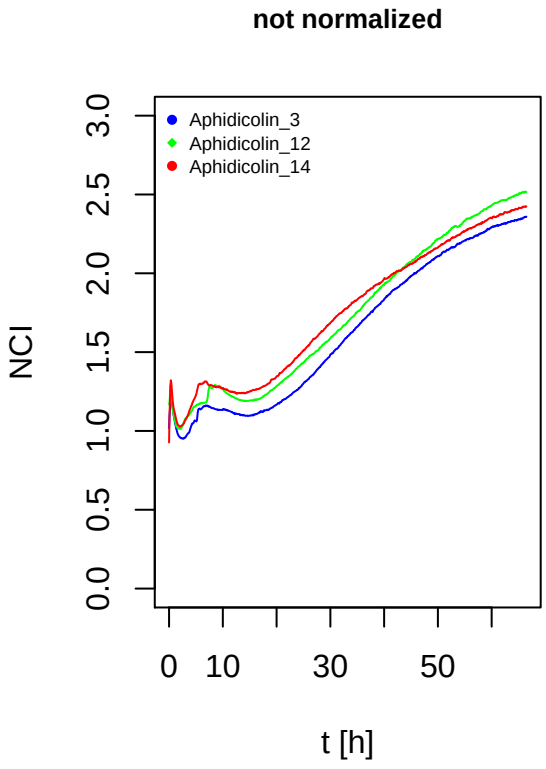

normalized
Alsterpaullone_2
Alsterpaullone_9
Alsterpaullone_11
Alsterpaullone_12
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

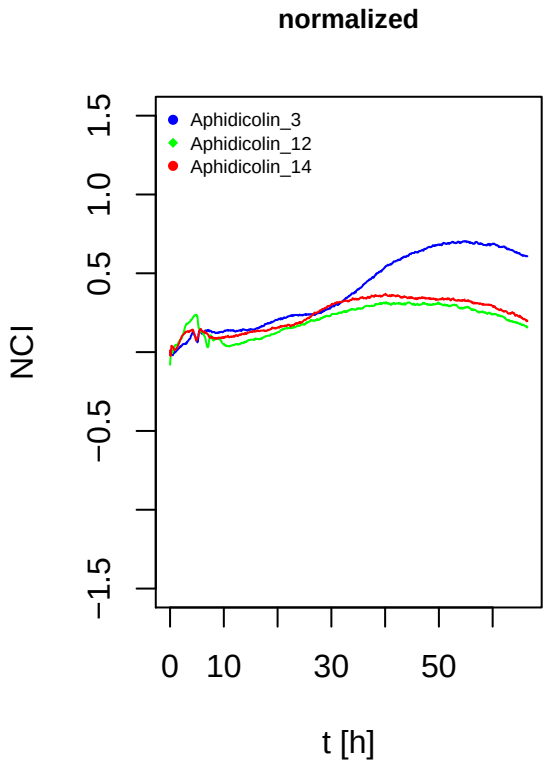

not normalized
Amanitin_4
Amanitin_12
Amanitin_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

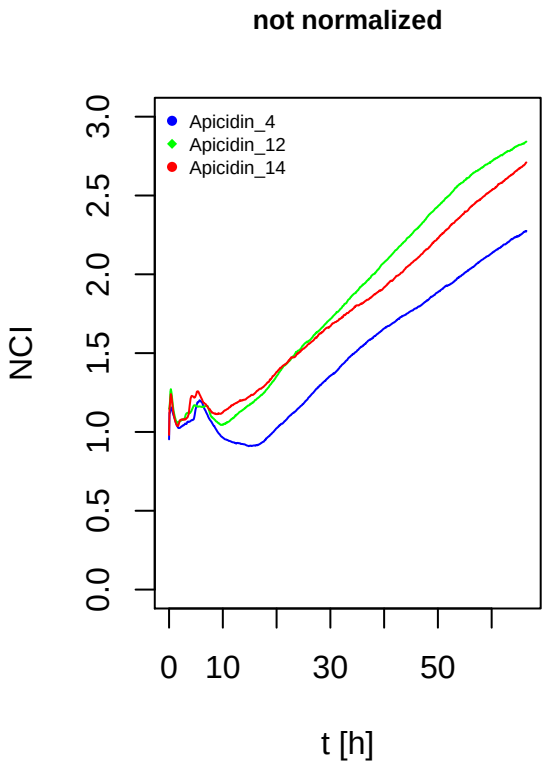

normalized
Amanitin_4
Amanitin_12
Amanitin_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

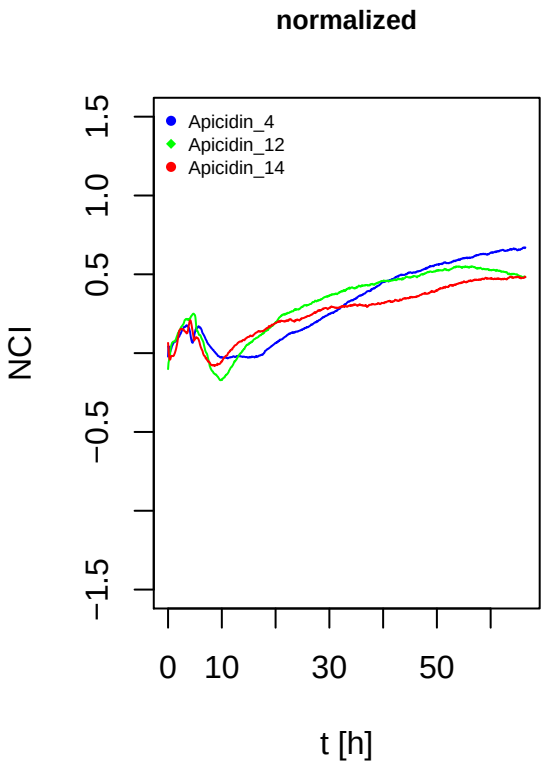

not normalized
Anisomycin_2
Anisomycin_7
Anisomycin_9
Anisomycin_10
Anisomycin_11
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Anisomycin_2
Anisomycin_7
Anisomycin_9
Anisomycin_10
Anisomycin_11
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Aphidicolin_3
Aphidicolin_12
Aphidicolin_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Aphidicolin_3
Aphidicolin_12
Aphidicolin_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Apicidin_4
Apicidin_12
Apicidin_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Apicidin_4
Apicidin_12
Apicidin_14
NCI
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1.5
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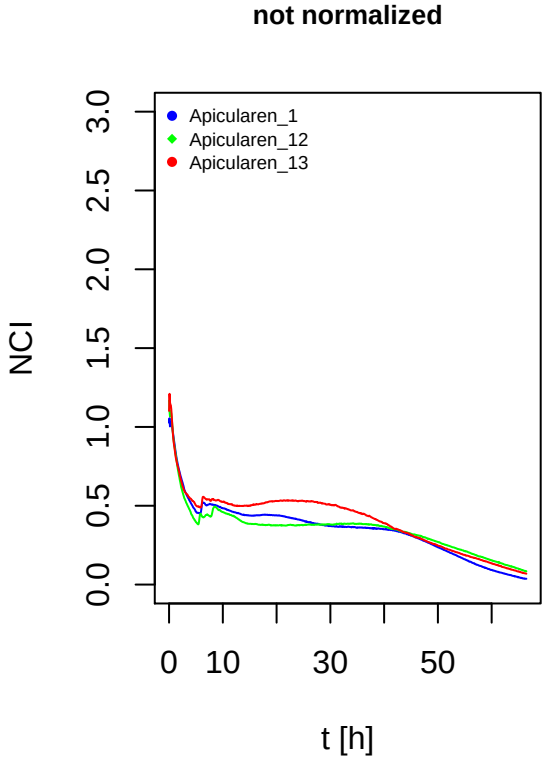
t [h]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Apicularen_1
Apicularen_12
Apicularen_13
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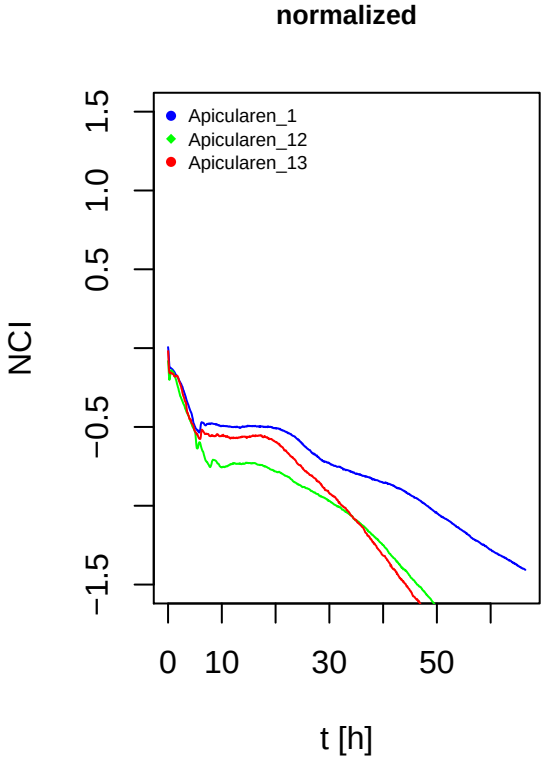
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Apicularen_12
Apicularen_13
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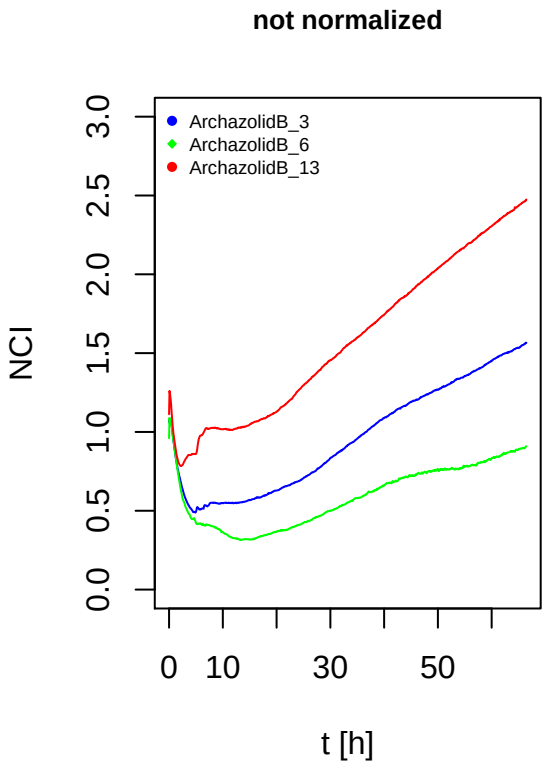
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ArchazolidB_6
ArchazolidB_13
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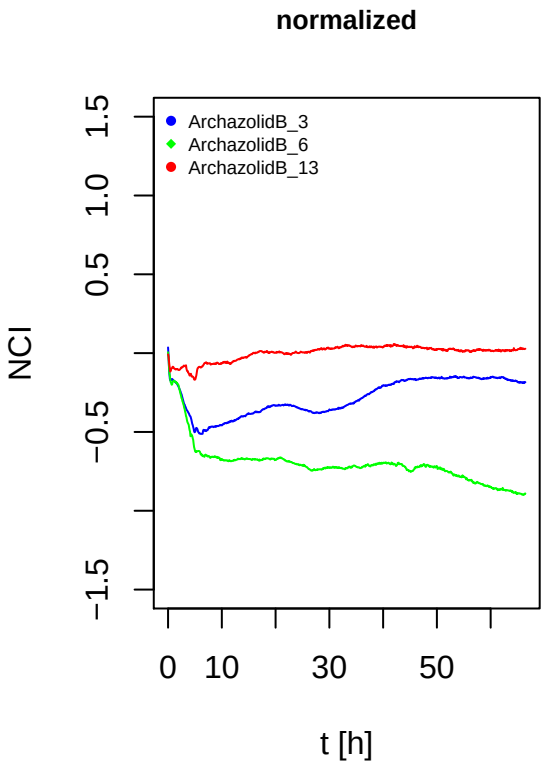
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ArchazolidB_6
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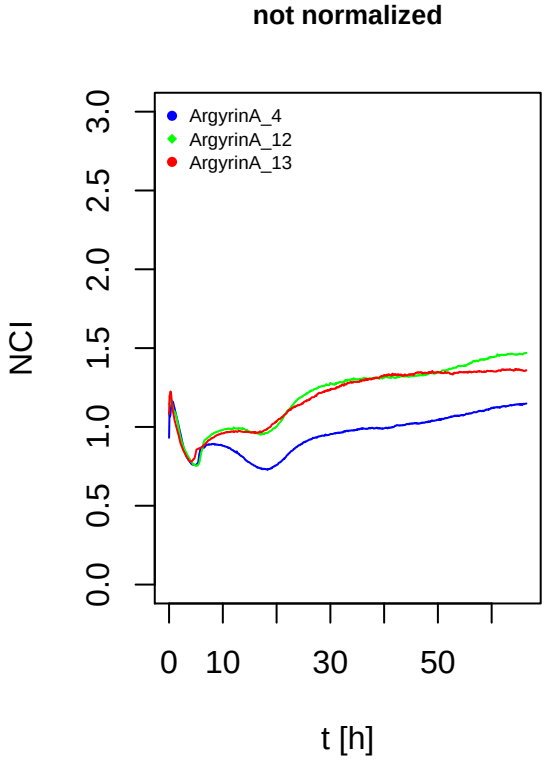
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ArgyrinA_12
ArgyrinA_13
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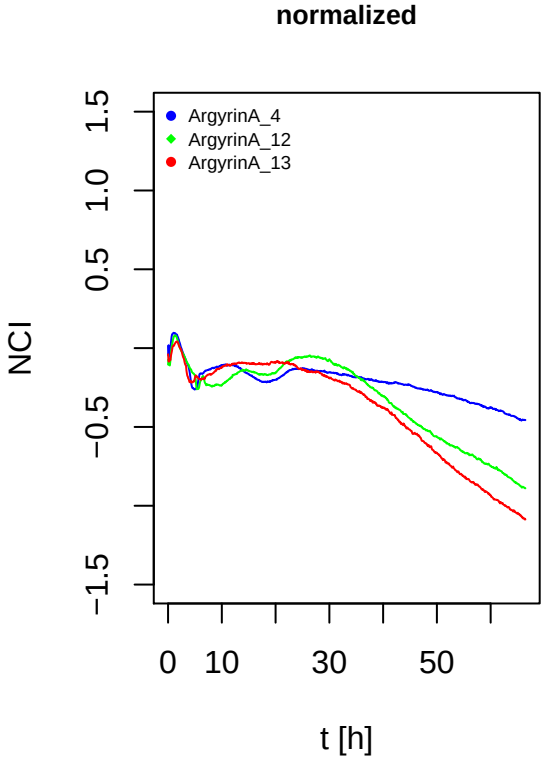
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ArgyrinA_12
ArgyrinA_13
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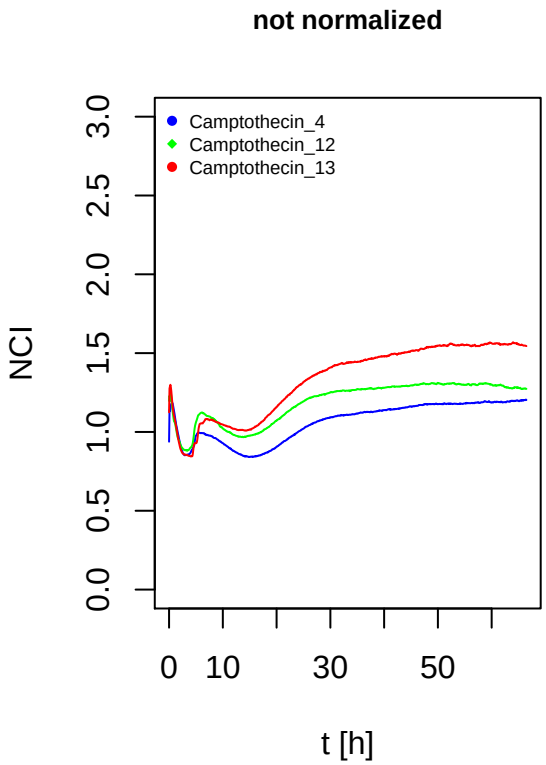
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Camptothecin_12
Camptothecin_13
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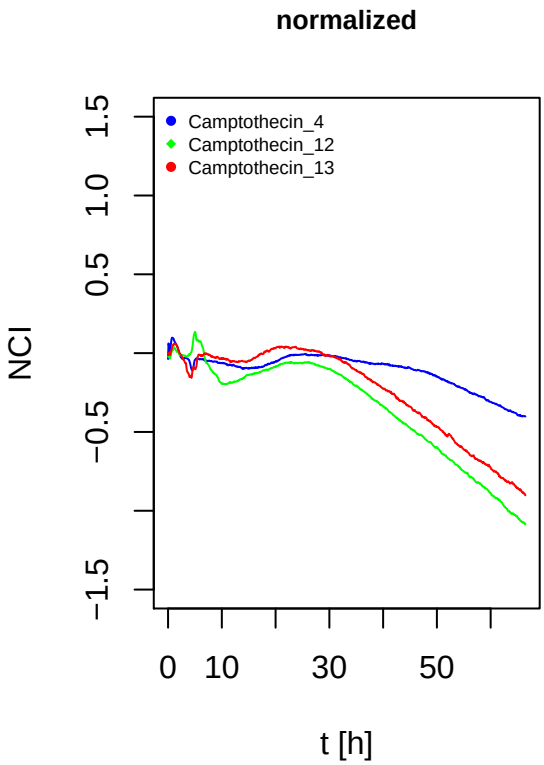
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Camptothecin_4
Camptothecin_12
Camptothecin_13
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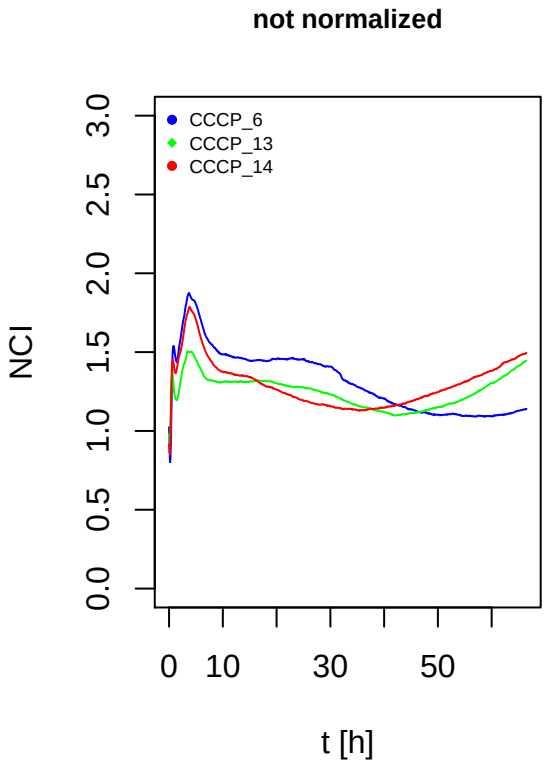
t [h]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CCCP_6
CCCP_13
CCCP_14
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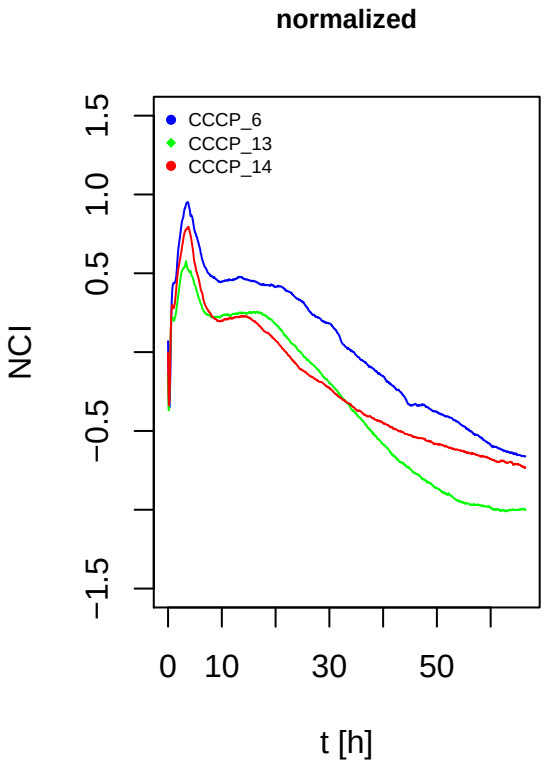
t [h]


normalized
CCCP_6
CCCP_13
CCCP_14
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−1.5
−0.5
0.5
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1.5
0
10
30
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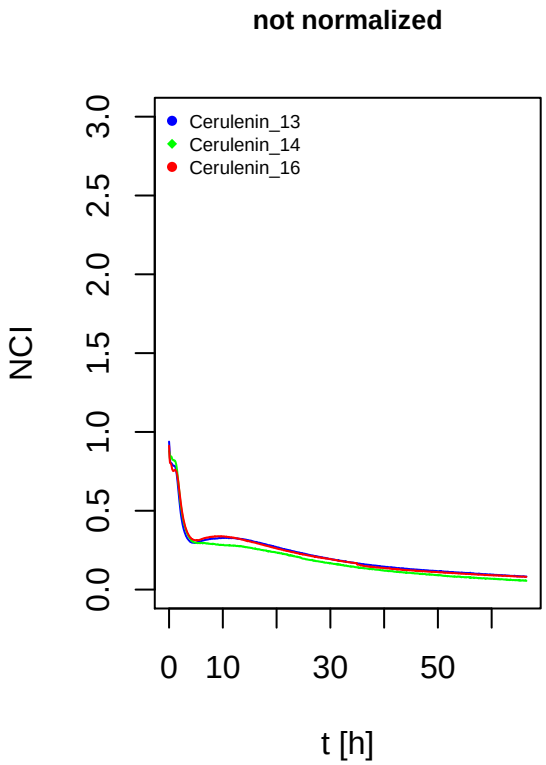
t [h]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Cerulenin_13
Cerulenin_14
Cerulenin_16
NCI
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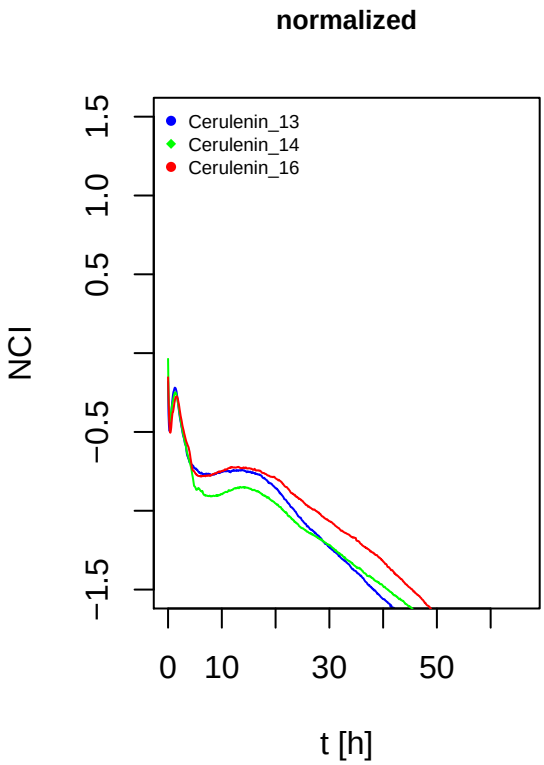
t [h]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Cerulenin_13
Cerulenin_14
Cerulenin_16
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1.5
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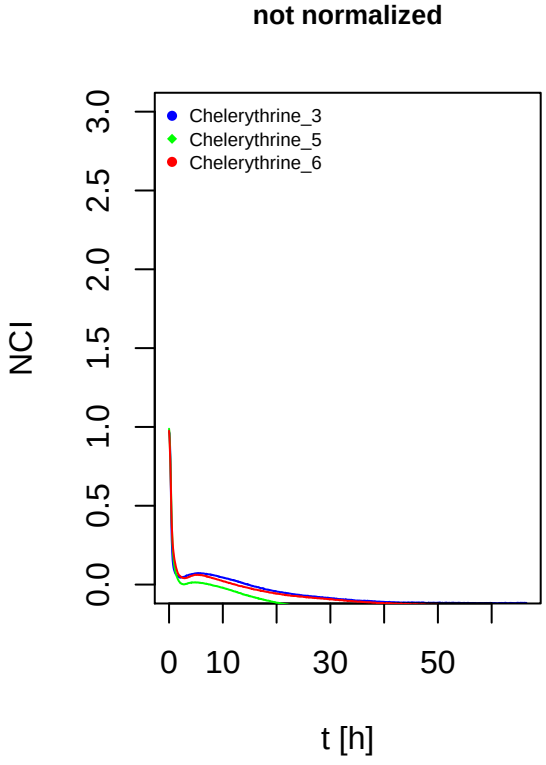
t [h]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Chelerythrine_5
Chelerythrine_6
NCI
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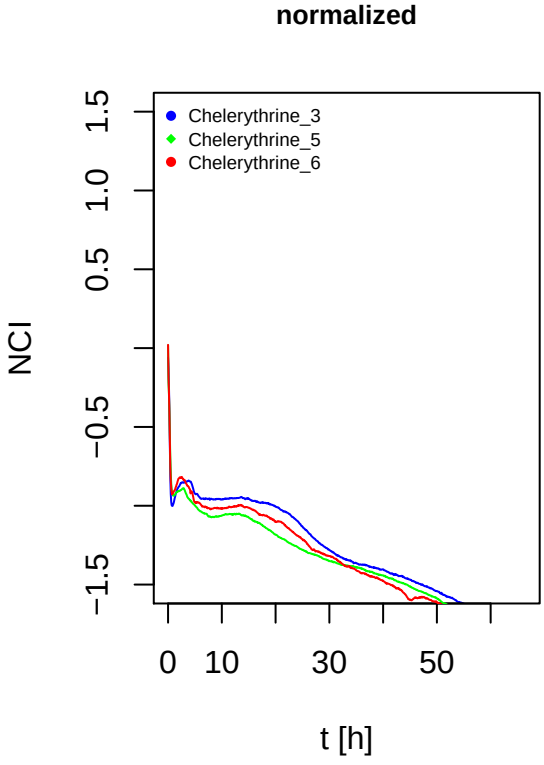
t [h]


normalized
Chelerythrine_3
Chelerythrine_5
Chelerythrine_6
NCI
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1.5
0
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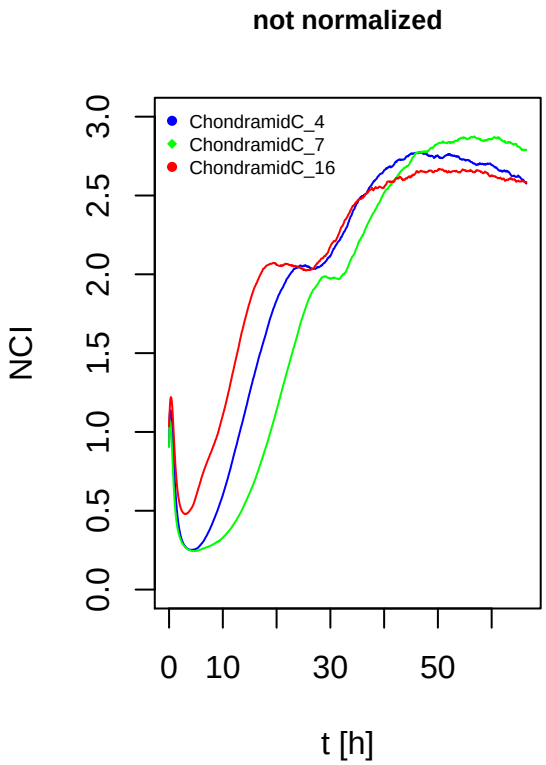
t [h]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ChondramidC_7
ChondramidC_16
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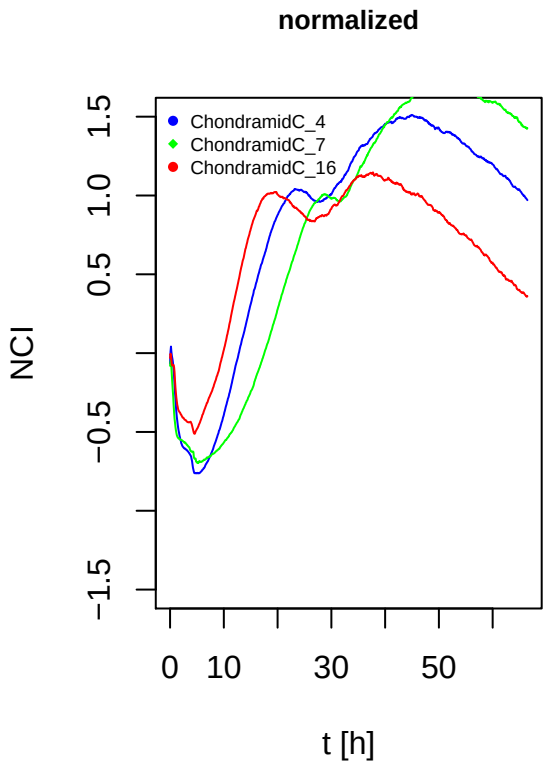
t [h]


normalized
ChondramidC_4
ChondramidC_7
ChondramidC_16
NCI
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0.5
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0
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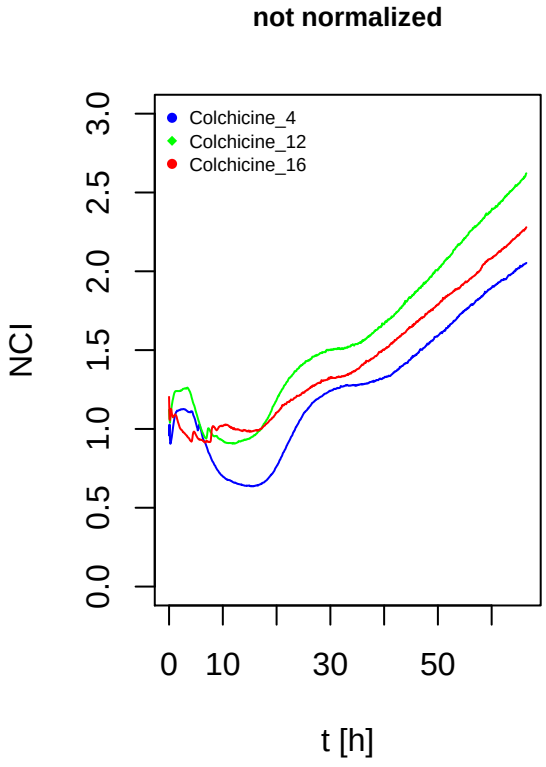
t [h]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Colchicine_4
Colchicine_12
Colchicine_16
NCI
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1.5
2.0
2.5
3.0
0
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30
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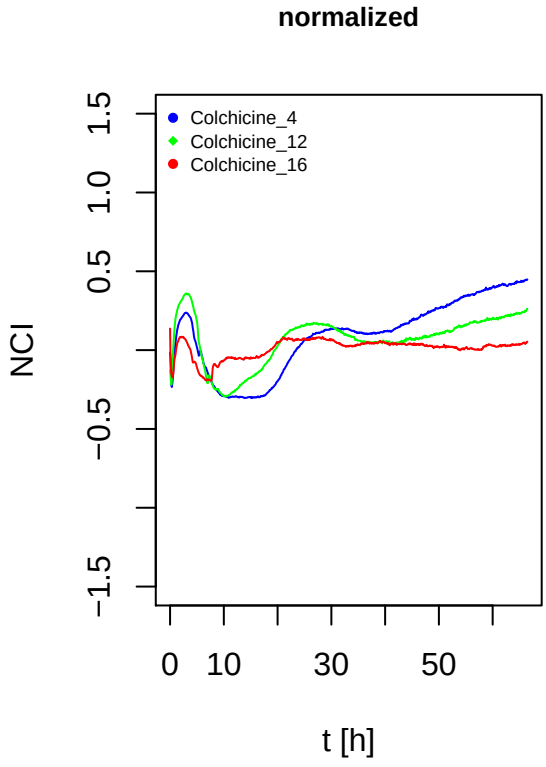
t [h]


normalized
Colchicine_4
Colchicine_12
Colchicine_16
NCI
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0.5
1.0
1.5
0
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30
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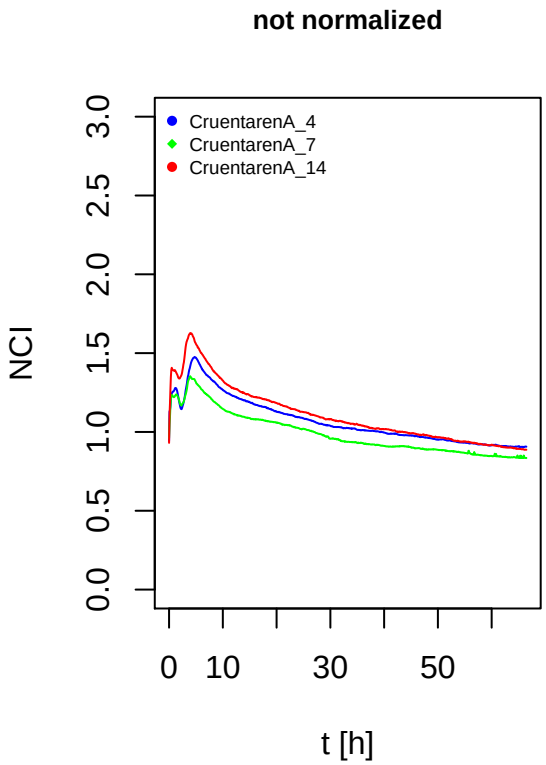
t [h]


not normalized
CruentarenA_4
CruentarenA_7
CruentarenA_14
NCI
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1.5
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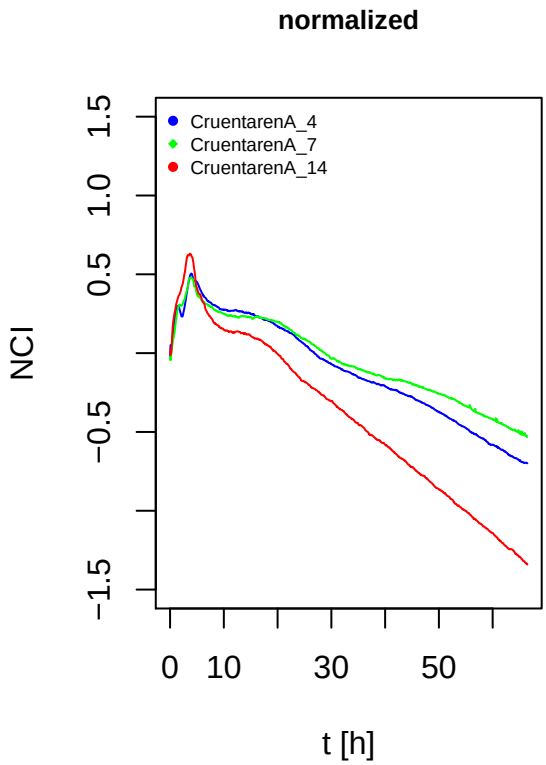
t [h]


normalized
CruentarenA_4
CruentarenA_7
CruentarenA_14
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0.5
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1.5
0
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30
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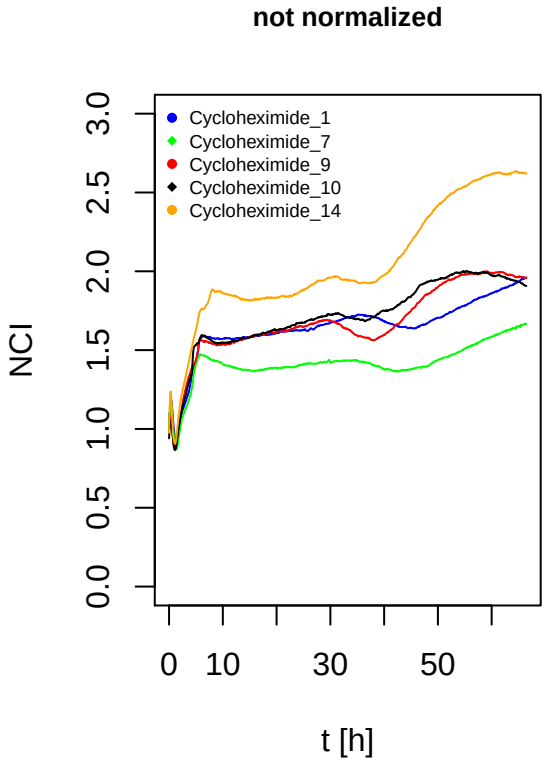
t [h]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Cycloheximide_7
Cycloheximide_9
Cycloheximide_10
Cycloheximide_14
NCI
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0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
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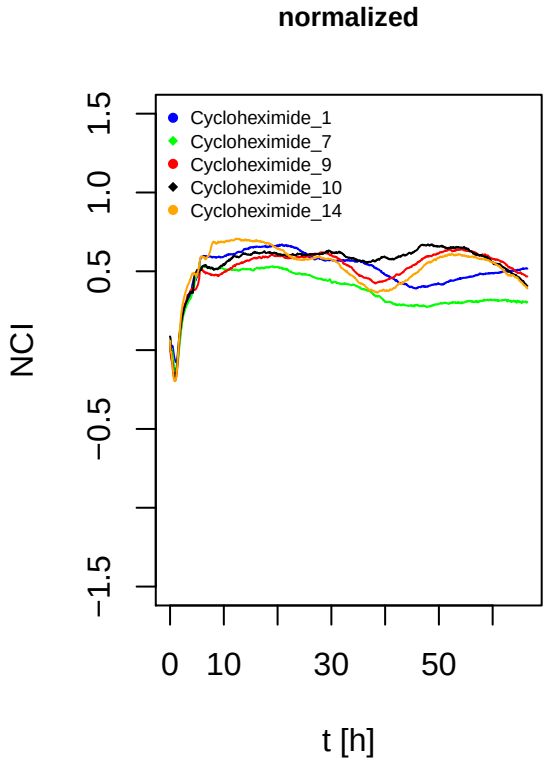
t [h]


normalized
Cycloheximide_1
Cycloheximide_7
Cycloheximide_9
Cycloheximide_10
Cycloheximide_14
NCI
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−0.5
0.5
1.0
1.5
0
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30
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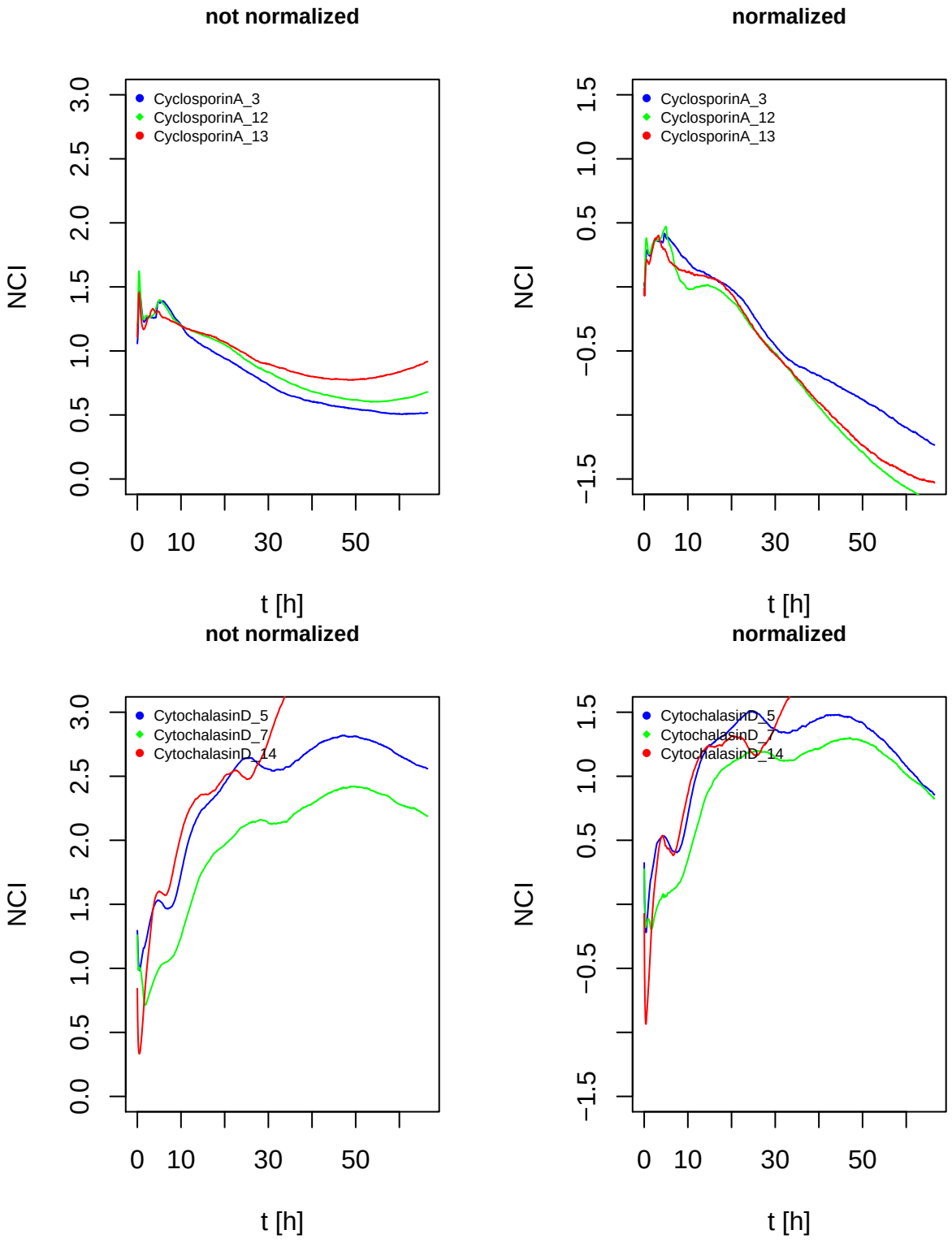
t [h]


not normalized
normalized
CyclosporinA_3
CyclosporinA_12
CyclosporinA_13
NCI
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not normalized
normalized
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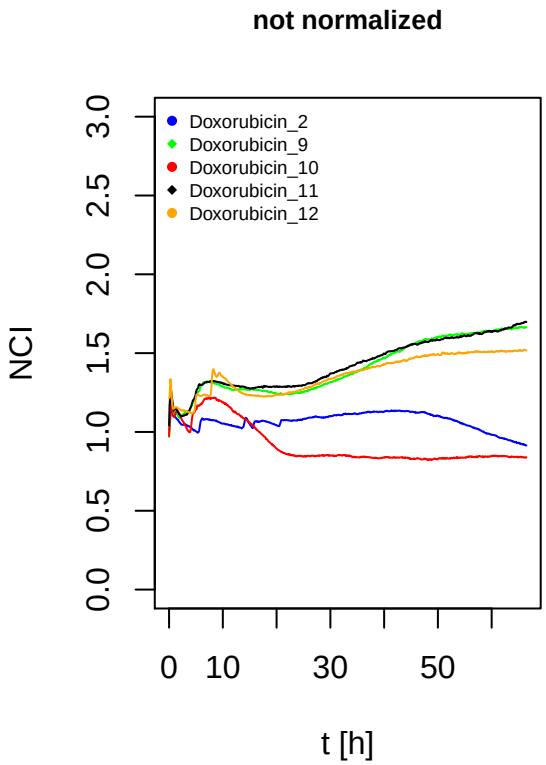
CytochalasinD_7
CytochalasinD_14
NCI
t [h]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Doxorubicin_9
Doxorubicin_10
Doxorubicin_11
Doxorubicin_12
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3.0
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30
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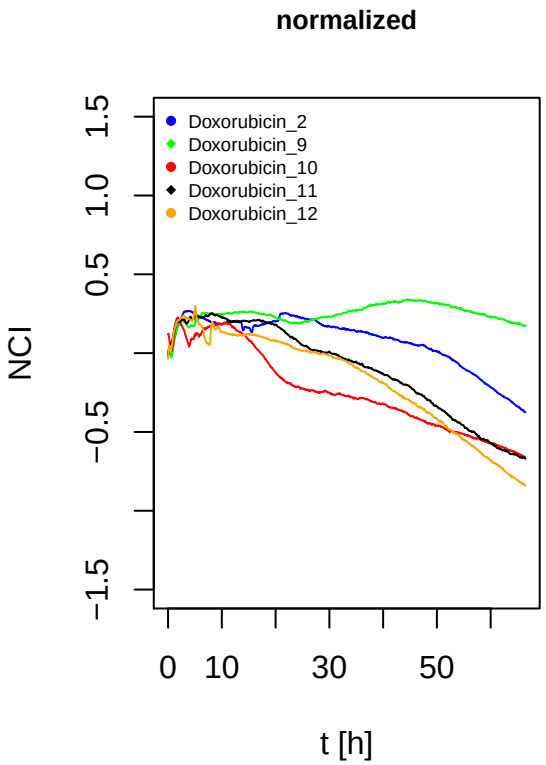
t [h]


normalized
Doxorubicin_2
Doxorubicin_9
Doxorubicin_10
Doxorubicin_11
Doxorubicin_12
NCI
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1.5
0
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30
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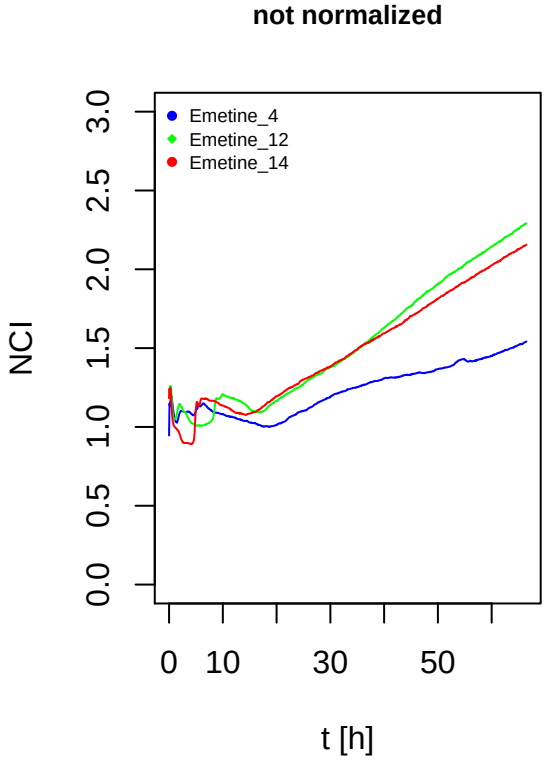
t [h]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Emetine_12
Emetine_14
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2.0
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3.0
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30
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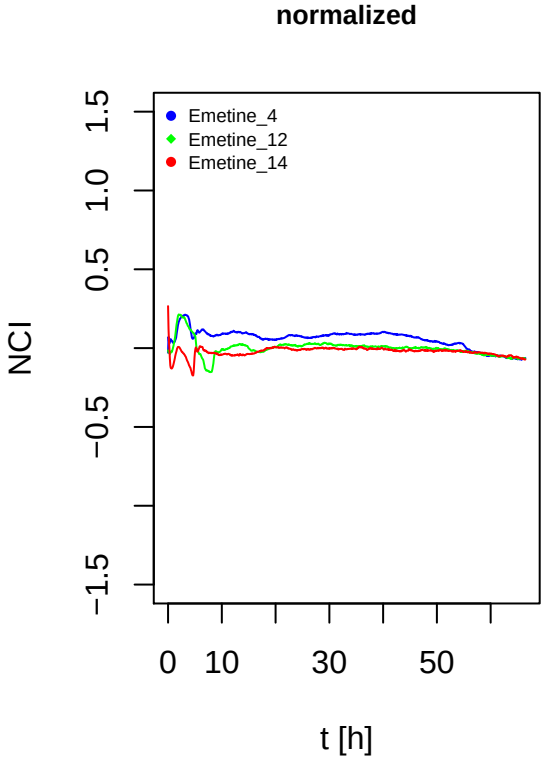
t [h]


normalized
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Emetine_12
Emetine_14
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1.5
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30
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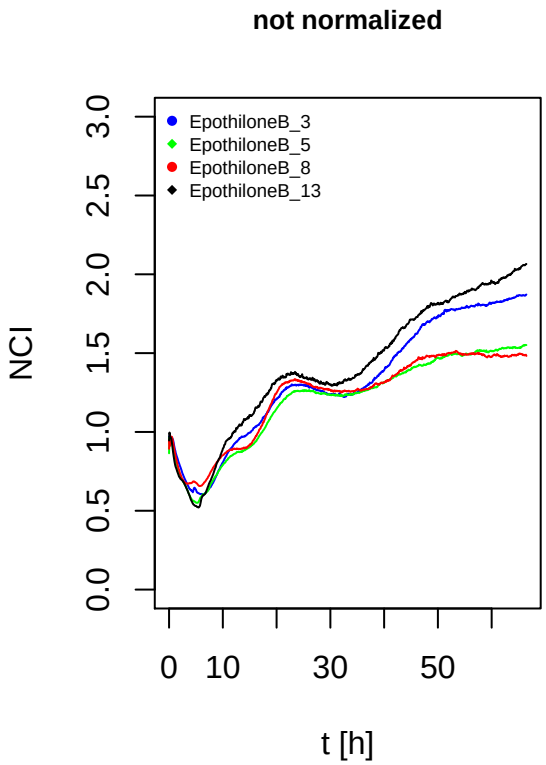
t [h]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EpothiloneB_5
EpothiloneB_8
EpothiloneB_13
NCI
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1.5
2.0
2.5
3.0
0
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30
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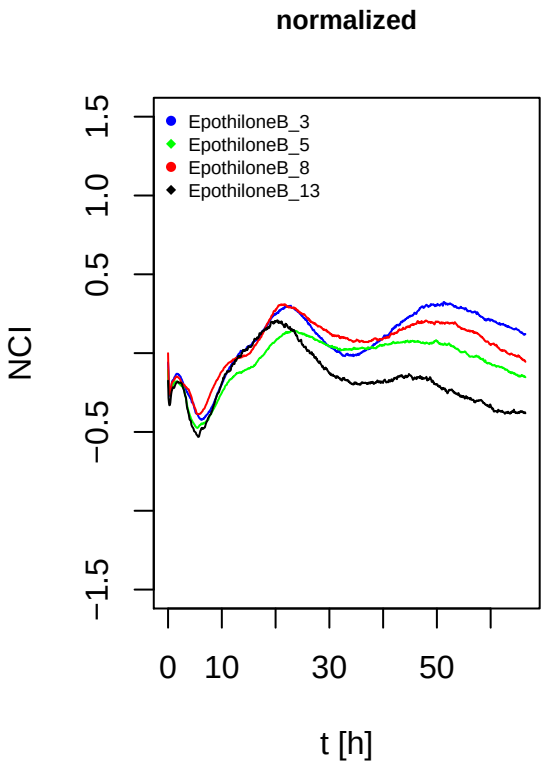
t [h]


normalized
EpothiloneB_3
EpothiloneB_5
EpothiloneB_8
EpothiloneB_13
NCI
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1.0
1.5
0
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30
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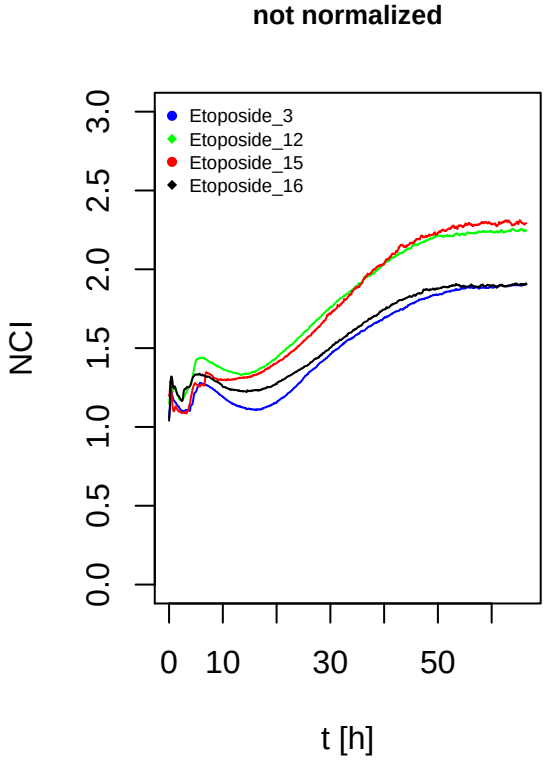
t [h]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Etoposide_12
Etoposide_15
Etoposide_16
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2.5
3.0
0
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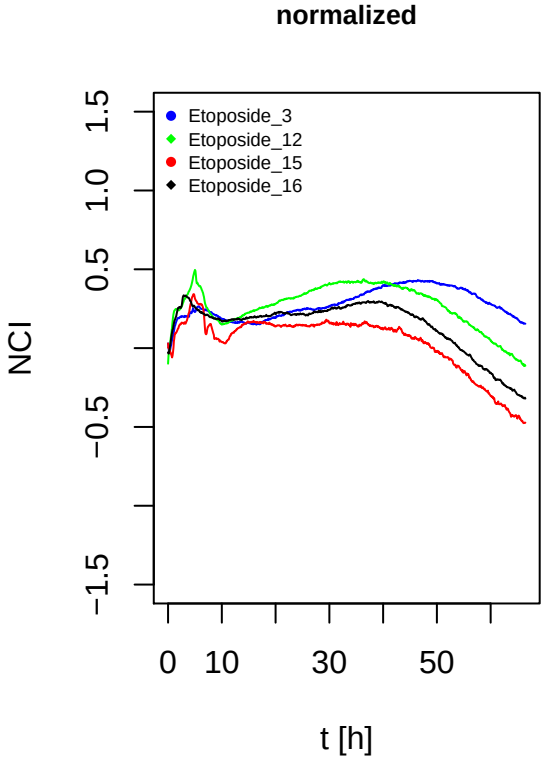
30
50
t [h]


normalized
Etoposide_3
Etoposide_12
Etoposide_15
Etoposide_16
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1.0
1.5
0
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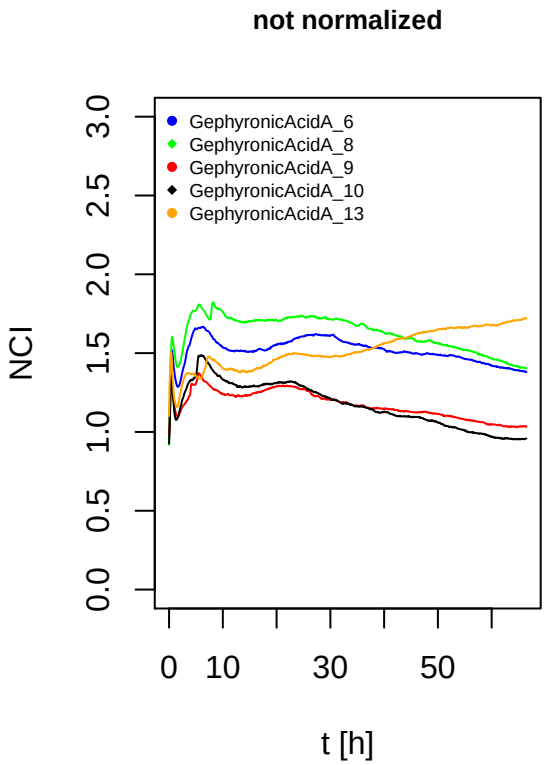
30
50
t [h]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GephyronicAcidA_6
GephyronicAcidA_8
GephyronicAcidA_9
GephyronicAcidA_10
GephyronicAcidA_13
NCI
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0.5
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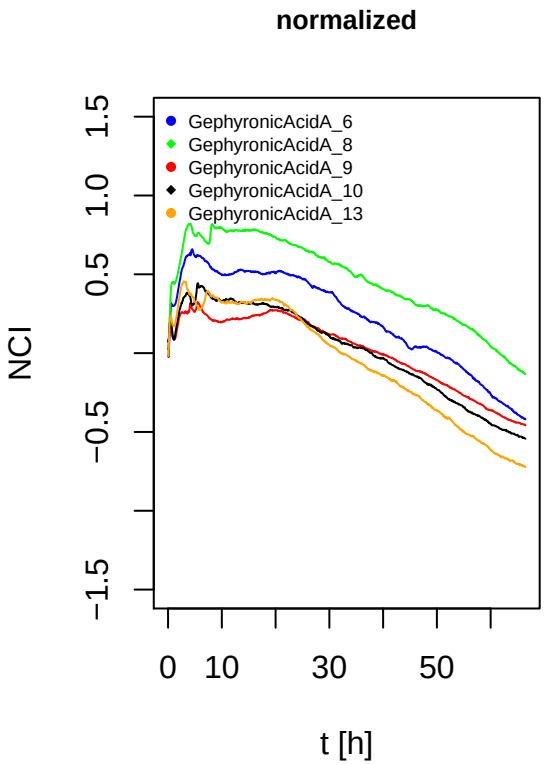
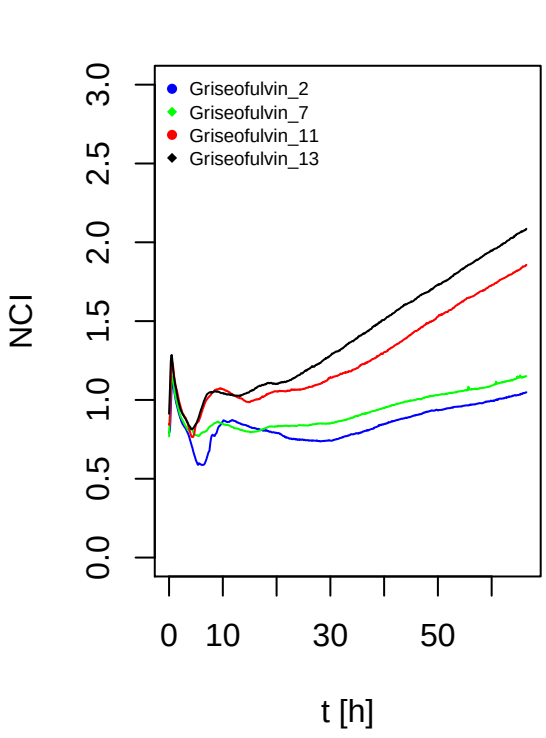
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
GephyronicAcidA_6
GephyronicAcidA_8
GephyronicAcidA_9
GephyronicAcidA_10
GephyronicAcidA_13
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]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Griseofulvin_7
Griseofulvin_11
Griseofulvin_13
NCI
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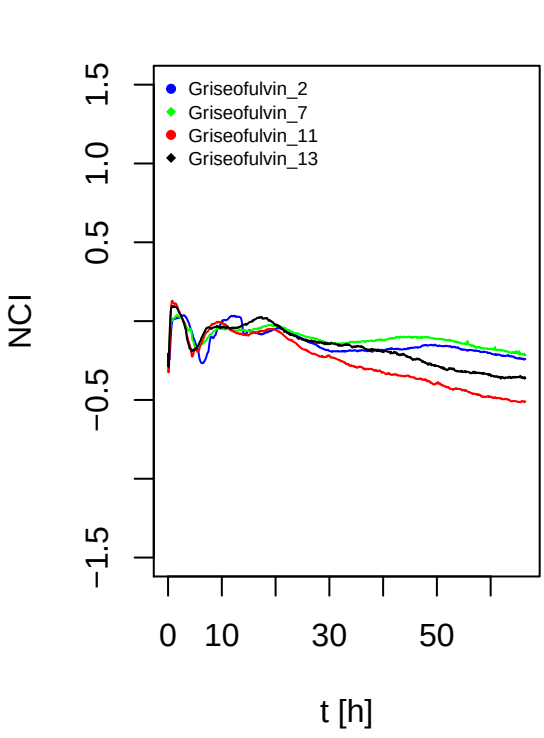
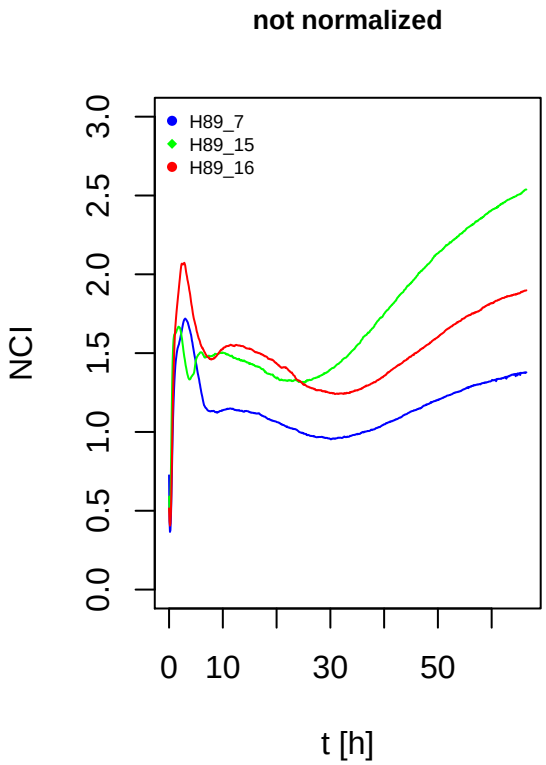
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Griseofulvin_2
Griseofulvin_7
Griseofulvin_11
Griseofulvin_13
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
H89_7
H89_15
H89_16
NCI
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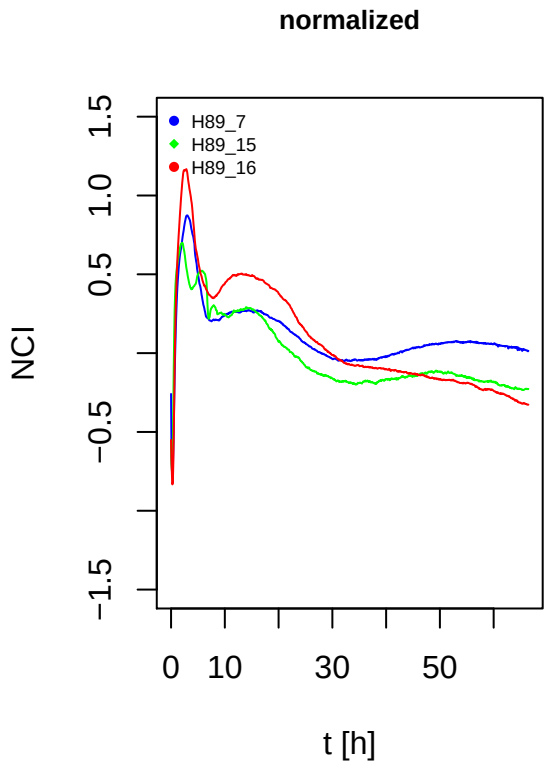
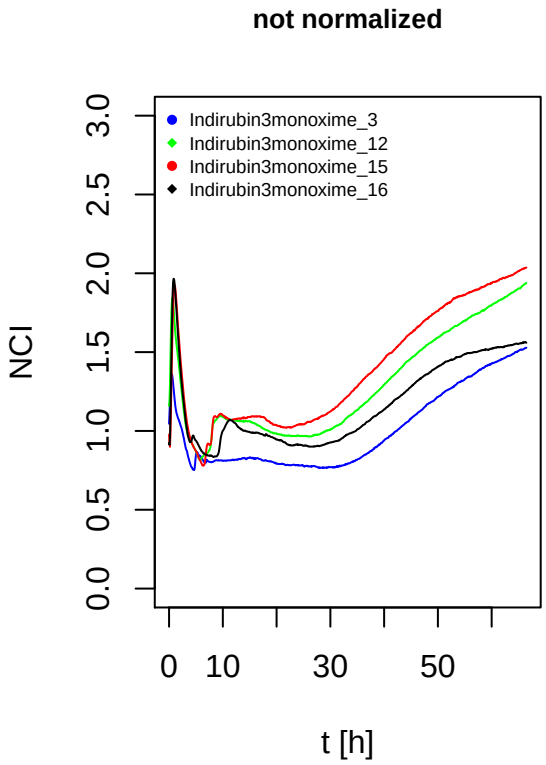
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
H89_7
H89_15
H89_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Indirubin3monoxime_3
Indirubin3monoxime_12
Indirubin3monoxime_15
Indirubin3monoxime_16
NCI
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1.5
2.0
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3.0
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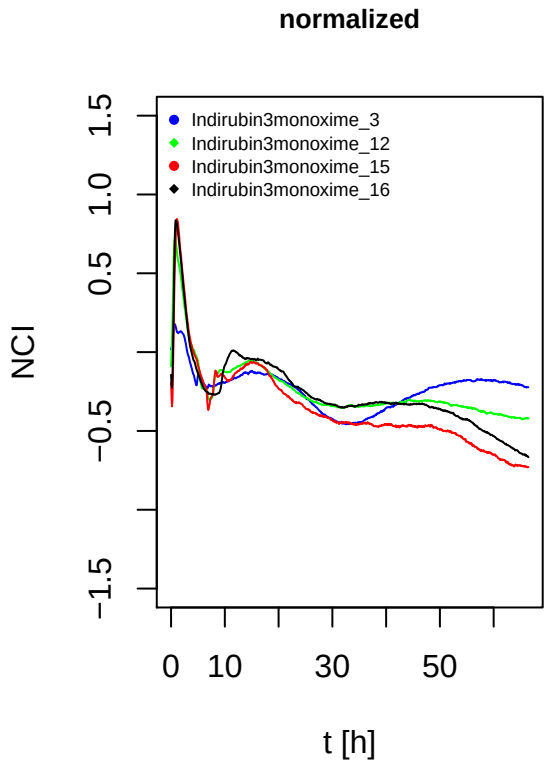
t [h]


normalized
Indirubin3monoxime_3
Indirubin3monoxime_12
Indirubin3monoxime_15
Indirubin3monoxime_16
NCI
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1.5
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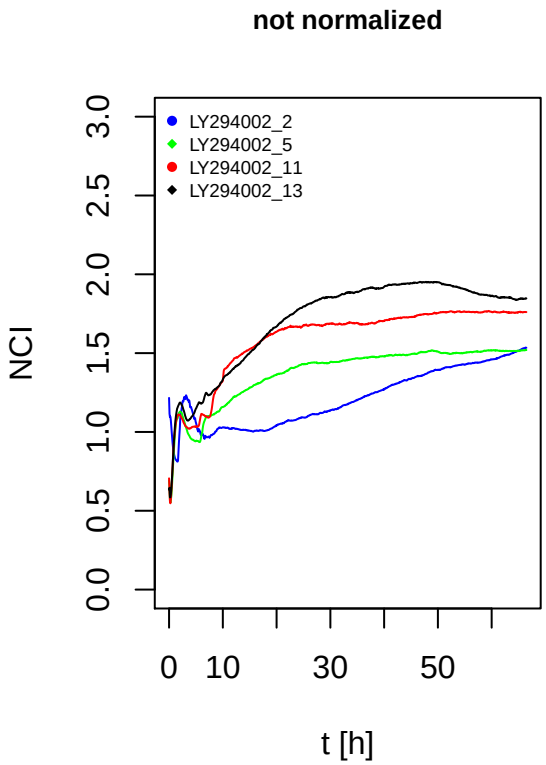
t [h]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LY294002_2
LY294002_5
LY294002_11
LY294002_13
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1.5
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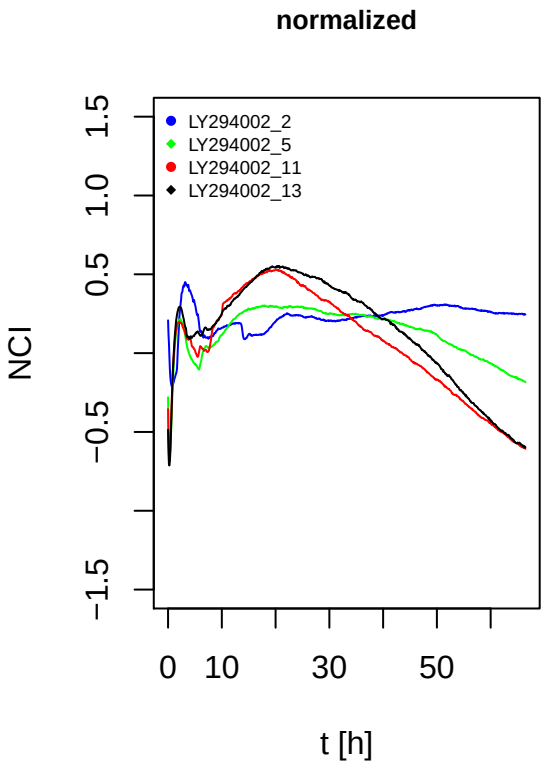
t [h]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LY294002_2
LY294002_5
LY294002_11
LY294002_13
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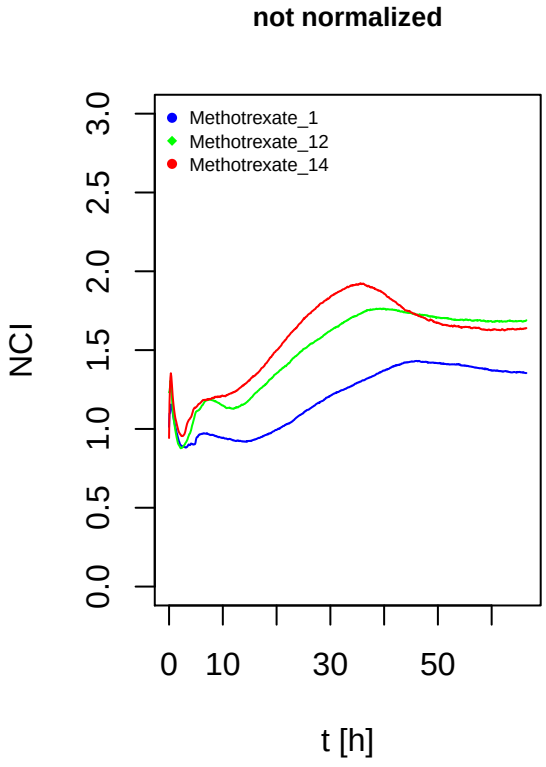
t [h]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Methotrexate_12
Methotrexate_14
NCI
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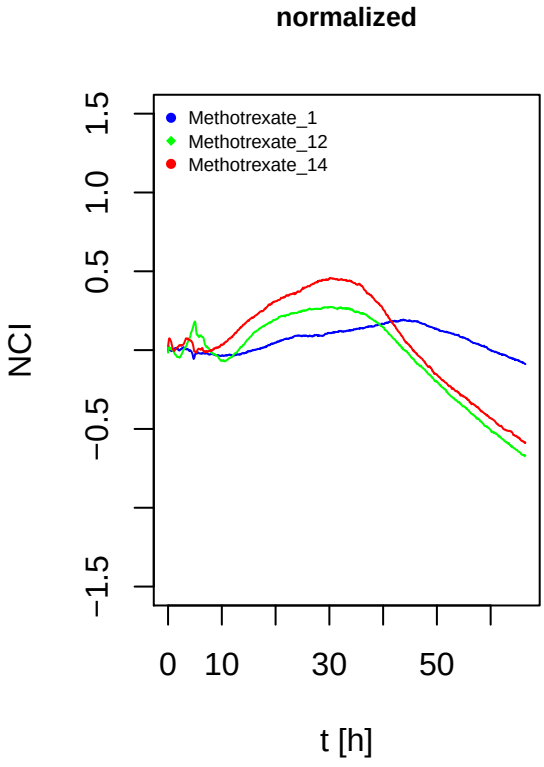
t [h]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Methotrexate_1
Methotrexate_12
Methotrexate_14
NCI
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1.5
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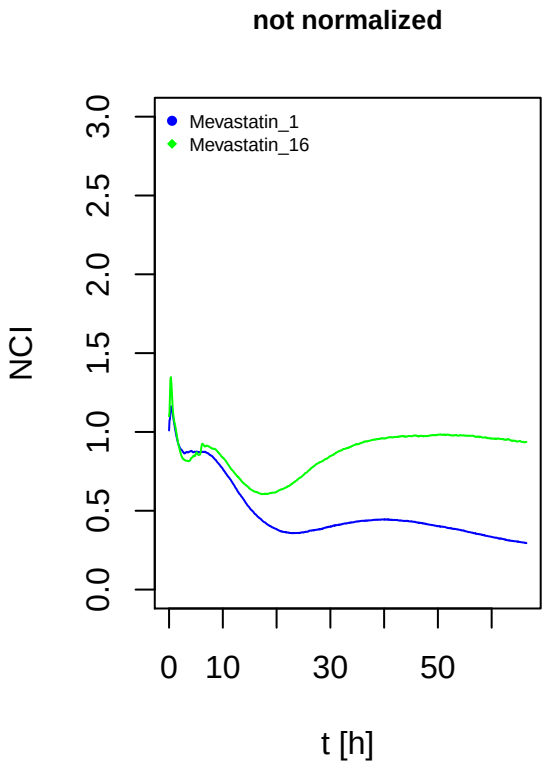
t [h]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Mevastatin_1
Mevastatin_16
NCI
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2.0
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3.0
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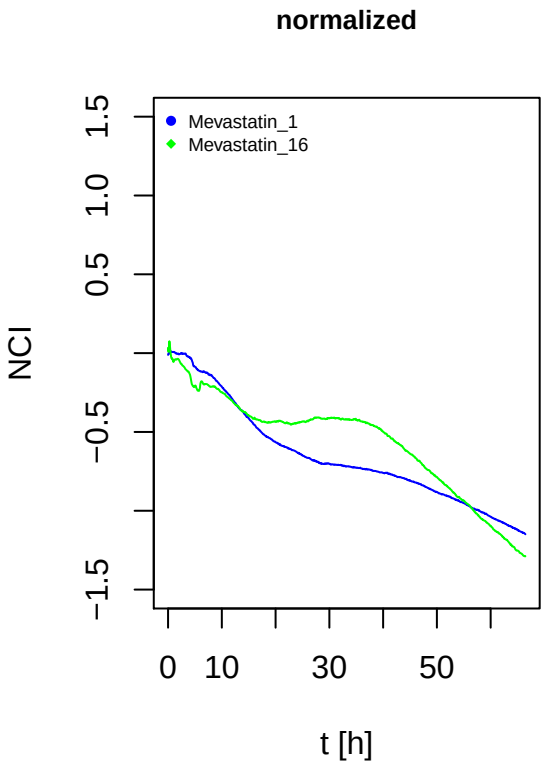
t [h]


normalized
Mevastatin_1
Mevastatin_16
NCI
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1.5
0
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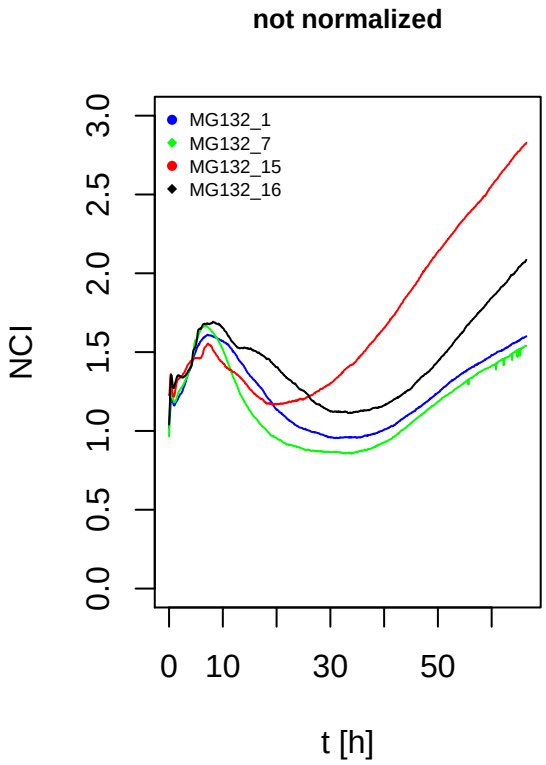
t [h]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MG132_1
MG132_7
MG132_15
MG132_16
NCI
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0
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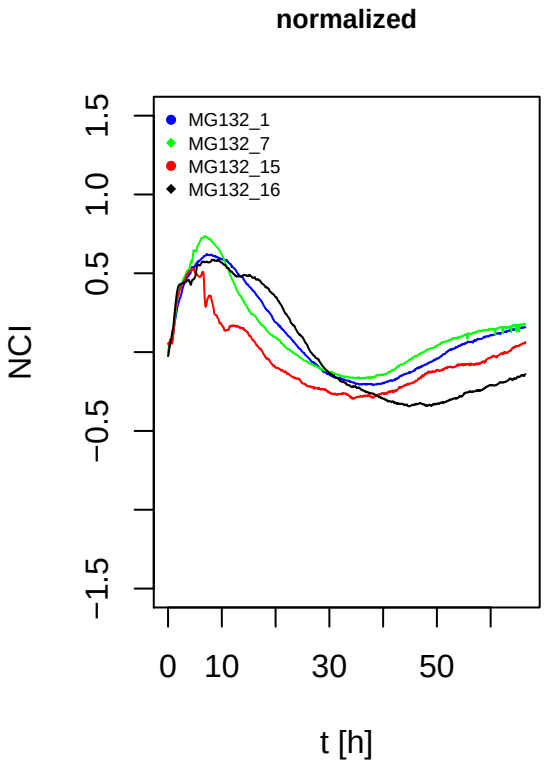
t [h]


normalized
MG132_1
MG132_7
MG132_15
MG132_16
NCI
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−0.5
0.5
1.0
1.5
0
10
30
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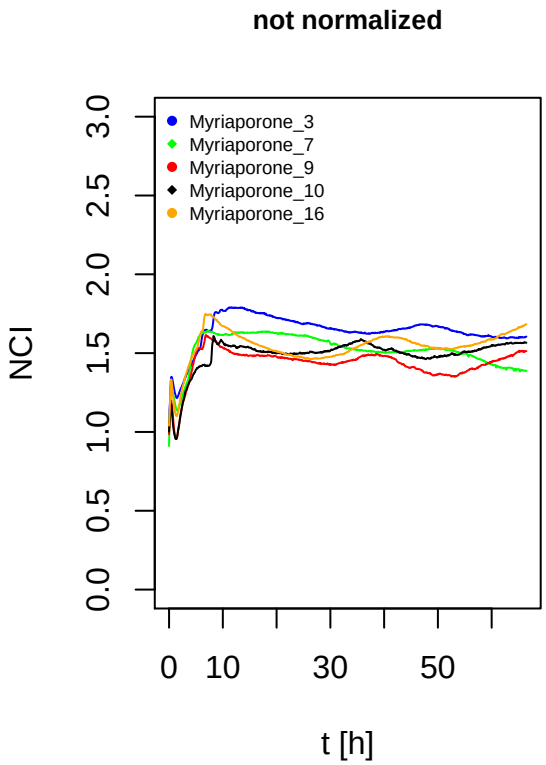
t [h]


not normalized
Myriaporone_3
Myriaporone_7
Myriaporone_9
Myriaporone_10
Myriaporone_16
NCI
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0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
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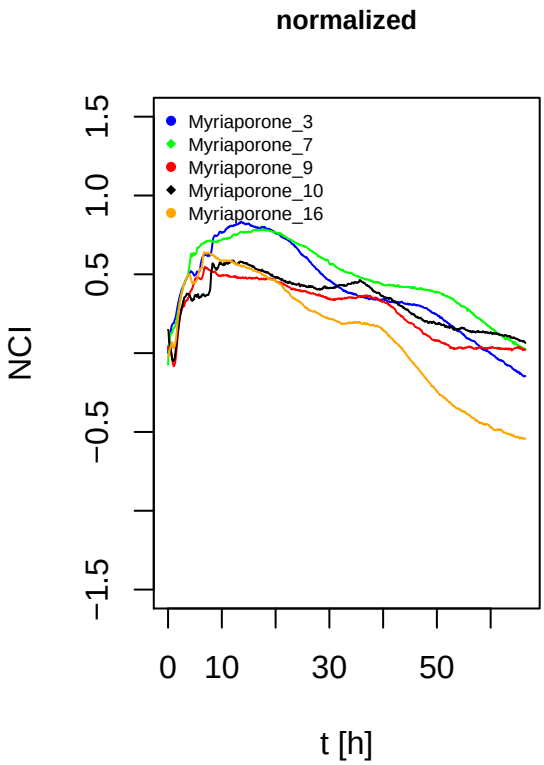
t [h]


normalized
Myriaporone_3
Myriaporone_7
Myriaporone_9
Myriaporone_10
Myriaporone_16
NCI
−1.5
−0.5
0.5
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1.5
0
10
30
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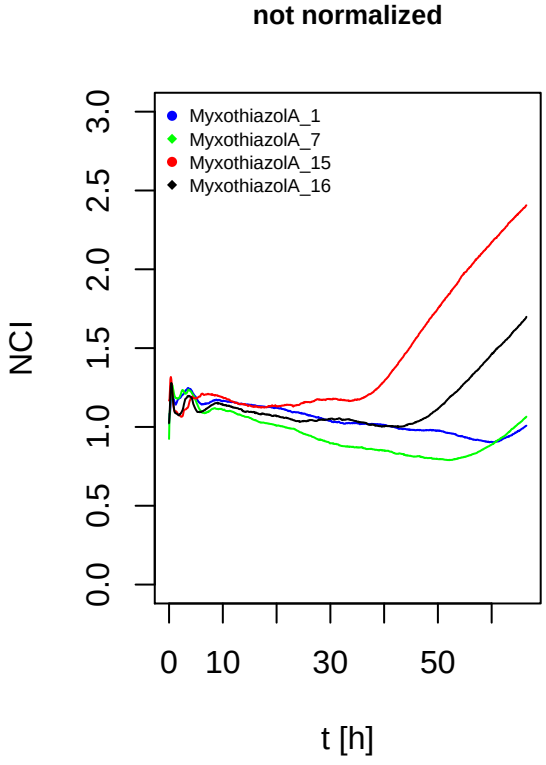
t [h]


not normalized
MyxothiazolA_1
MyxothiazolA_7
MyxothiazolA_15
MyxothiazolA_16
NCI
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0.5
1.0
1.5
2.0
2.5
3.0
0
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30
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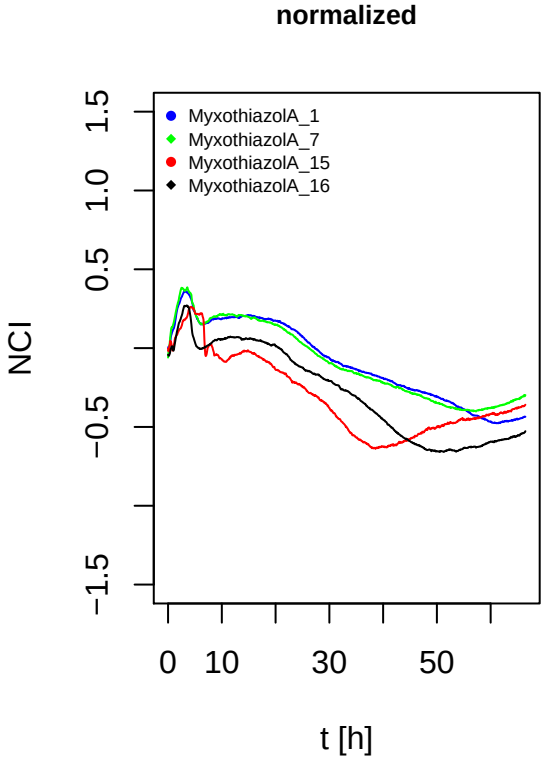
t [h]


normalized
MyxothiazolA_1
MyxothiazolA_7
MyxothiazolA_15
MyxothiazolA_16
NCI
−1.5
−0.5
0.5
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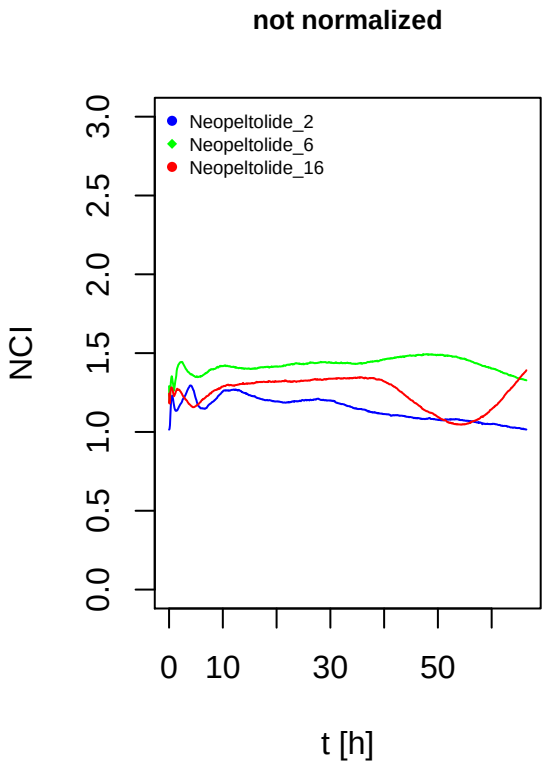
1.5
0
10
30
50
t [h]


not normalized
Neopeltolide_2
Neopeltolide_6
Neopeltolide_16
NCI
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0.5
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1.5
2.0
2.5
3.0
0
10
30
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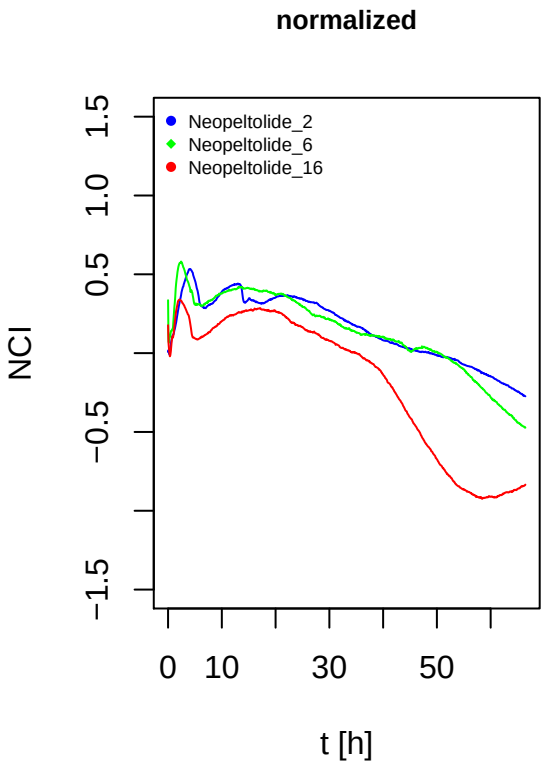
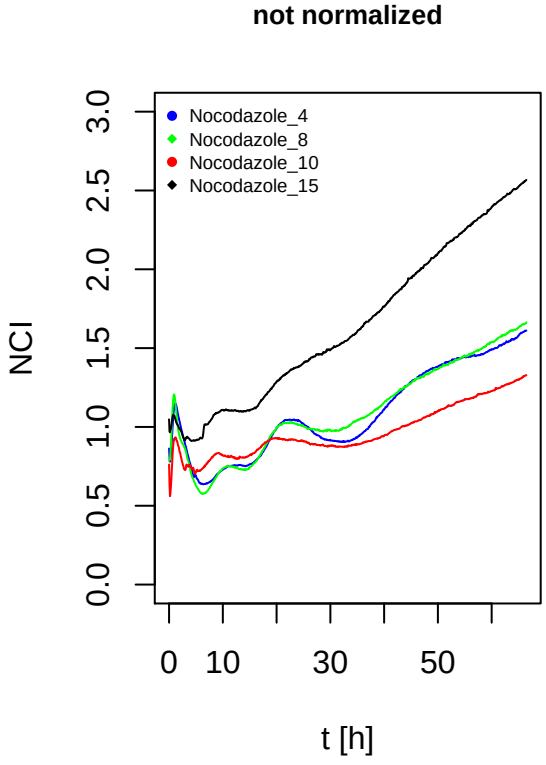
t [h]


normalized
Neopeltolide_2
Neopeltolide_6
Neopeltolide_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Nocodazole_4
Nocodazole_8
Nocodazole_10
Nocodazole_15
NCI
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0.5
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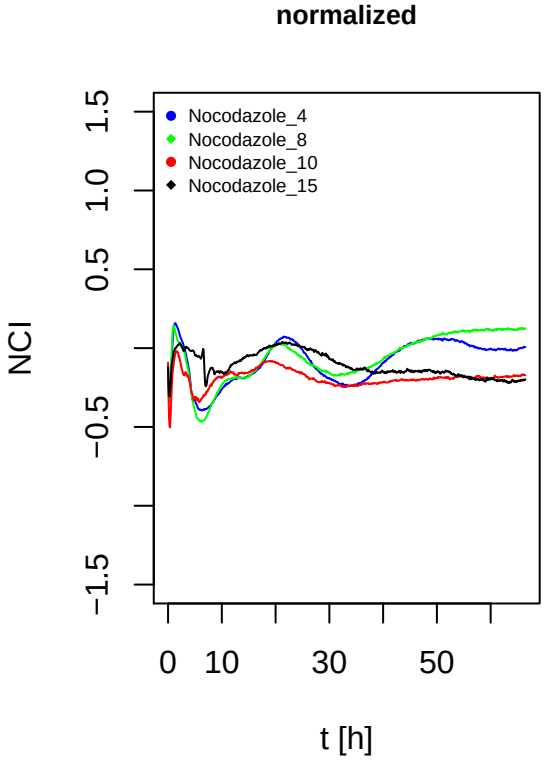
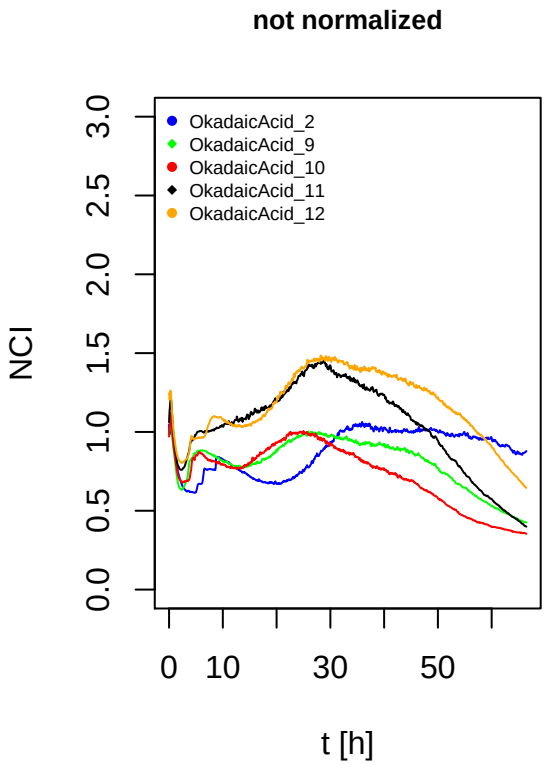
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Nocodazole_4
Nocodazole_8
Nocodazole_10
Nocodazole_15
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
OkadaicAcid_2
OkadaicAcid_9
OkadaicAcid_10
OkadaicAcid_11
OkadaicAcid_12
NCI
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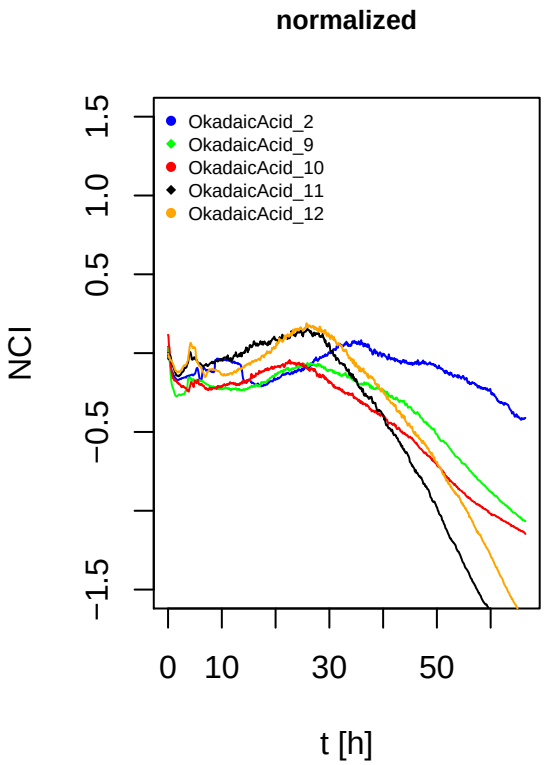
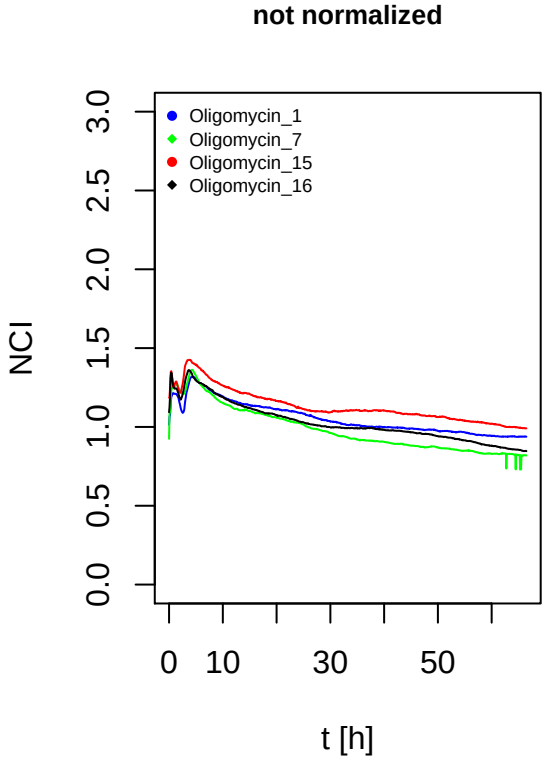
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
OkadaicAcid_2
OkadaicAcid_9
OkadaicAcid_10
OkadaicAcid_11
OkadaicAcid_12
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Oligomycin_1
Oligomycin_7
Oligomycin_15
Oligomycin_16
NCI
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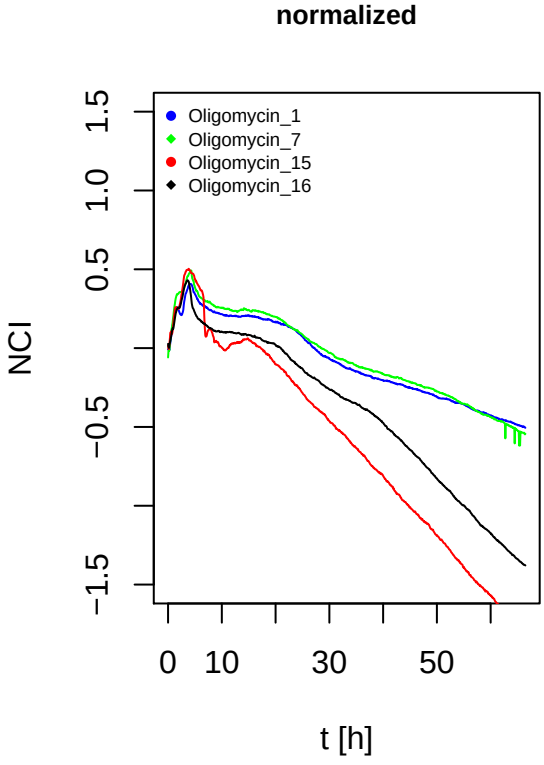
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Oligomycin_1
Oligomycin_7
Oligomycin_15
Oligomycin_16
NCI
−1.5
−0.5
0.5
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1.5
0
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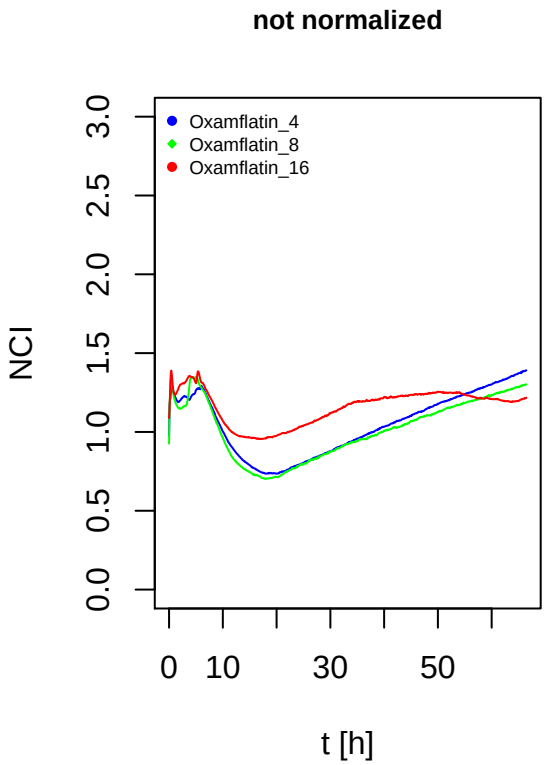
30
50
t [h]


not normalized
Oxamflatin_4
Oxamflatin_8
Oxamflatin_16
NCI
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0.5
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1.5
2.0
2.5
3.0
0
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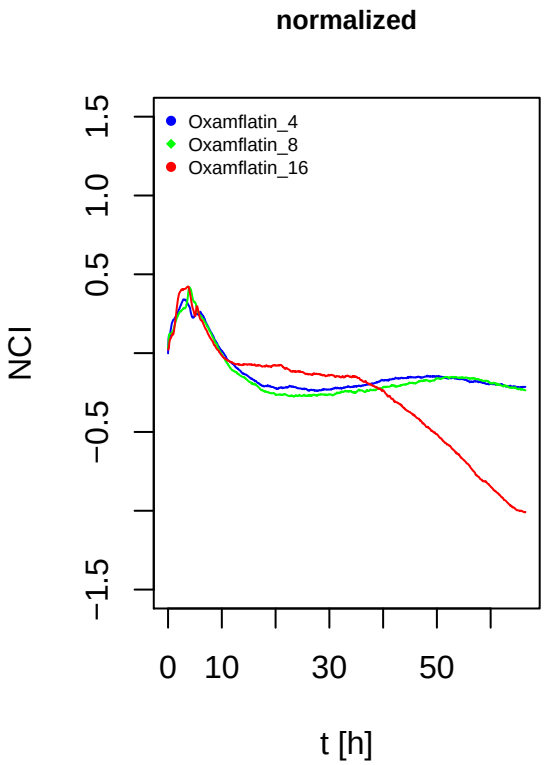
30
50
t [h]


normalized
Oxamflatin_4
Oxamflatin_8
Oxamflatin_16
NCI
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−0.5
0.5
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1.5
0
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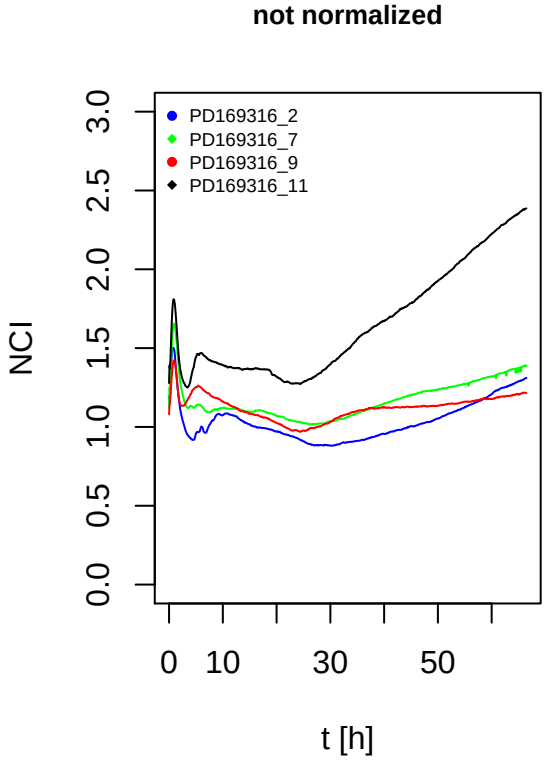
30
50
t [h]


not normalized
PD169316_2
PD169316_7
PD169316_9
PD169316_11
NCI
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0.5
1.0
1.5
2.0
2.5
3.0
0
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30
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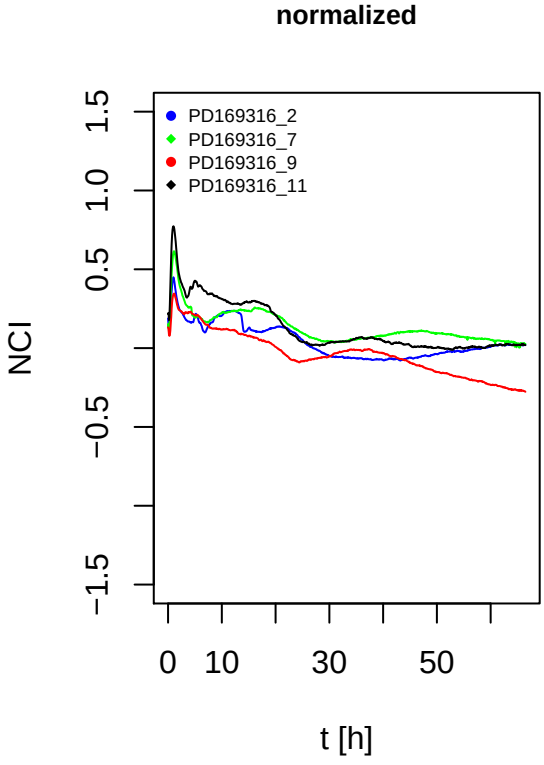
t [h]


normalized
PD169316_2
PD169316_7
PD169316_9
PD169316_11
NCI
−1.5
−0.5
0.5
1.0
1.5
0
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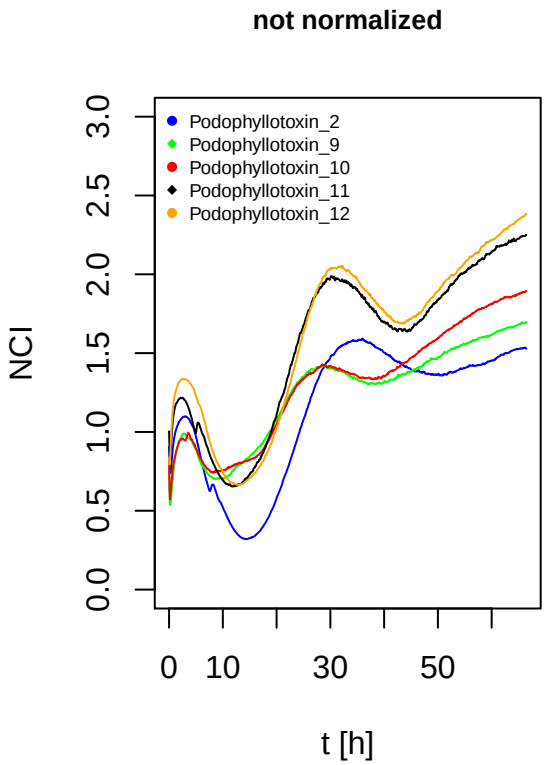
30
50
t [h]


not normalized
Podophyllotoxin_2
Podophyllotoxin_9
Podophyllotoxin_10
Podophyllotoxin_11
Podophyllotoxin_12
NCI
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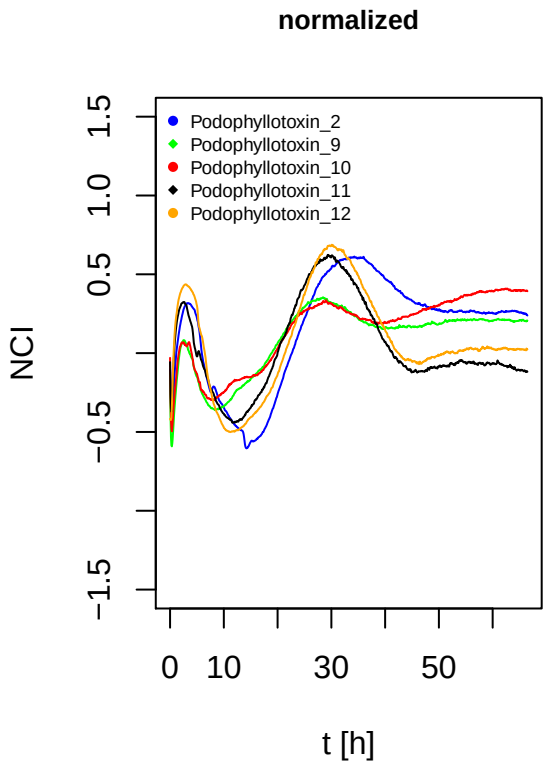
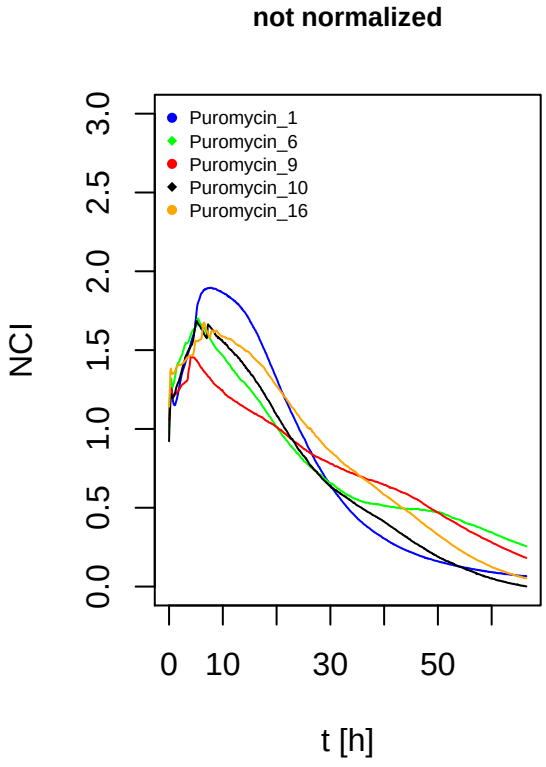
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Podophyllotoxin_2
Podophyllotoxin_9
Podophyllotoxin_10
Podophyllotoxin_11
Podophyllotoxin_12
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Puromycin_1
Puromycin_6
Puromycin_9
Puromycin_10
Puromycin_16
NCI
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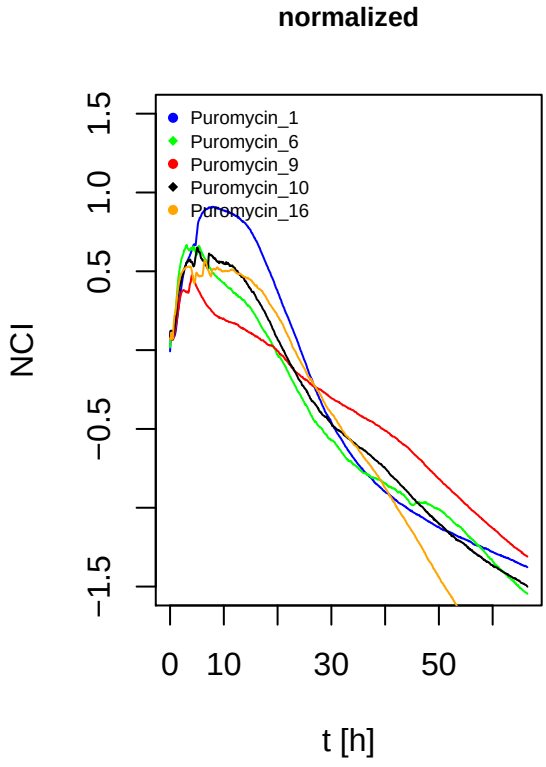
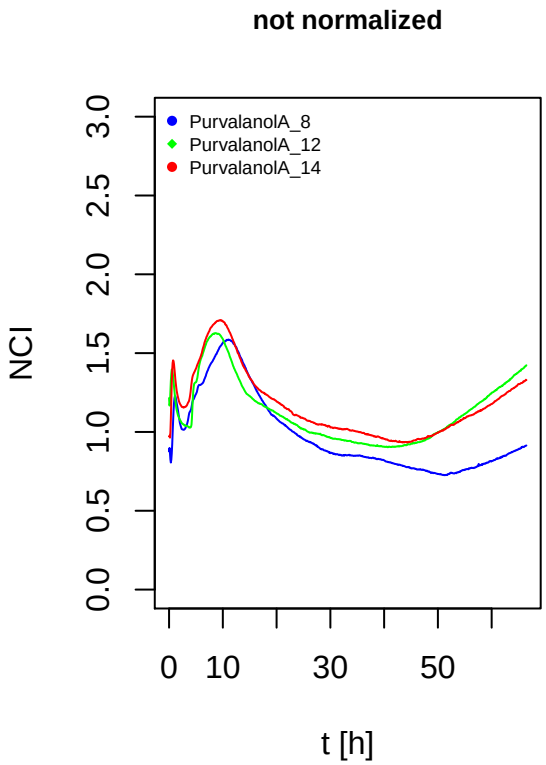
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Puromycin_1
Puromycin_6
Puromycin_9
Puromycin_10
Puromycin_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
PurvalanolA_8
PurvalanolA_12
PurvalanolA_14
NCI
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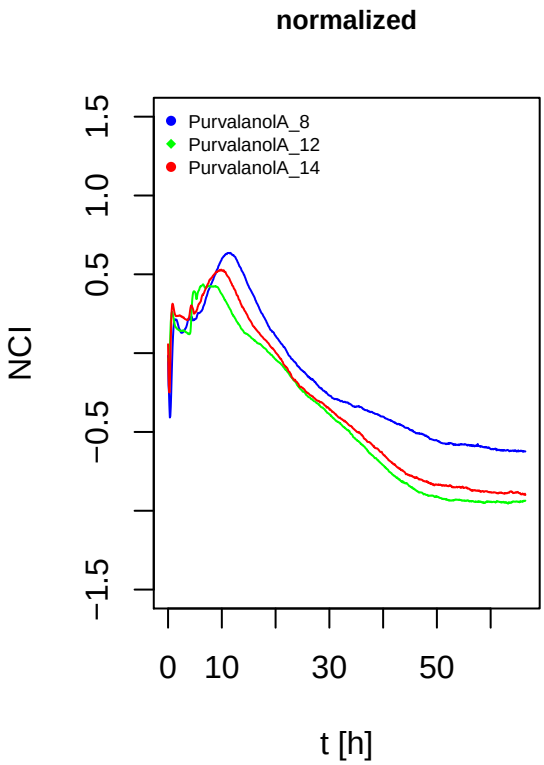
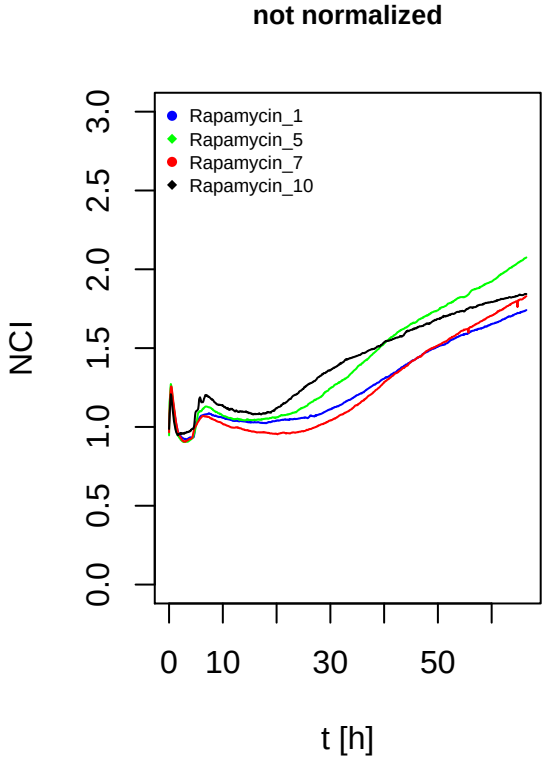
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
PurvalanolA_8
PurvalanolA_12
PurvalanolA_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Rapamycin_1
Rapamycin_5
Rapamycin_7
Rapamycin_10
NCI
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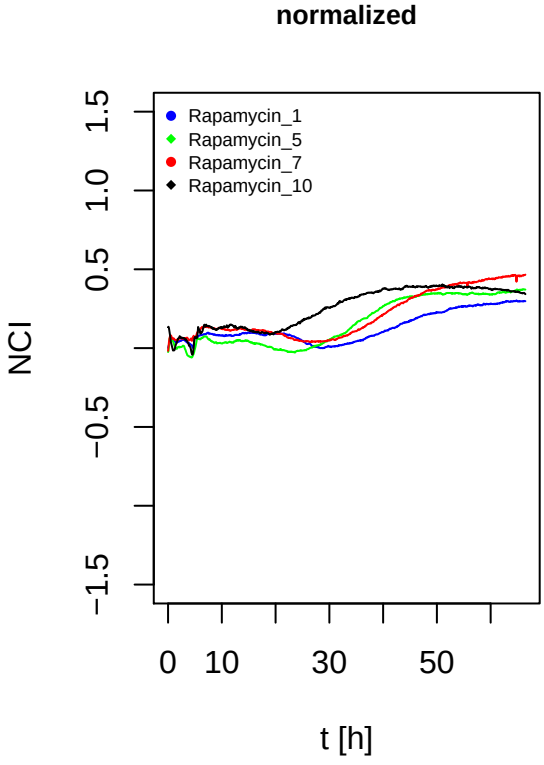
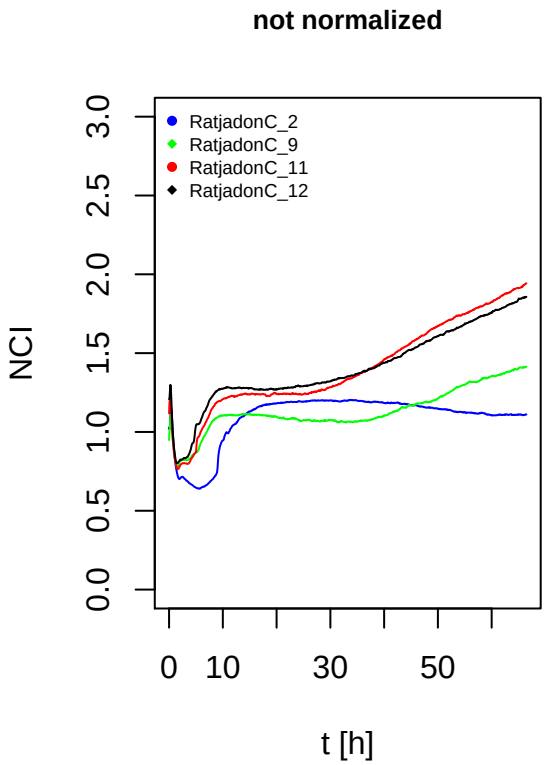
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Rapamycin_1
Rapamycin_5
Rapamycin_7
Rapamycin_10
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
RatjadonC_2
RatjadonC_9
RatjadonC_11
RatjadonC_12
NCI
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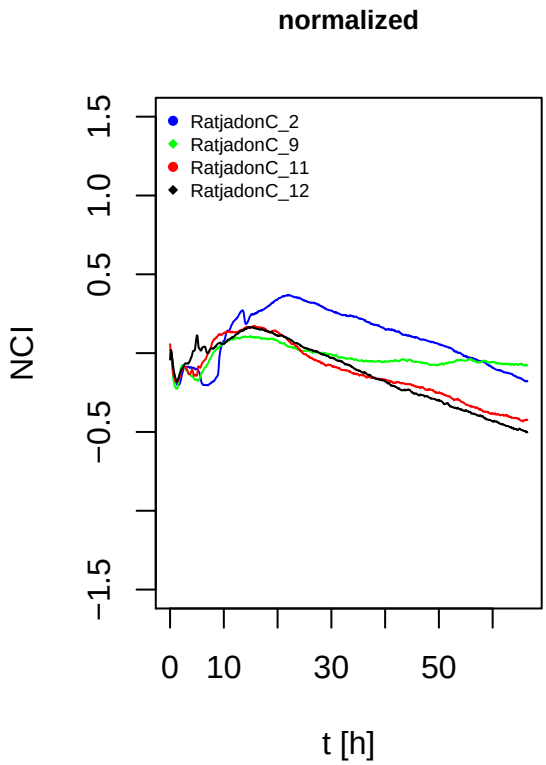
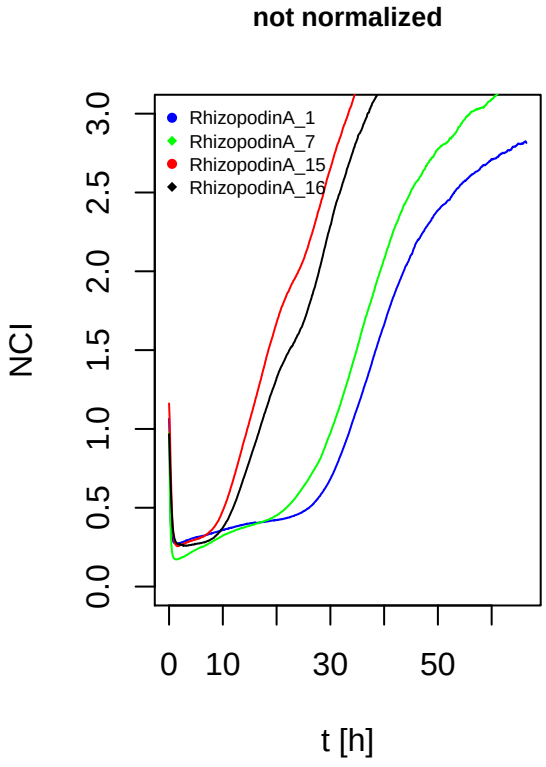
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
RatjadonC_2
RatjadonC_9
RatjadonC_11
RatjadonC_12
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
RhizopodinA_1
RhizopodinA_7
RhizopodinA_15
RhizopodinA_16
NCI
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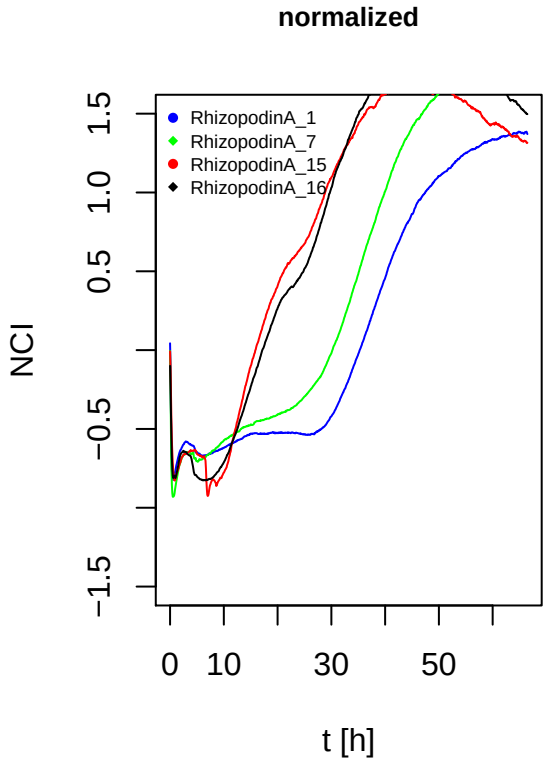
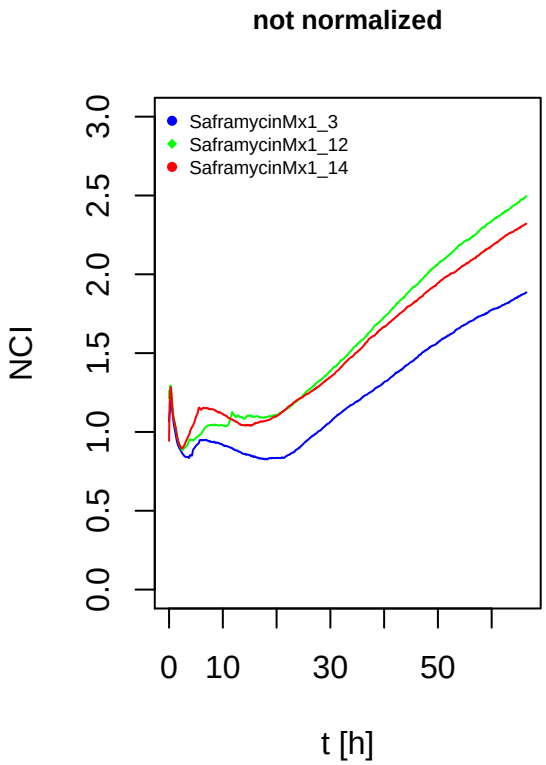
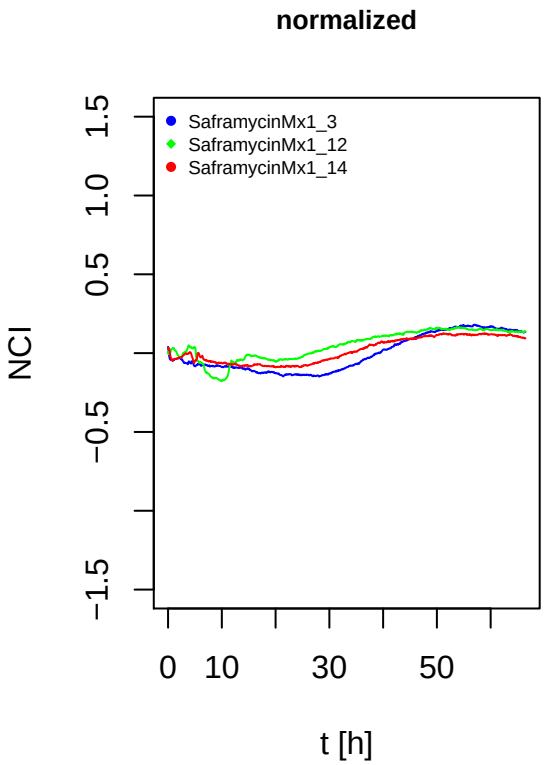
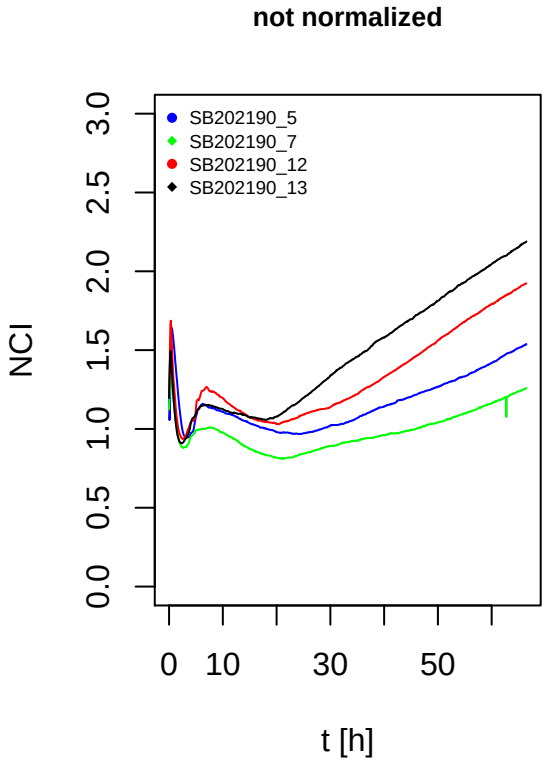
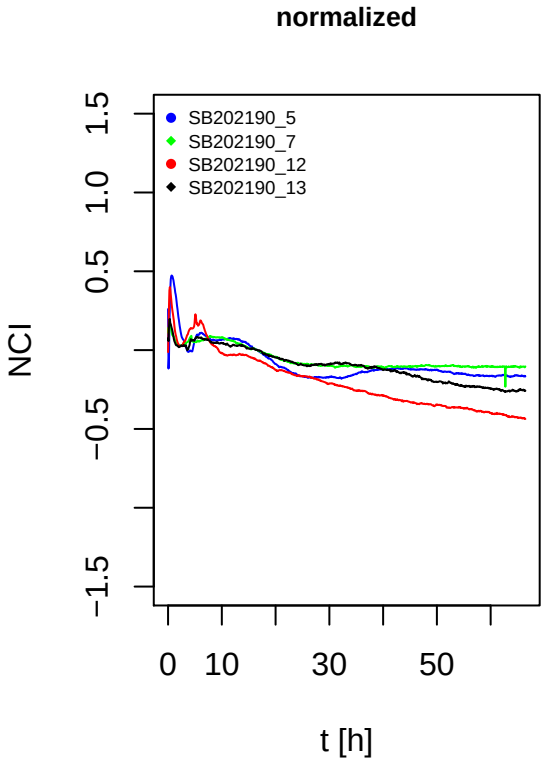
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

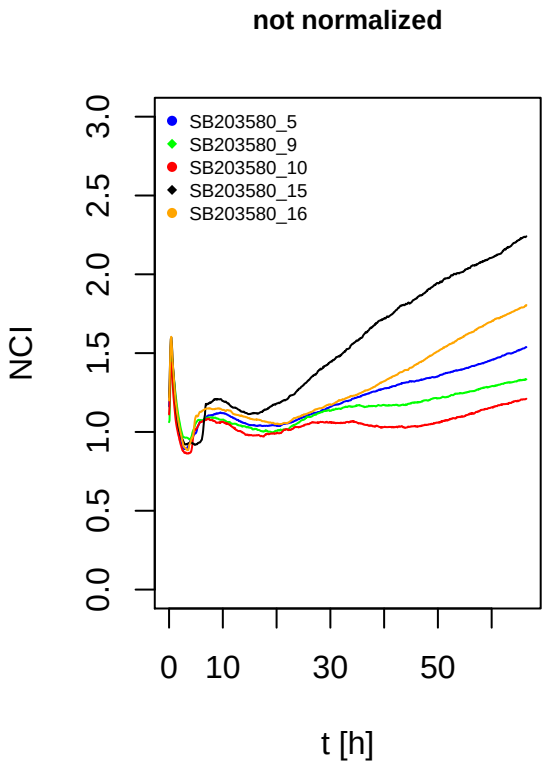

normalized
RhizopodinA_1
RhizopodinA_7
RhizopodinA_15
RhizopodinA_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

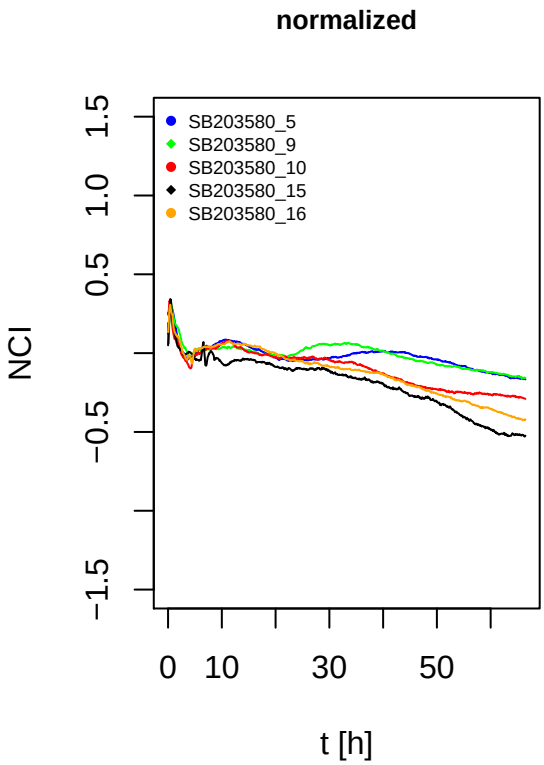

not normalized
SaframycinMx1_3
SaframycinMx1_12
SaframycinMx1_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

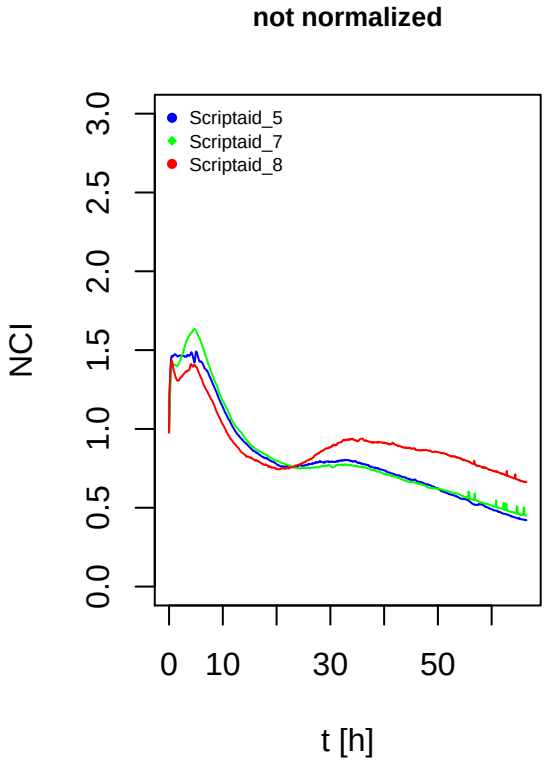

normalized
SaframycinMx1_3
SaframycinMx1_12
SaframycinMx1_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

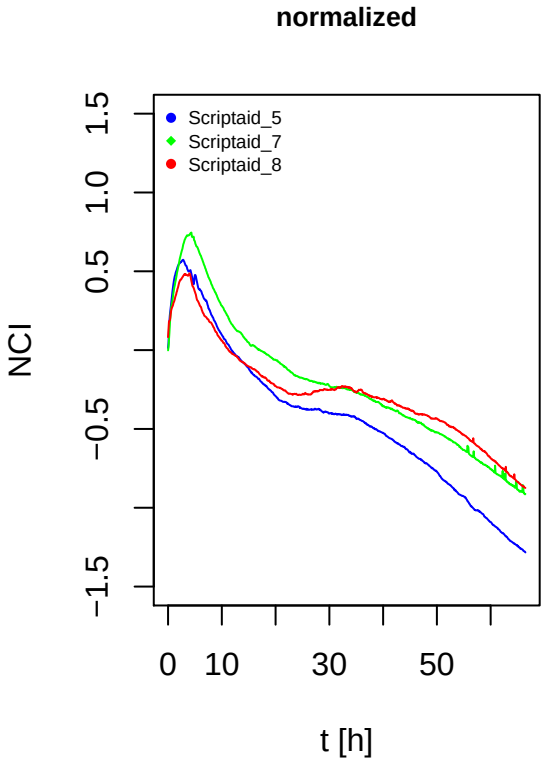

not normalized
SB202190_5
SB202190_7
SB202190_12
SB202190_13
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

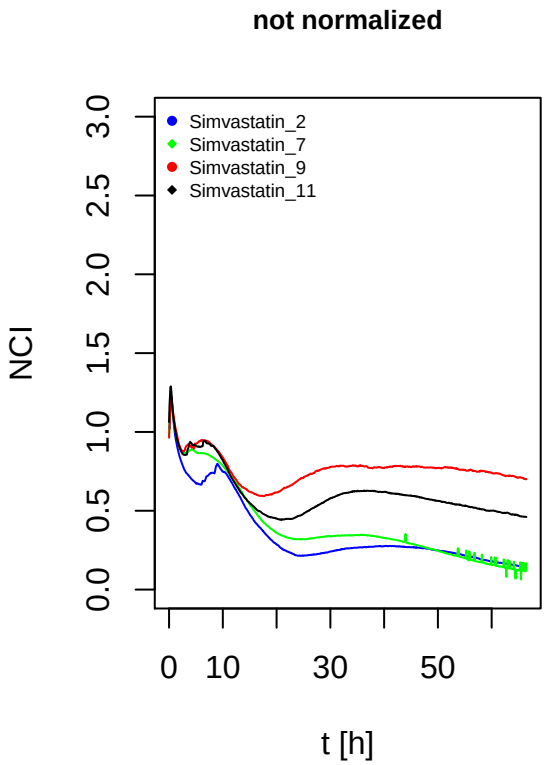

normalized
SB202190_5
SB202190_7
SB202190_12
SB202190_13
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

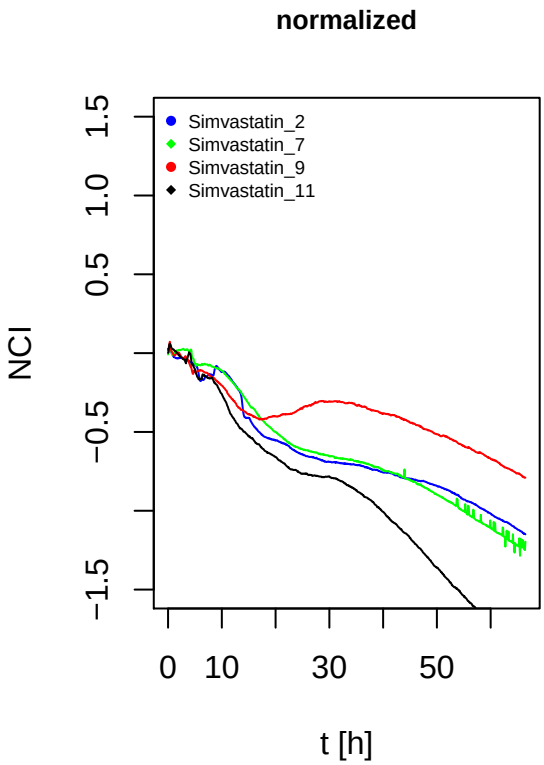

not normalized
SB203580_5
SB203580_9
SB203580_10
SB203580_15
SB203580_16
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

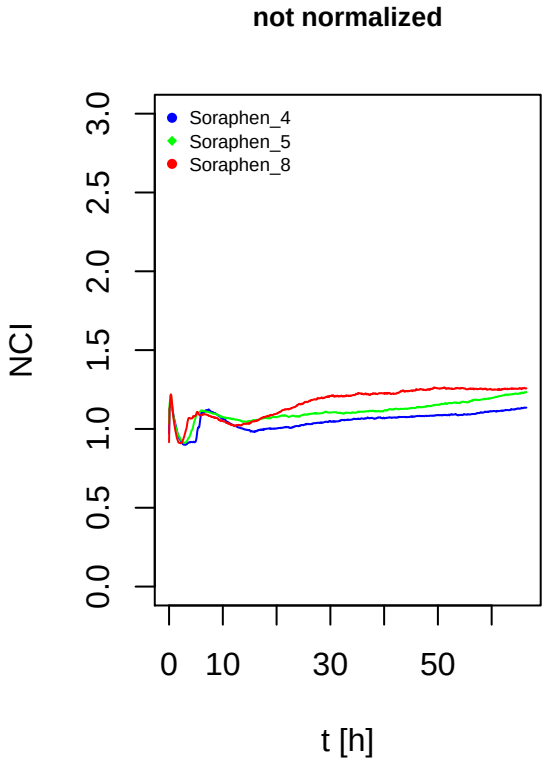

normalized
SB203580_5
SB203580_9
SB203580_10
SB203580_15
SB203580_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

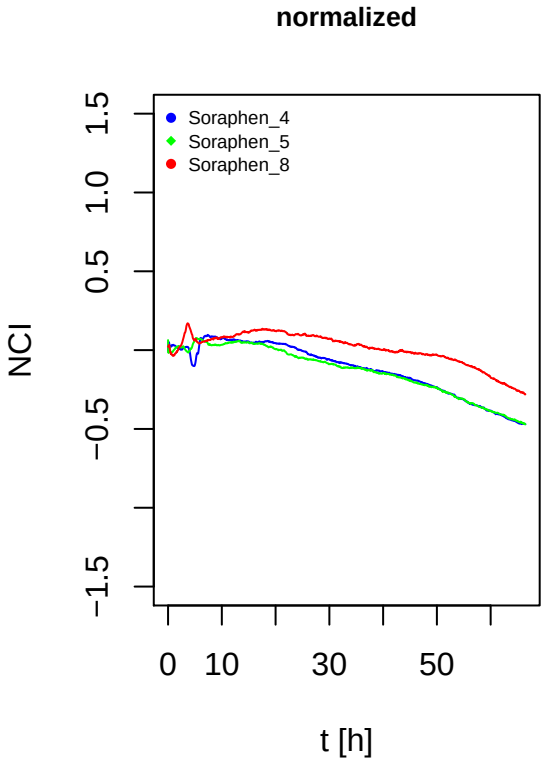

not normalized
Scriptaid_5
Scriptaid_7
Scriptaid_8
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

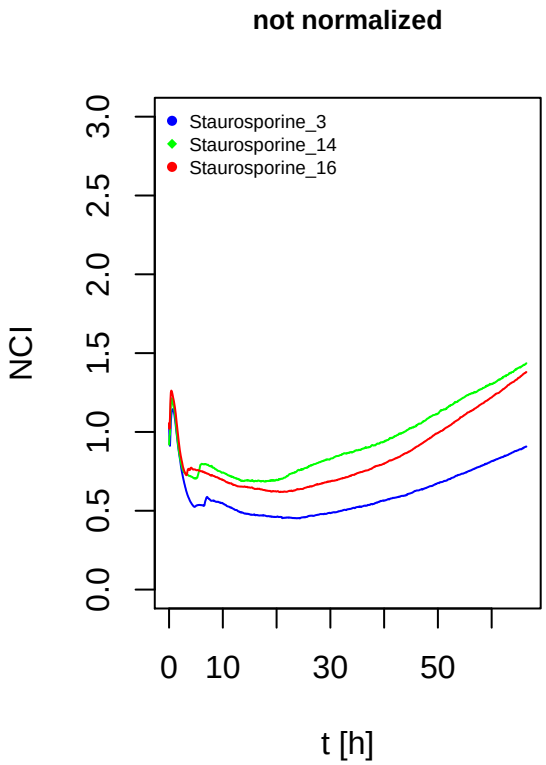

normalized
Scriptaid_5
Scriptaid_7
Scriptaid_8
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

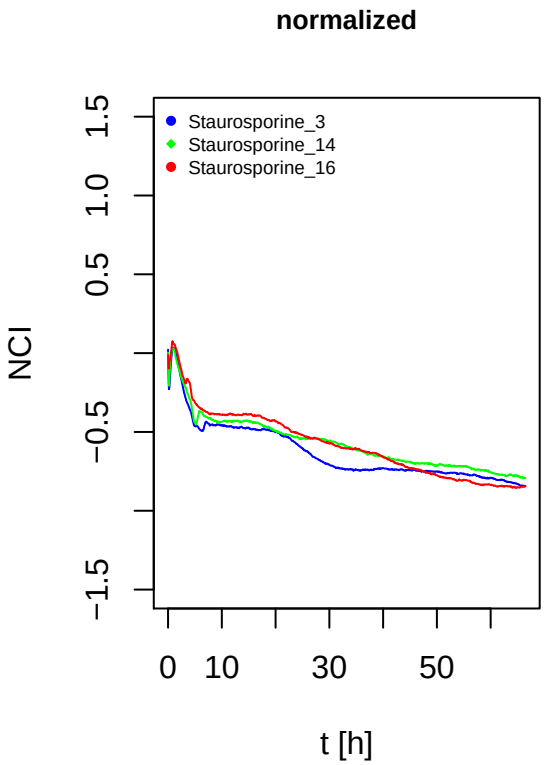

not normalized
Simvastatin_2
Simvastatin_7
Simvastatin_9
Simvastatin_11
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

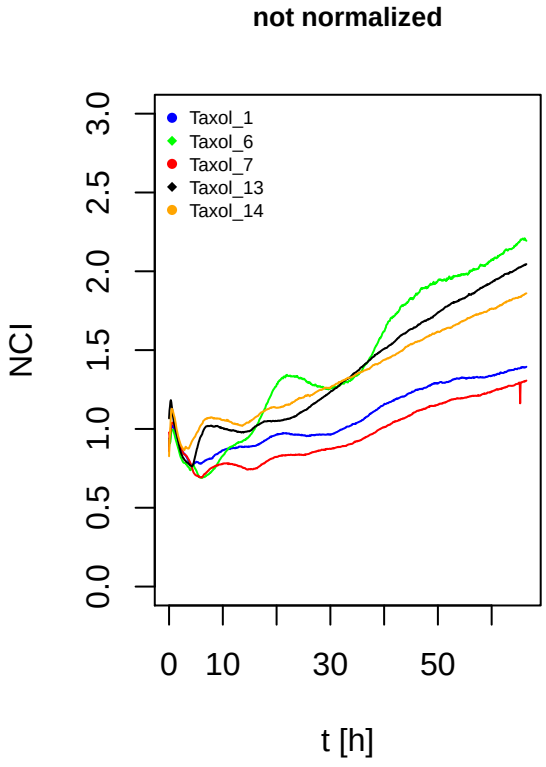

normalized
Simvastatin_2
Simvastatin_7
Simvastatin_9
Simvastatin_11
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

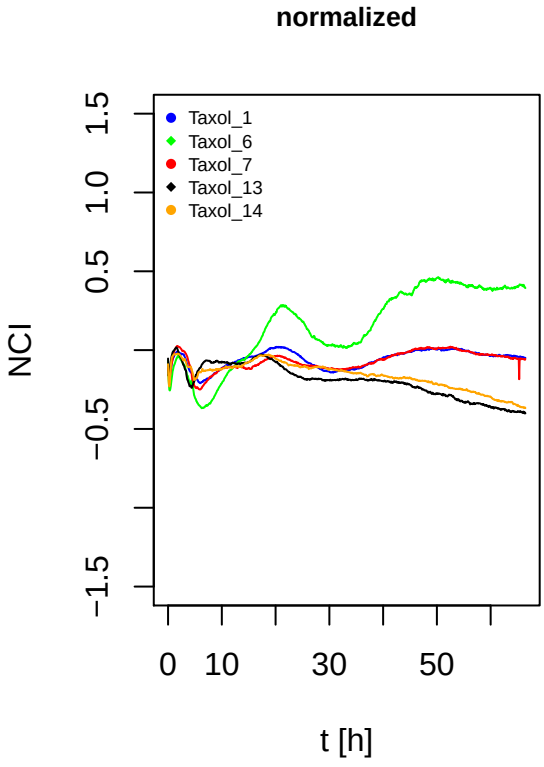

not normalized
Soraphen_4
Soraphen_5
Soraphen_8
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

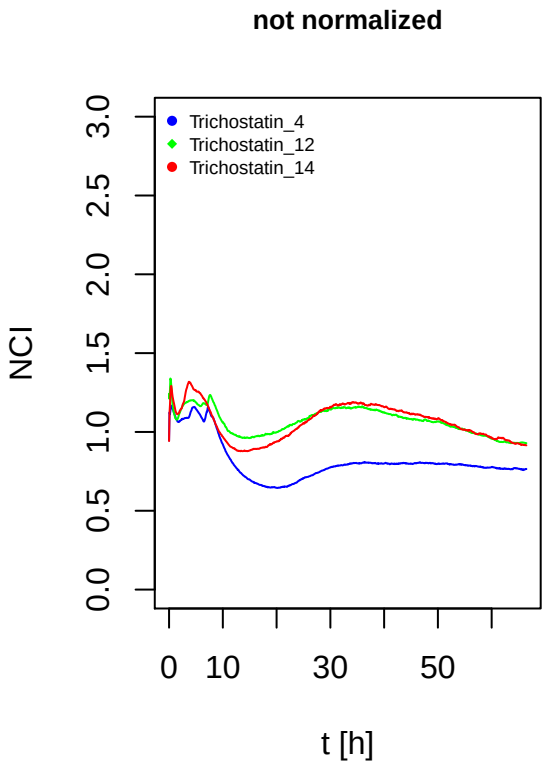

normalized
Soraphen_4
Soraphen_5
Soraphen_8
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

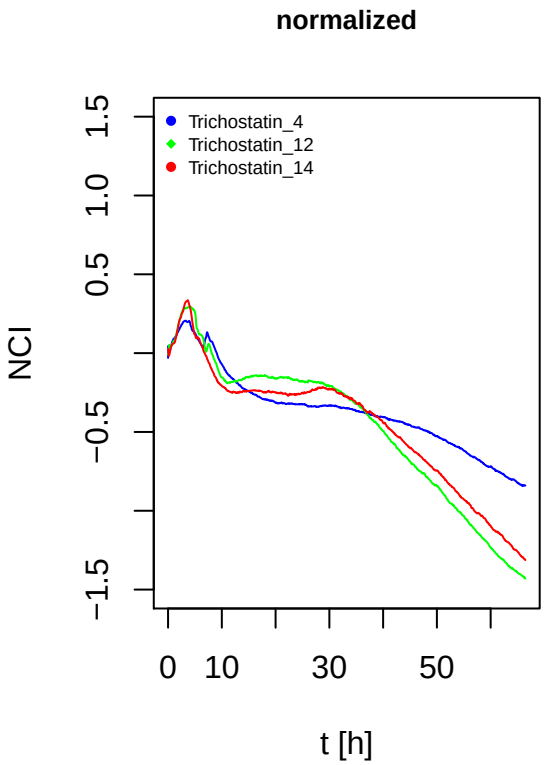

not normalized
Staurosporine_3
Staurosporine_14
Staurosporine_16
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

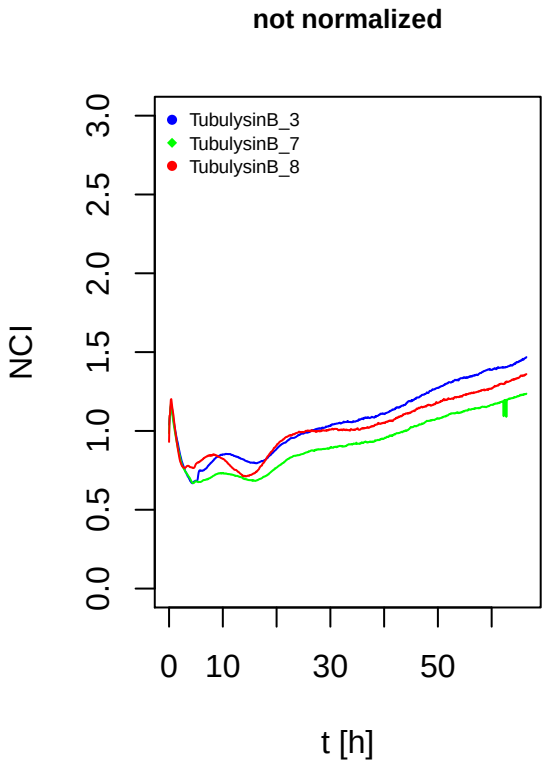

normalized
Staurosporine_3
Staurosporine_14
Staurosporine_16
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

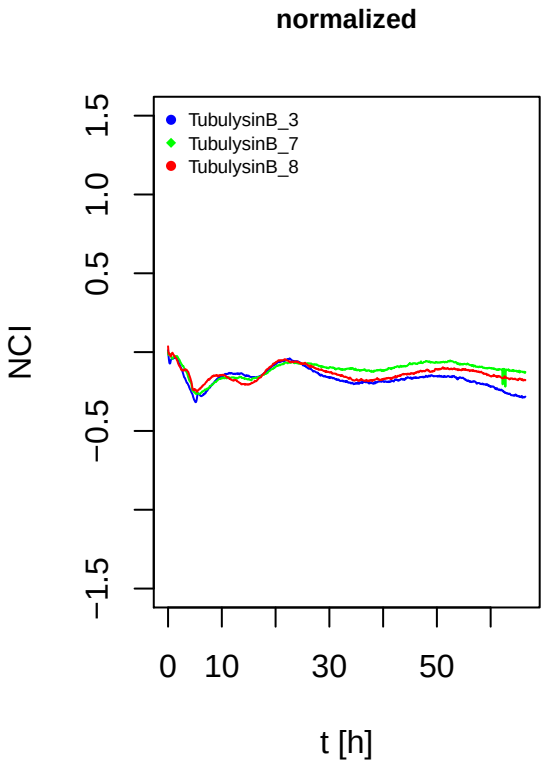

not normalized
Taxol_1
Taxol_6
Taxol_7
Taxol_13
Taxol_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

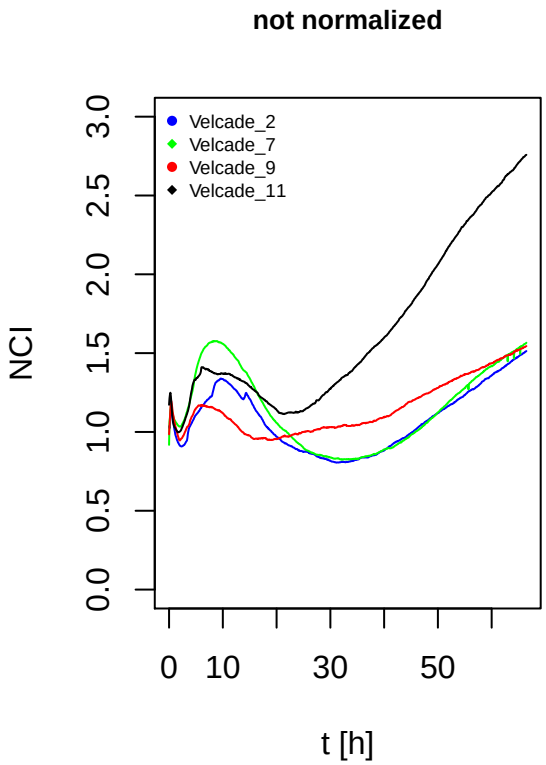

normalized
Taxol_1
Taxol_6
Taxol_7
Taxol_13
Taxol_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

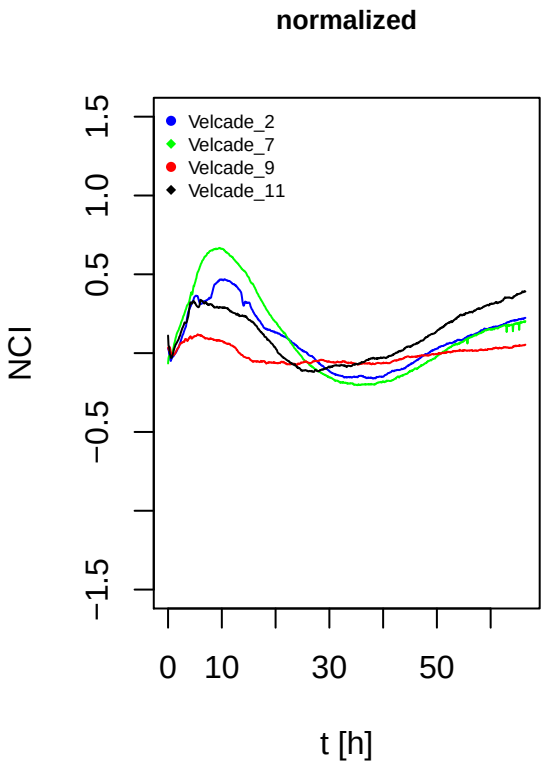

not normalized
Trichostatin_4
Trichostatin_12
Trichostatin_14
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

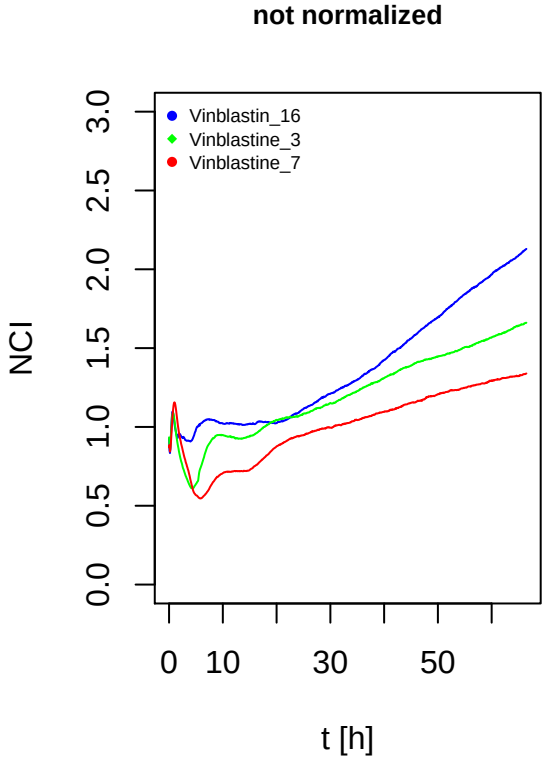

normalized
Trichostatin_4
Trichostatin_12
Trichostatin_14
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]

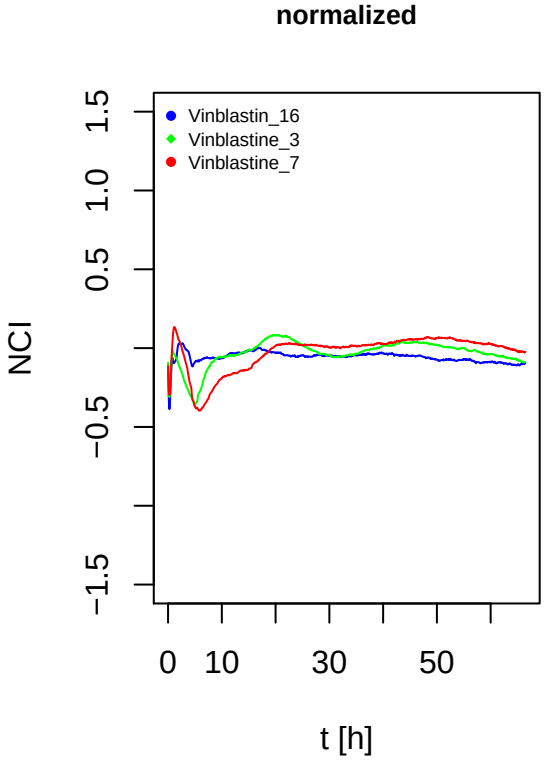

not normalized
TubulysinB_3
TubulysinB_7
TubulysinB_8
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]

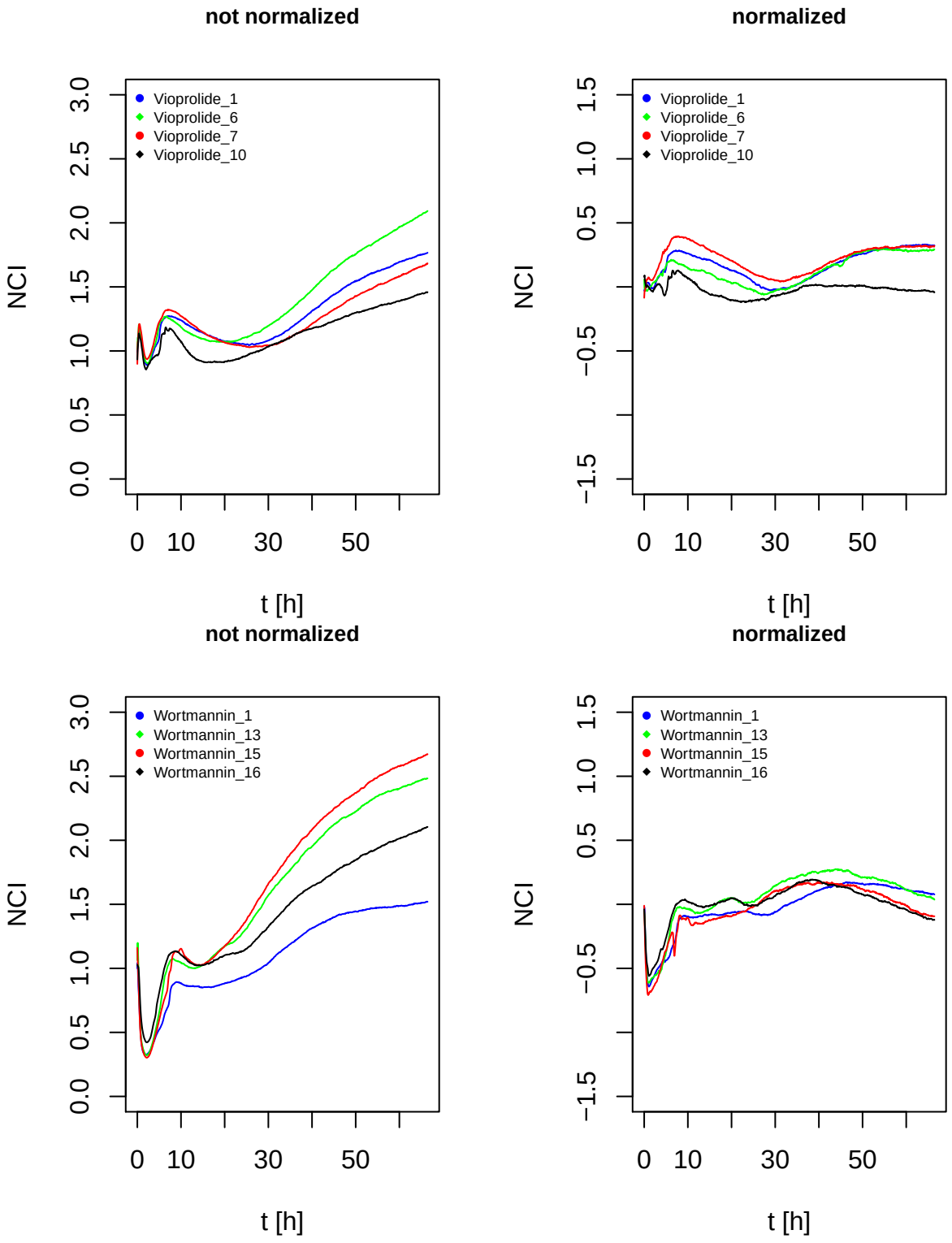

normalized
TubulysinB_3
TubulysinB_7
TubulysinB_8
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Velcade_2
Velcade_7
Velcade_9
Velcade_11
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Velcade_2
Velcade_7
Velcade_9
Velcade_11
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]


not normalized
Vinblastin_16
Vinblastine_3
Vinblastine_7
NCI
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
10
30
50
t [h]


normalized
Vinblastin_16
Vinblastine_3
Vinblastine_7
NCI
−1.5
−0.5
0.5
1.0
1.5
0
10
30
50
t [h]



In the case where more than one biological replicate or one compound was round to be below the threshold, the one the deviates the most (judged by visual inspection of the plots) is removed from the data.

E.g. Archazolid: The replicate from run 13 is very close to the DMSO control, run 3 and 6 show more effect. Therefore ArchazolidB_13 is removed (see below).

```
my_outliers_selected <- c("Apicularen_1", "ArchazolidB_13", "ArgyrinA_4", "Camptothecin_4", "Colchicine_

ma <- match(my_outliers_selected, colnames(median.combined.ordered))
median.combined.edited <- median.combined.ordered[, -ma]


#calculate cubic smoothing splines

median.sp.edited<-matrix(ncol=22, nrow=192)
row.names(median.sp.edited)<-newrownames$V1[-ma]
t<-rownames(median.combined.edited)
t<-as.numeric(t)

i<-0
repeat{
  i<-i+1
  temp<-smooth.spline(x=t, y= median.combined.edited[,i], nknots=20)
  median.sp.edited[i,]<-temp$fit$coef
  if (i==192) break
}



median.sp.edited.scaled <- scale(median.sp.edited, center = FALSE, scale = TRUE)
res <- score1.function(median.sp.edited.scaled, "euclidean")
euclidean.scaled <- sum(res$normscore)/i
cat(paste0("Euclidean.scaled after removal of outliers: ", round(euclidean.scaled, 3)))
```

```
## Euclidean.scaled after removal of outliers: 0.647
```

```
group.score <- c()

for(i in 1:length(groupmatch)){

  ma <- grep(groupmatch[i], res$rep)
  gscore <- sum(res$normscore[ma])/length(ma)
  group.score <- c(group.score, gscore)

}
group.result <- data.frame(groupmatch,group.score)
group.result <- group.result[order(-group.result$group.score),]
kable(group.result)
```

	groupmatch	group.score
8	Apicularen	1.0000000
10	ArgyrinA	1.0000000
13	Cerulenin	1.0000000
14	Chelerythrine	1.0000000
16	Colchicine	1.0000000
27	H89	1.0000000
29	LY294002	1.0000000
30	Methotrexate	1.0000000
35	Neopeltolide	1.0000000
39	Oxamflatin	1.0000000

	groupmatch	group.score
47	SaframycinMx1	1.0000000
53	Staurosporine	1.0000000
55	Trichostatin	1.0000000
56	TubulysinB	1.0000000
60	Wortmannin	1.0000000
1	A23187	0.9523810
23	EpothiloneB	0.9523810
18	Cycloheximide	0.9304348
28	Indirubin3monoxime	0.8484848
40	PD169316	0.8484848
2	ActinomycinD	0.8333333
59	Vioprolide	0.8333333
5	Anisomycin	0.8320261
7	Apicidin	0.8055556
19	CyclosporinA	0.7777778
20	Cytochalasin	0.7619048
4	Amanitin	0.7023810
44	Rapamycin	0.6944444
3	Alsterpaullone	0.6835017
41	Podophyllotoxin	0.6631485
50	Scriptaid	0.6395604
49	SB203580	0.6392857
17	CruentarenA	0.6250000
42	Puromycin	0.6110276
15	ChondramidC	0.5865801
51	Simvastatin	0.5578866
57	Velcade	0.5544890
31	Mevastatin	0.5500000
36	Nocodazol	0.5454981
58	Vinblastin	0.5440476
43	PurvalanolA	0.5438596
37	OkadaicAcid	0.5435235
22	Emetine	0.5158730
11	Camptothecin	0.5142857
46	Rhizopodin	0.4989508
24	Etoposide	0.4779202
32	MG132	0.4687747
48	SB202190	0.3631785
6	Aphidicolin	0.3492424
26	Griseofulvin	0.3425232
52	Soraphen	0.3399933
33	Myriaporone	0.3336412
54	Taxol	0.3334500
34	MyxothiazolA	0.2868851
12	CCCP	0.2359447
21	Doxorubicin	0.1784604
9	ArchazolidB	0.1758621
25	GephyronicAcidA	0.1675484
45	RatjadonC	0.1181932
38	Oligomycin	0.0831636

With the improved data the medians of the biological replicates is calculated.

```
#Calculate medians of medians
median.combined.median<-matrix(ncol=60, nrow=800)
colnames(median.combined.median)<-groupmatch
rownames(median.combined.median)<-row.names(median.combined.edited)
i<-0
repeat{
  i<-i+1

  name<-groupmatch[i]
  ma<-grep(groupmatch[i], colnames(median.combined.edited))
  z<-median.combined.edited[,ma]
  median.combined.median[,i]<-apply(z, 1, median)

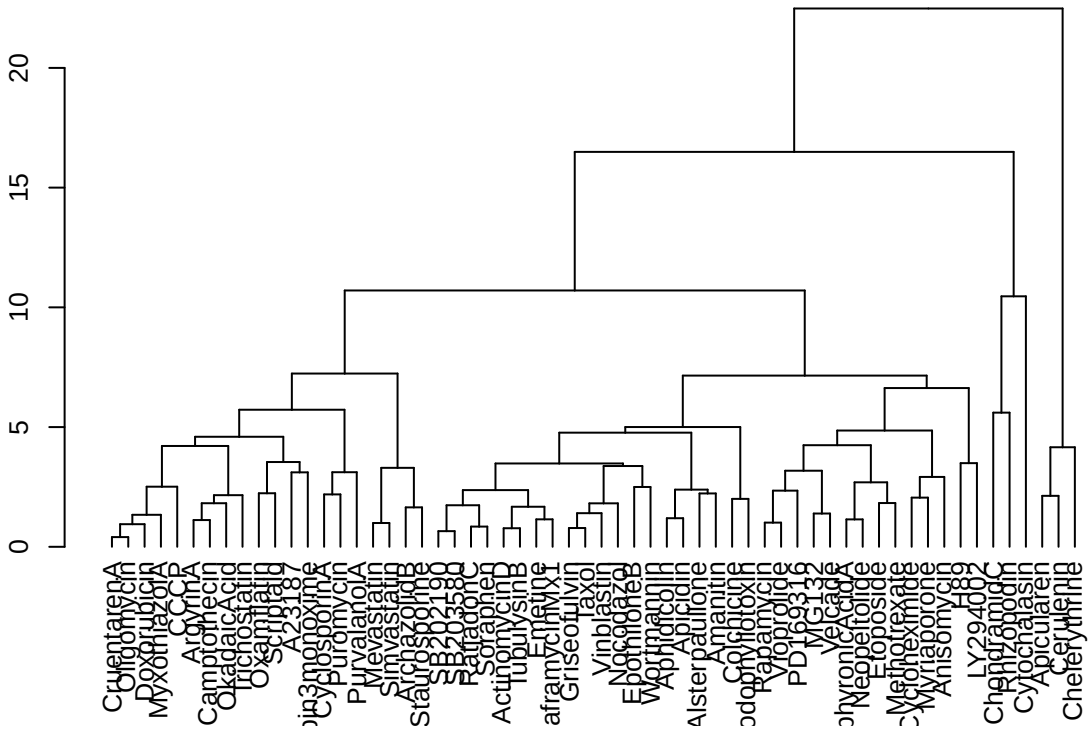
  if (i==60) break
}


#smoothing splines for median.combined
xmedian.combined<-matrix(ncol=22, nrow=60)
row.names(xmedian.combined)<-colnames(median.combined.median)
t<-rownames(median.combined.median)
t<-as.numeric(t)

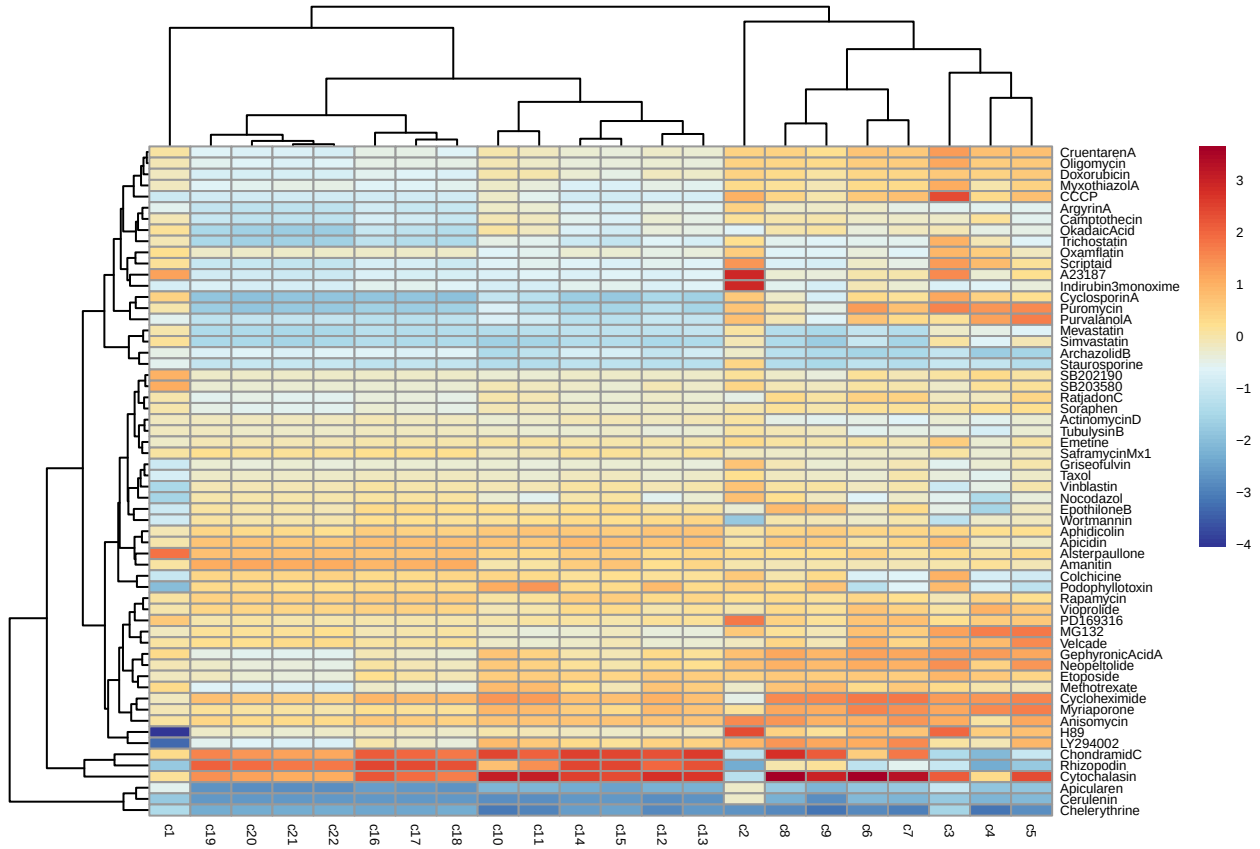

i<-0
repeat{
  i<-i+1
  temp<-smooth.spline(x=t, y= median.combined.median[,i], nknots=20)
  xmedian.combined[i,]<-temp$fit$coef
  if (i==60) break
}


#Scaling
xmedian.combined.scaled <- scale(xmedian.combined, scale = TRUE, center = FALSE)
colnames(xmedian.combined.scaled) <- c("c1", "c2", "c3", "c4", "c5", "c6", "c7", "c8", "c9", "c10", "c1
                                "c12", "c13", "c14", "c15", "c16", "c17", "c18", "c19",
                                "c20", "c21", "c22")

##distmat and hierarchical clustering
xmedian.combined.distmat <- dist(xmedian.combined.scaled, method = "euclidean")
xmedian.hclust.sorted <- dendsort(hclust(xmedian.combined.distmat, method = "complete"))
par(cex = 0.8)
plot(as.dendrogram(xmedian.hclust.sorted))
```



```
#heatmap
my_color = colorRampPalette(rev(brewer.pal(n = 10, name = "RdYlBu")))(100)
pheatmap(xmedian.combined.scaled, cluster_rows = xmedian.hclust.sorted, cluster_cols = TRUE, color = my
```



Rank-based MoA prediction

```
xmedian.combined.scaled <- scale(xmedian.combined)
mydistmat <- dist(xmedian.combined.scaled, method = "euclidean")
mydistmat <- as.matrix(mydistmat)
rank.predict <- matrix(ncol=60, nrow=60)
colnames(rank.predict) <- colnames(mydistmat)
rownames(rank.predict) <- c(1:60)

for (i in 1:60){
mydistmat.ordered <- mydistmat[order(mydistmat[,i]),]
rank.predict[,i] <- rownames(mydistmat.ordered)
}

rank <- 1:59
rank.predict <- rank.predict[-1,]
rank.predict <- as.data.frame(cbind(rank, rank.predict))


write.csv2(rank.predict, "rankpredict.csv")
rank.predict
```

```
##    rank             A23187       ActinomycinD     Alsterpaullone
## 2     1          Scriptaid         TubulysinB          Rapamycin
## 3     2 Indirubin3monoxime              Taxol           Amanitin
## 4     3       MyxothiazolA      SaframycinMx1           Apicidin
## 5     4         Oxamflatin       Griseofulvin        Aphidicolin
## 6     5         Oligomycin             Emetine         Vioprolide
## 7     6               CCCP           SB202190      SaframycinMx1
## 8     7        CruentarenA           Soraphen           PD169316
## 9     8        Doxorubicin         Oxamflatin            Emetine
## 10    9           SB203580           SB203580            Velcade
## 11   10       Trichostatin         Vinblastin         Anisomycin
## 12   11           SB202190          Nocodazol           SB202190
## 13   12       Camptothecin          RatjadonC          Etoposide
## 14   13           PD169316        Colchicine           SB203580
## 15   14           Soraphen       EpothiloneB         Colchicine
## 16   15           ArgyrinA       MyxothiazolA       ActinomycinD
## 17   16        PurvalanolA         Wortmannin        EpothiloneB
## 18   17       Griseofulvin       Camptothecin               MG132
## 19   18            Emetine          Rapamycin         TubulysinB
## 20   19       CyclosporinA        Doxorubicin       Neopeltolide
## 21   20         TubulysinB           ArgyrinA        Myriaporone
## 22   21       ActinomycinD         Vioprolide           Soraphen
## 23   22              Taxol         Oligomycin         Oxamflatin
## 24   23          RatjadonC           PD169316       Methotrexate
## 25   24        OkadaicAcid        Aphidicolin          RatjadonC
## 26   25       Neopeltolide          Etoposide              Taxol
## 27   26    GephyronicAcidA       Methotrexate         Wortmannin
## 28   27          Puromycin        CruentarenA      Cycloheximide
## 29   28         Mevastatin             Velcade    GephyronicAcidA
## 30   29              MG132        ArchazolidB          Vinblastin
## 31   30          Etoposide Indirubin3monoxime          Oligomycin
## 32   31      SaframycinMx1           Scriptaid         CruentarenA
## 33   32       Methotrexate            Amanitin       Griseofulvin
```

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## 34   33        Simvastatin          Apicidin       MyxothiazolA
## 35   34            Velcade    Podophyllotoxin        Doxorubicin
## 36   35          Nocodazol     Alsterpaullone          Nocodazol
## 37   36      Staurosporine        OkadaicAcid    Podophyllotoxin
## 38   37         Vinblastin              MG132       Camptothecin
## 39   38         Colchicine      Staurosporine             A23187
## 40   39         Vioprolide       Trichostatin          Scriptaid
## 41   40          Rapamycin       Neopeltolide           ArgyrinA
## 42   41        ArchazolidB             A23187 Indirubin3monoxime
## 43   42         Anisomycin         Mevastatin               CCCP
## 44   43        EpothiloneB               CCCP           LY294002
## 45   44        Aphidicolin    GephyronicAcidA        OkadaicAcid
## 46   45     Alsterpaullone        PurvalanolA        PurvalanolA
## 47   46                H89         Anisomycin        ArchazolidB
## 48   47           Apicidin        Simvastatin       Trichostatin
## 49   48        Myriaporone        Myriaporone                H89
## 50   49    Podophyllotoxin           LY294002        ChondramidC
## 51   50           LY294002                H89      Staurosporine
## 52   51         Wortmannin       CyclosporinA         Mevastatin
## 53   52           Amanitin      Cycloheximide         Rhizopodin
## 54   53      Cycloheximide          Puromycin        Simvastatin
## 55   54         Apicularen         Rhizopodin          Puromycin
## 56   55          Cerulenin         Apicularen       CyclosporinA
## 57   56      Chelerythrine        ChondramidC       Cytochalasin
## 58   57        ChondramidC          Cerulenin         Apicularen
## 59   58         Rhizopodin      Chelerythrine          Cerulenin
## 60   59       Cytochalasin       Cytochalasin      Chelerythrine
##              Amanitin         Anisomycin        Aphidicolin
## 2           Rapamycin       Neopeltolide           Apicidin
## 3            Apicidin        Myriaporone          Rapamycin
## 4      Alsterpaullone        Aphidicolin         Vioprolide
## 5          Vioprolide          Etoposide          Etoposide
## 6         Aphidicolin           PD169316           Emetine
## 7       SaframycinMx1           Apicidin      SaframycinMx1
## 8          Colchicine      Cycloheximide     Alsterpaullone
## 9              Emetine          Rapamycin          Anisomycin
## 10        EpothiloneB    GephyronicAcidA           Amanitin
## 11           Velcade         Vioprolide           PD169316
## 12        Wortmannin     Alsterpaullone         Colchicine
## 13       ActinomycinD            Velcade        EpothiloneB
## 14        Vinblastin            Emetine       Neopeltolide
## 15          PD169316              MG132       Methotrexate
## 16         Etoposide       Methotrexate            Velcade
## 17        Anisomycin           Amanitin        Myriaporone
## 18              Taxol        EpothiloneB         Vinblastin
## 19        TubulysinB      SaframycinMx1         Wortmannin
## 20          SB202190         Oligomycin           Soraphen
## 21         Nocodazol         Colchicine               Taxol
## 22    Podophyllotoxin        CruentarenA           SB202190
## 23              MG132         Vinblastin       ActinomycinD
## 24          SB203580        Doxorubicin           SB203580
## 25        Oxamflatin           Soraphen          RatjadonC
## 26       Griseofulvin          RatjadonC    GephyronicAcidA
## 27           Soraphen           SB203580    Podophyllotoxin
```

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## 28          RatjadonC           LY294002        TubulysinB
## 29      Cycloheximide           SB202190      Cycloheximide
## 30        Myriaporone              Taxol             MG132
## 31       Neopeltolide       MyxothiazolA         Oligomycin
## 32       Methotrexate    Podophyllotoxin       Griseofulvin
## 33         Oligomycin       Griseofulvin        Doxorubicin
## 34       MyxothiazolA        TubulysinB        CruentarenA
## 35        Doxorubicin       ActinomycinD         Oxamflatin
## 36    GephyronicAcidA          Nocodazol          Nocodazol
## 37        CruentarenA         Oxamflatin       MyxothiazolA
## 38       Camptothecin         Wortmannin           LY294002
## 39 Indirubin3monoxime                H89       Camptothecin
## 40           LY294002               CCCP           ArgyrinA
## 41           ArgyrinA             A23187          Scriptaid
## 42          Scriptaid       Camptothecin               CCCP
## 43         Rhizopodin          Scriptaid                H89
## 44                H89 Indirubin3monoxime Indirubin3monoxime
## 45               CCCP           ArgyrinA             A23187
## 46        ArchazolidB        PurvalanolA        OkadaicAcid
## 47             A23187        OkadaicAcid        PurvalanolA
## 48        ChondramidC       Trichostatin       Trichostatin
## 49        OkadaicAcid        ChondramidC        ArchazolidB
## 50        PurvalanolA       Cytochalasin        ChondramidC
## 51      Staurosporine          Puromycin      Staurosporine
## 52       Trichostatin        ArchazolidB         Mevastatin
## 53         Mevastatin      Staurosporine         Rhizopodin
## 54        Simvastatin         Mevastatin          Puromycin
## 55          Puromycin       CyclosporinA        Simvastatin
## 56       CyclosporinA         Rhizopodin       CyclosporinA
## 57       Cytochalasin        Simvastatin       Cytochalasin
## 58         Apicularen         Apicularen         Apicularen
## 59          Cerulenin          Cerulenin          Cerulenin
## 60      Chelerythrine      Chelerythrine      Chelerythrine
##              Apicidin         Apicularen        ArchazolidB
## 2         Aphidicolin          Cerulenin      Staurosporine
## 3           Rapamycin      Chelerythrine         Mevastatin
## 4           Amanitin         Simvastatin        Simvastatin
## 5      Alsterpaullone         Mevastatin           ArgyrinA
## 6          Vioprolide      Staurosporine         TubulysinB
## 7          Colchicine       CyclosporinA       ActinomycinD
## 8       SaframycinMx1       Trichostatin              Taxol
## 9           Etoposide        ArchazolidB       Griseofulvin
## 10         Anisomycin        OkadaicAcid       Camptothecin
## 11            Emetine           ArgyrinA          Nocodazol
## 12        EpothiloneB       Camptothecin       Trichostatin
## 13    Podophyllotoxin          Puromycin         Oxamflatin
## 14           PD169316          Scriptaid Indirubin3monoxime
## 15            Velcade        PurvalanolA        OkadaicAcid
## 16         Wortmannin Indirubin3monoxime           SB202190
## 17        Myriaporone             A23187          Soraphen
## 18      Cycloheximide       Griseofulvin         Vinblastin
## 19       Neopeltolide       MyxothiazolA           SB203580
## 20       Methotrexate         TubulysinB      SaframycinMx1
## 21         Vinblastin               CCCP          Scriptaid
```

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## 22       ActinomycinD         Oxamflatin          RatjadonC
## 23             Taxol           Soraphen       MyxothiazolA
## 24        TubulysinB       ActinomycinD           Emetine
## 25          SB202190       Doxorubicin         Wortmannin
## 26          SB203580             Taxol        EpothiloneB
## 27          Soraphen         RatjadonC        Doxorubicin
## 28         Nocodazol          SB203580         Colchicine
## 29         RatjadonC          SB202190         Oligomycin
## 30             MG132        Oligomycin              A23187
## 31    GephyronicAcidA         Nocodazol        PurvalanolA
## 32       Oxamflatin       CruentarenA       CyclosporinA
## 33      Griseofulvin        Vinblastin        CruentarenA
## 34        Oligomycin           Emetine       Methotrexate
## 35       CruentarenA     SaframycinMx1               CCCP
## 36       Doxorubicin       Methotrexate          Rapamycin
## 37      MyxothiazolA         Wortmannin    Podophyllotoxin
## 38          LY294002        EpothiloneB          PD169316
## 39      Camptothecin         Colchicine         Vioprolide
## 40              H89          PD169316           Velcade
## 41             CCCP            Velcade         Apicularen
## 42         ArgyrinA              MG132          Etoposide
## 43         Scriptaid          Etoposide        Aphidicolin
## 44 Indirubin3monoxime                H89           Amanitin
## 45            A23187    GephyronicAcidA              MG132
## 46       ChondramidC       Neopeltolide     Alsterpaullone
## 47       OkadaicAcid    Podophyllotoxin          Apicidin
## 48        Rhizopodin           LY294002          Puromycin
## 49       ArchazolidB        Vioprolide         Cerulenin
## 50      Trichostatin          Rapamycin       Neopeltolide
## 51       PurvalanolA       Aphidicolin    GephyronicAcidA
## 52     Staurosporine     Alsterpaullone      Chelerythrine
## 53        Mevastatin           Amanitin                H89
## 54      Cytochalasin           Apicidin           LY294002
## 55       Simvastatin       Myriaporone          Anisomycin
## 56         Puromycin         Anisomycin       Myriaporone
## 57      CyclosporinA      Cycloheximide      Cycloheximide
## 58        Apicularen         Rhizopodin         Rhizopodin
## 59         Cerulenin        ChondramidC        ChondramidC
## 60     Chelerythrine       Cytochalasin       Cytochalasin
##             ArgyrinA       Camptothecin               CCCP
## 2       Camptothecin           ArgyrinA         Oligomycin
## 3        OkadaicAcid        OkadaicAcid       MyxothiazolA
## 4       Trichostatin           Soraphen        CruentarenA
## 5       Griseofulvin        Doxorubicin        Doxorubicin
## 6           Soraphen       Trichostatin          Scriptaid
## 7       Doxorubicin          RatjadonC        PurvalanolA
## 8             Taxol       MyxothiazolA           Soraphen
## 9        TubulysinB       Griseofulvin              A23187
## 10      MyxothiazolA           SB203580          Puromycin
## 11         RatjadonC          Scriptaid       Neopeltolide
## 12         Scriptaid         Oligomycin       Trichostatin
## 13        Mevastatin           SB202190       Camptothecin
## 14      ActinomycinD              Taxol    GephyronicAcidA
## 15 Indirubin3monoxime        TubulysinB          RatjadonC
```

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## 16      Staurosporine        CruentarenA         Oxamflatin
## 17           SB203580       ActinomycinD             MG132
## 18           SB202190        Oxamflatin       Griseofulvin
## 19         Oligomycin       Methotrexate           ArgyrinA
## 20         Oxamflatin           Emetine            Emetine
## 21        CruentarenA       PurvalanolA            Velcade
## 22        PurvalanolA         Mevastatin           SB202190
## 23        ArchazolidB Indirubin3monoxime          Etoposide
## 24         Vinblastin        Vinblastin       CyclosporinA
## 25             Emetine              CCCP              Taxol
## 26          Nocodazol      Staurosporine                H89
## 27         Simvastatin      SaframycinMx1           SB203580
## 28        Methotrexate          Etoposide           PD169316
## 29                CCCP            A23187        OkadaicAcid
## 30             A23187         Nocodazol       Methotrexate
## 31      SaframycinMx1        Simvastatin Indirubin3monoxime
## 32       CyclosporinA        ArchazolidB         TubulysinB
## 33       EpothiloneB           PD169316       ActinomycinD
## 34         Etoposide       CyclosporinA         Vinblastin
## 35         Wortmannin       EpothiloneB      SaframycinMx1
## 36           PD169316         Wortmannin           LY294002
## 37         Colchicine    GephyronicAcidA          Nocodazol
## 38          Puromycin       Neopeltolide         Vioprolide
## 39       Neopeltolide            Velcade         Colchicine
## 40             Velcade          Puromycin         Mevastatin
## 41    GephyronicAcidA         Vioprolide        Myriaporone
## 42         Vioprolide         Colchicine       EpothiloneB
## 43          Rapamycin              MG132        Aphidicolin
## 44              MG132          Rapamycin         Anisomycin
## 45        Aphidicolin        Aphidicolin        Simvastatin
## 46           LY294002           LY294002          Rapamycin
## 47    Podophyllotoxin    Podophyllotoxin      Staurosporine
## 48                H89           Apicidin    Podophyllotoxin
## 49           Apicidin     Alsterpaullone         Wortmannin
## 50     Alsterpaullone        Myriaporone           Apicidin
## 51         Anisomycin         Anisomycin        ArchazolidB
## 52        Myriaporone                H89     Alsterpaullone
## 53           Amanitin           Amanitin           Amanitin
## 54         Apicularen      Cycloheximide      Cycloheximide
## 55      Cycloheximide         Apicularen         Apicularen
## 56          Cerulenin          Cerulenin          Cerulenin
## 57      Chelerythrine      Chelerythrine      Chelerythrine
## 58         Rhizopodin        ChondramidC        ChondramidC
## 59        ChondramidC         Rhizopodin         Rhizopodin
## 60       Cytochalasin       Cytochalasin       Cytochalasin
##             Cerulenin      Chelerythrine        ChondramidC
## 2          Apicularen          Cerulenin         Rhizopodin
## 3       Chelerythrine         Apicularen           Apicidin
## 4         Simvastatin        Simvastatin       Cytochalasin
## 5       Staurosporine      Staurosporine      Cycloheximide
## 6          Mevastatin         Mevastatin        Aphidicolin
## 7         ArchazolidB        ArchazolidB           Amanitin
## 8        CyclosporinA       Trichostatin         Anisomycin
## 9        Trichostatin       CyclosporinA     Alsterpaullone
```

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## 10           ArgyrinA        OkadaicAcid        EpothiloneB
## 11        OkadaicAcid          ArgyrinA          Rapamycin
## 12       Camptothecin       Camptothecin    Podophyllotoxin
## 13 Indirubin3monoxime          Scriptaid         Wortmannin
## 14        PurvalanolA Indirubin3monoxime        Myriaporone
## 15          Puromycin        PurvalanolA         Vioprolide
## 16          Scriptaid         TubulysinB          Etoposide
## 17       Griseofulvin          Puromycin         Colchicine
## 18         TubulysinB       ActinomycinD      SaframycinMx1
## 19              A23187       Griseofulvin       Methotrexate
## 20       MyxothiazolA              Taxol            Emetine
## 21              Taxol          Oxamflatin         Vinblastin
## 22       ActinomycinD       MyxothiazolA       Neopeltolide
## 23         Oxamflatin          Nocodazol           PD169316
## 24               CCCP           Soraphen           LY294002
## 25           Soraphen          RatjadonC          Nocodazol
## 26           Nocodazol           SB202190    GephyronicAcidA
## 27        Doxorubicin             A23187            Velcade
## 28          RatjadonC           SB203580              Taxol
## 29           SB202190        Doxorubicin         TubulysinB
## 30           SB203580               CCCP       ActinomycinD
## 31         Vinblastin         Vinblastin          RatjadonC
## 32         Oligomycin         Wortmannin           SB203580
## 33        CruentarenA         Oligomycin           SB202190
## 34             Emetine      SaframycinMx1           Soraphen
## 35      SaframycinMx1            Emetine       Griseofulvin
## 36         Wortmannin        CruentarenA              MG132
## 37        EpothiloneB        EpothiloneB         Oligomycin
## 38       Methotrexate         Colchicine        Doxorubicin
## 39         Colchicine       Methotrexate        CruentarenA
## 40                H89            Velcade         Oxamflatin
## 41             Velcade    Podophyllotoxin       MyxothiazolA
## 42           PD169316              MG132       Camptothecin
## 43              MG132           PD169316                H89
## 44          Etoposide          Etoposide           ArgyrinA
## 45    Podophyllotoxin         Vioprolide        OkadaicAcid
## 46           LY294002          Rapamycin Indirubin3monoxime
## 47         Vioprolide                H89               CCCP
## 48          Rapamycin           LY294002        ArchazolidB
## 49       Neopeltolide       Neopeltolide             A23187
## 50    GephyronicAcidA        Aphidicolin          Scriptaid
## 51        Aphidicolin    GephyronicAcidA       Trichostatin
## 52           Amanitin           Amanitin        PurvalanolA
## 53     Alsterpaullone     Alsterpaullone      Staurosporine
## 54           Apicidin           Apicidin         Mevastatin
## 55         Anisomycin        Myriaporone        Simvastatin
## 56        Myriaporone         Anisomycin          Puromycin
## 57      Cycloheximide      Cycloheximide       CyclosporinA
## 58          Rhizopodin         Rhizopodin         Apicularen
## 59        ChondramidC        ChondramidC          Cerulenin
## 60       Cytochalasin       Cytochalasin      Chelerythrine
##           Colchicine        CruentarenA      Cycloheximide
## 2     Podophyllotoxin         Oligomycin        Myriaporone
## 3              Emetine        Doxorubicin         Anisomycin
```

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## 4       SaframycinMx1       MyxothiazolA        Aphidicolin
## 5           Nocodazol           Soraphen          Apicidin
## 6           Apicidin    GephyronicAcidA       Neopeltolide
## 7        EpothiloneB          RatjadonC          Etoposide
## 8        ActinomycinD       Neopeltolide         Vioprolide
## 9        Aphidicolin               CCCP    GephyronicAcidA
## 10             Taxol          Etoposide          Rapamycin
## 11         Vinblastin           SB202190           Velcade
## 12         Rapamycin           SB203580     Alsterpaullone
## 13        TubulysinB            Emetine              MG132
## 14          Amanitin              MG132          PD169316
## 15      Griseofulvin          Scriptaid          Amanitin
## 16         Etoposide           Velcade       Methotrexate
## 17         Vioprolide       Methotrexate           Emetine
## 18         Oxamflatin         Oxamflatin        EpothiloneB
## 19           Soraphen          PD169316      SaframycinMx1
## 20           SB202190      Camptothecin           LY294002
## 21        Wortmannin       Griseofulvin        CruentarenA
## 22          PD169316              Taxol         Oligomycin
## 23          SB203580        PurvalanolA          RatjadonC
## 24     Alsterpaullone         Vioprolide         Colchicine
## 25          RatjadonC        TubulysinB         Wortmannin
## 26       Methotrexate          ArgyrinA           Soraphen
## 27       MyxothiazolA       ActinomycinD        Doxorubicin
## 28            Velcade      SaframycinMx1    Podophyllotoxin
## 29         Oligomycin             A23187        Vinblastin
## 30         Anisomycin        Myriaporone           SB202190
## 31        Doxorubicin        OkadaicAcid           SB203580
## 32       Neopeltolide       Trichostatin       MyxothiazolA
## 33        CruentarenA         Vinblastin       Cytochalasin
## 34              MG132        Aphidicolin              Taxol
## 35      Camptothecin          Rapamycin       ActinomycinD
## 36          ArgyrinA         Anisomycin         TubulysinB
## 37    GephyronicAcidA        EpothiloneB       Griseofulvin
## 38 Indirubin3monoxime          Puromycin          Oxamflatin
## 39          Scriptaid Indirubin3monoxime                H89
## 40        Myriaporone          Nocodazol          Nocodazol
## 41                H89         Colchicine               CCCP
## 42               CCCP           LY294002       ChondramidC
## 43          LY294002         Wortmannin       Camptothecin
## 44        ArchazolidB           Apicidin          Scriptaid
## 45             A23187     Alsterpaullone        PurvalanolA
## 46      Cycloheximide       CyclosporinA           ArgyrinA
## 47        OkadaicAcid                H89             A23187
## 48       Trichostatin         Mevastatin        OkadaicAcid
## 49      Staurosporine    Podophyllotoxin Indirubin3monoxime
## 50        PurvalanolA           Amanitin          Rhizopodin
## 51         Mevastatin      Cycloheximide       Trichostatin
## 52        Simvastatin        Simvastatin          Puromycin
## 53         Rhizopodin      Staurosporine        ArchazolidB
## 54       CyclosporinA         ArchazolidB       CyclosporinA
## 55          Puromycin          Apicularen         Mevastatin
## 56        ChondramidC        ChondramidC      Staurosporine
## 57       Cytochalasin          Rhizopodin        Simvastatin
```

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## 58         Apicularen          Cerulenin         Apicularen
## 59          Cerulenin       Cytochalasin          Cerulenin
## 60      Chelerythrine      Chelerythrine      Chelerythrine
##          CyclosporinA       Cytochalasin        Doxorubicin
## 2           Puromycin      Cycloheximide         Oligomycin
## 3         Trichostatin        ChondramidC        CruentarenA
## 4         PurvalanolA        Myriaporone           Soraphen
## 5         Simvastatin         Anisomycin       MyxothiazolA
## 6          Mevastatin           Apicidin          RatjadonC
## 7           Scriptaid        Aphidicolin       Camptothecin
## 8         OkadaicAcid       Neopeltolide           SB203580
## 9        Camptothecin          Etoposide           SB202190
## 10           ArgyrinA     Alsterpaullone            Emetine
## 11               CCCP    GephyronicAcidA       Griseofulvin
## 12             A23187          Rapamycin       Methotrexate
## 13       MyxothiazolA         Vioprolide          Scriptaid
## 14      Staurosporine           Amanitin          Etoposide
## 15        Doxorubicin          LY294002         Oxamflatin
## 16        CruentarenA       Methotrexate              Taxol
## 17         Oligomycin            Velcade       Neopeltolide
## 18           Soraphen         Rhizopodin               CCCP
## 19 Indirubin3monoxime        EpothiloneB    GephyronicAcidA
## 20         Oxamflatin           PD169316           ArgyrinA
## 21          RatjadonC    Podophyllotoxin           PD169316
## 22           SB203580              MG132         TubulysinB
## 23           SB202190             Emetine       ActinomycinD
## 24       Griseofulvin          Colchicine            Velcade
## 25        ArchazolidB         Wortmannin         PurvalanolA
## 26              Taxol      SaframycinMx1              MG132
## 27         TubulysinB        CruentarenA         OkadaicAcid
## 28         Apicularen         Oligomycin      SaframycinMx1
## 29       ActinomycinD          RatjadonC          Vinblastin
## 30            Emetine         Vinblastin        Trichostatin
## 31       Methotrexate        Doxorubicin          Vioprolide
## 32    GephyronicAcidA           Soraphen             A23187
## 33              MG132           SB203580         EpothiloneB
## 34            Velcade           SB202190         Aphidicolin
## 35       Neopeltolide                H89           Rapamycin
## 36           PD169316              Taxol Indirubin3monoxime
## 37         Vinblastin       MyxothiazolA           Nocodazol
## 38          Etoposide       ActinomycinD         Myriaporone
## 39          Nocodazol         TubulysinB         Wortmannin
## 40      SaframycinMx1          Nocodazol          Colchicine
## 41                H89       Griseofulvin           LY294002
## 42          Cerulenin         Oxamflatin          Anisomycin
## 43         Vioprolide               CCCP           Puromycin
## 44        EpothiloneB       Camptothecin        CyclosporinA
## 45         Wortmannin             A23187           Apicidin
## 46           LY294002          Scriptaid         Mevastatin
## 47         Colchicine           ArgyrinA      Alsterpaullone
## 48          Rapamycin         OkadaicAcid                H89
## 49        Aphidicolin         PurvalanolA     Podophyllotoxin
## 50        Myriaporone Indirubin3monoxime       Staurosporine
## 51         Anisomycin       Trichostatin         Simvastatin
```

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## 52     Alsterpaullone          Puromycin        ArchazolidB
## 53    Podophyllotoxin        ArchazolidB           Amanitin
## 54           Apicidin       CyclosporinA      Cycloheximide
## 55      Chelerythrine         Mevastatin         Apicularen
## 56           Amanitin      Staurosporine        ChondramidC
## 57      Cycloheximide        Simvastatin          Cerulenin
## 58        ChondramidC         Apicularen         Rhizopodin
## 59         Rhizopodin          Cerulenin       Cytochalasin
## 60       Cytochalasin      Chelerythrine      Chelerythrine
##               Emetine        EpothiloneB          Etoposide
## 2       SaframycinMx1         Vinblastin       Neopeltolide
## 3               Taxol         Nocodazol        Aphidicolin
## 4        ActinomycinD            Emetine       Methotrexate
## 5            Soraphen              Taxol    GephyronicAcidA
## 6          TubulysinB      SaframycinMx1            Emetine
## 7            SB202190         TubulysinB           PD169316
## 8           RatjadonC         Wortmannin         Vioprolide
## 9        Griseofulvin         Colchicine         Oligomycin
## 10           SB203580       ActinomycinD          Rapamycin
## 11          Etoposide        Aphidicolin        CruentarenA
## 12          Rapamycin          Rapamycin       Doxorubicin
## 13         Vinblastin          RatjadonC       Myriaporone
## 14         Oxamflatin       Griseofulvin          Soraphen
## 15         Colchicine           Soraphen         Anisomycin
## 16        Aphidicolin            Apicidin          RatjadonC
## 17         Vioprolide          Etoposide      SaframycinMx1
## 18       MyxothiazolA       Methotrexate           Apicidin
## 19        EpothiloneB         Vioprolide            Velcade
## 20         Oligomycin    Podophyllotoxin           SB203580
## 21        Doxorubicin           SB203580           SB202190
## 22           PD169316           SB202190       MyxothiazolA
## 23            Velcade            Amanitin              MG132
## 24          Nocodazol           PD169316              Taxol
## 25       Methotrexate       MyxothiazolA        EpothiloneB
## 26        CruentarenA        Doxorubicin         Vinblastin
## 27       Neopeltolide            Velcade         Colchicine
## 28           Apicidin         Oligomycin       Griseofulvin
## 29         Wortmannin       Neopeltolide       ActinomycinD
## 30              MG132         Anisomycin         Oxamflatin
## 31       Camptothecin         Oxamflatin         TubulysinB
## 32     Alsterpaullone     Alsterpaullone     Alsterpaullone
## 33           Amanitin        CruentarenA         Wortmannin
## 34    GephyronicAcidA       Camptothecin       Camptothecin
## 35    Podophyllotoxin           ArgyrinA           LY294002
## 36           ArgyrinA           LY294002    Podophyllotoxin
## 37         Anisomycin    GephyronicAcidA      Cycloheximide
## 38          Scriptaid              MG132           Amanitin
## 39               CCCP        Myriaporone          Nocodazol
## 40        Myriaporone Indirubin3monoxime               CCCP
## 41 Indirubin3monoxime        OkadaicAcid          Scriptaid
## 42             A23187              CCCP           ArgyrinA
## 43        OkadaicAcid        ArchazolidB             A23187
## 44           LY294002      Cycloheximide                H89
## 45       Trichostatin          Scriptaid        OkadaicAcid
```

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## 46        PurvalanolA               H89 Indirubin3monoxime
## 47        ArchazolidB       Trichostatin        PurvalanolA
## 48                H89            A23187       Trichostatin
## 49      Cycloheximide      Staurosporine          Puromycin
## 50      Staurosporine        PurvalanolA        ArchazolidB
## 51         Mevastatin         Mevastatin         Mevastatin
## 52        Simvastatin        Simvastatin      Staurosporine
## 53          Puromycin       CyclosporinA       CyclosporinA
## 54       CyclosporinA       ChondramidC        Simvastatin
## 55         Rhizopodin          Puromycin       ChondramidC
## 56       ChondramidC         Rhizopodin         Rhizopodin
## 57        Apicularen       Cytochalasin       Cytochalasin
## 58       Cytochalasin        Apicularen        Apicularen
## 59          Cerulenin          Cerulenin          Cerulenin
## 60      Chelerythrine      Chelerythrine      Chelerythrine
##       GephyronicAcidA       Griseofulvin                H89
## 2        Neopeltolide              Taxol           LY294002
## 3           Etoposide         TubulysinB               CCCP
## 4         CruentarenA         Vinblastin         Oligomycin
## 5         Myriaporone       ActinomycinD         Vinblastin
## 6           Oligomycin           Soraphen       Neopeltolide
## 7         Doxorubicin          Nocodazol        CruentarenA
## 8           PD169316            Emetine              MG132
## 9        Methotrexate          RatjadonC       Griseofulvin
## 10             MG132       MyxothiazolA          Etoposide
## 11            Velcade           SB203580       MyxothiazolA
## 12          Anisomycin           SB202190       Doxorubicin
## 13           Soraphen           ArgyrinA          Nocodazol
## 14       MyxothiazolA         Oxamflatin            Emetine
## 15          RatjadonC        Doxorubicin              Taxol
## 16         Vioprolide      SaframycinMx1         Colchicine
## 17            Emetine       Camptothecin    GephyronicAcidA
## 18        Aphidicolin          Oligomycin    Podophyllotoxin
## 19           SB203580 Indirubin3monoxime           PD169316
## 20           SB202190        EpothiloneB            Velcade
## 21               CCCP        CruentarenA Indirubin3monoxime
## 22          Rapamycin           PD169316         Anisomycin
## 23      Cycloheximide         Colchicine           Soraphen
## 24         Oxamflatin          Scriptaid          Scriptaid
## 25      SaframycinMx1         Wortmannin         Vioprolide
## 26           LY294002          Rapamycin         Oxamflatin
## 27      Camptothecin          Etoposide          RatjadonC
## 28       Griseofulvin         Vioprolide        Aphidicolin
## 29           Apicidin       Methotrexate        Myriaporone
## 30              Taxol            Velcade        EpothiloneB
## 31          Scriptaid        Aphidicolin        PurvalanolA
## 32     Alsterpaullone              MG132          Rapamycin
## 33         Vinblastin        OkadaicAcid       ActinomycinD
## 34        EpothiloneB        PurvalanolA      SaframycinMx1
## 35         TubulysinB        ArchazolidB         TubulysinB
## 36       ActinomycinD               CCCP           ArgyrinA
## 37        PurvalanolA       Neopeltolide       Methotrexate
## 38             A23187       Trichostatin       Camptothecin
## 39         Colchicine      Staurosporine             A23187
```

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## 40           ArgyrinA            A23187          Apicidin
## 41         Wortmannin    Podophyllotoxin          SB202190
## 42        OkadaicAcid    GephyronicAcidA          SB203580
## 43                H89        Mevastatin       Trichostatin
## 44          Nocodazol          Apicidin         Wortmannin
## 45           Amanitin          LY294002          Amanitin
## 46    Podophyllotoxin          Amanitin      Cycloheximide
## 47       Trichostatin     Alsterpaullone          Puromycin
## 48 Indirubin3monoxime               H89        OkadaicAcid
## 49          Puromycin         Anisomycin     Alsterpaullone
## 50       CyclosporinA        Simvastatin      Staurosporine
## 51          Mevastatin        Myriaporone       CyclosporinA
## 52      Staurosporine       CyclosporinA          Mevastatin
## 53        Simvastatin          Puromycin        ArchazolidB
## 54        ArchazolidB      Cycloheximide        Simvastatin
## 55        ChondramidC         Apicularen         Rhizopodin
## 56       Cytochalasin         Rhizopodin        ChondramidC
## 57         Rhizopodin          Cerulenin         Apicularen
## 58         Apicularen        ChondramidC       Cytochalasin
## 59          Cerulenin      Chelerythrine          Cerulenin
## 60      Chelerythrine       Cytochalasin      Chelerythrine
##    Indirubin3monoxime           LY294002       Methotrexate
## 2        Griseofulvin               H89          Etoposide
## 3           ArgyrinA       Neopeltolide          RatjadonC
## 4             A23187          Etoposide           Soraphen
## 5           Scriptaid         Vinblastin        Doxorubicin
## 6               Taxol        EpothiloneB            Emetine
## 7           Nocodazol    GephyronicAcidA       Neopeltolide
## 8        Camptothecin       Methotrexate         Oligomycin
## 9          TubulysinB        Doxorubicin          SB203580
## 10         Vinblastin        Myriaporone        CruentarenA
## 11       ActinomycinD         Oligomycin    GephyronicAcidA
## 12         Oxamflatin         Anisomycin       Aphidicolin
## 13          Soraphen       Griseofulvin          SB202190
## 14       MyxothiazolA        CruentarenA       Camptothecin
## 15      Staurosporine          RatjadonC       MyxothiazolA
## 16        Doxorubicin             Emetine      SaframycinMx1
## 17          SB203580               Taxol        EpothiloneB
## 18          SB202190        Aphidicolin              Taxol
## 19             Emetine          Soraphen          PD169316
## 20         Oligomycin          Nocodazol        TubulysinB
## 21          PD169316       MyxothiazolA        ActinomycinD
## 22       Trichostatin    Podophyllotoxin       Griseofulvin
## 23        PurvalanolA          PD169316          Rapamycin
## 24          RatjadonC              CCCP         Vioprolide
## 25          Mevastatin         Vioprolide         Vinblastin
## 26        ArchazolidB          Rapamycin         Wortmannin
## 27        CruentarenA             Velcade        Myriaporone
## 28               CCCP          Colchicine        OkadaicAcid
## 29      SaframycinMx1               MG132          Apicidin
## 30        OkadaicAcid         Wortmannin          ArgyrinA
## 31        Simvastatin       Camptothecin             Velcade
## 32         Colchicine         TubulysinB         Oxamflatin
## 33        EpothiloneB      SaframycinMx1         Anisomycin
```

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## 34          Etoposide           Apicidin        Colchicine
## 35       Methotrexate           ArgyrinA    Podophyllotoxin
## 36              MG132      Cycloheximide     Alsterpaullone
## 37          Rapamycin       ActinomycinD          Nocodazol
## 38       CyclosporinA           SB203580              MG132
## 39         Vioprolide           SB202190           LY294002
## 40             Velcade Indirubin3monoxime          Scriptaid
## 41                H89        PurvalanolA               CCCP
## 42       Neopeltolide         Oxamflatin       Trichostatin
## 43    GephyronicAcidA        OkadaicAcid      Cycloheximide
## 44        Aphidicolin          Scriptaid           Amanitin
## 45           LY294002           Amanitin             A23187
## 46          Puromycin       Trichostatin        PurvalanolA
## 47         Wortmannin             A23187 Indirubin3monoxime
## 48    Podophyllotoxin     Alsterpaullone                H89
## 49         Anisomycin          Puromycin         Mevastatin
## 50     Alsterpaullone      Staurosporine        ArchazolidB
## 51           Apicidin        ArchazolidB          Puromycin
## 52           Amanitin       CyclosporinA      Staurosporine
## 53        Myriaporone         Mevastatin       CyclosporinA
## 54         Apicularen        Simvastatin         Simvastatin
## 55      Cycloheximide         ChondramidC         ChondramidC
## 56          Cerulenin       Cytochalasin          Rhizopodin
## 57      Chelerythrine          Rhizopodin       Cytochalasin
## 58          Rhizopodin         Apicularen          Apicularen
## 59         ChondramidC          Cerulenin          Cerulenin
## 60       Cytochalasin      Chelerythrine      Chelerythrine
##           Mevastatin              MG132        Myriaporone
## 2         Simvastatin            Velcade       Neopeltolide
## 3       Staurosporine         Vioprolide      Cycloheximide
## 4         Trichostatin         Oligomycin    GephyronicAcidA
## 5         ArchazolidB        CruentarenA         Anisomycin
## 6             ArgyrinA           PD169316          Etoposide
## 7         OkadaicAcid       Neopeltolide         Aphidicolin
## 8        Camptothecin    GephyronicAcidA          Vioprolide
## 9           Scriptaid       MyxothiazolA             Velcade
## 10       CyclosporinA        Doxorubicin              MG132
## 11        PurvalanolA          Etoposide           PD169316
## 12 Indirubin3monoxime            Emetine          Rapamycin
## 13         Oxamflatin           SB202190       Methotrexate
## 14       Griseofulvin         Oxamflatin           Apicidin
## 15       MyxothiazolA           Soraphen        CruentarenA
## 16         TubulysinB          Rapamycin          Oligomycin
## 17       ActinomycinD        Myriaporone             Emetine
## 18            Soraphen           SB203580        Doxorubicin
## 19               Taxol          RatjadonC     Alsterpaullone
## 20           SB202190        Aphidicolin           RatjadonC
## 21        Doxorubicin      SaframycinMx1            Soraphen
## 22           SB203580               CCCP           LY294002
## 23             A23187       Griseofulvin      SaframycinMx1
## 24          RatjadonC         Anisomycin       MyxothiazolA
## 25          Puromycin               Taxol            SB203580
## 26         Apicularen       ActinomycinD            SB202190
## 27         Oligomycin         Vinblastin        EpothiloneB
```

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## 28              CCCP          Scriptaid           Amanitin
## 29       CruentarenA     Alsterpaullone         Vinblastin
## 30         Nocodazol         TubulysinB         Wortmannin
## 31           Emetine        PurvalanolA              Taxol
## 32         Vinblastin       Methotrexate         Colchicine
## 33     SaframycinMx1           Apicidin       Griseofulvin
## 34       Methotrexate           Amanitin         Oxamflatin
## 35         Wortmannin         Colchicine              CCCP
## 36          Cerulenin        EpothiloneB       ActinomycinD
## 37       EpothiloneB       Camptothecin         TubulysinB
## 38          PD169316          Nocodazol    Podophyllotoxin
## 39            Velcade      Cycloheximide               H89
## 40         Colchicine             A23187       Camptothecin
## 41              MG132        Wortmannin          Nocodazol
## 42          Etoposide               H89          Scriptaid
## 43         Vioprolide           ArgyrinA        PurvalanolA
## 44          Rapamycin Indirubin3monoxime           ArgyrinA
## 45       Neopeltolide           LY294002             A23187
## 46    GephyronicAcidA    Podophyllotoxin        OkadaicAcid
## 47      Chelerythrine          Puromycin Indirubin3monoxime
## 48       Aphidicolin       Trichostatin       Trichostatin
## 49    Podophyllotoxin        OkadaicAcid          Puromycin
## 50                H89       CyclosporinA       Cytochalasin
## 51     Alsterpaullone         Mevastatin        ChondramidC
## 52           LY294002      Staurosporine       CyclosporinA
## 53           Amanitin        ArchazolidB         Mevastatin
## 54           Apicidin        Simvastatin        ArchazolidB
## 55       Myriaporone        ChondramidC      Staurosporine
## 56         Anisomycin         Rhizopodin        Simvastatin
## 57      Cycloheximide       Cytochalasin         Rhizopodin
## 58         Rhizopodin         Apicularen         Apicularen
## 59       ChondramidC          Cerulenin          Cerulenin
## 60       Cytochalasin      Chelerythrine      Chelerythrine
##         MyxothiazolA       Neopeltolide          Nocodazol
## 2          Oligomycin    GephyronicAcidA         Vinblastin
## 3         Doxorubicin          Etoposide              Taxol
## 4         CruentarenA        Myriaporone       Griseofulvin
## 5            Soraphen        CruentarenA         TubulysinB
## 6           RatjadonC         Oligomycin       ActinomycinD
## 7           SB202190         Anisomycin        EpothiloneB
## 8          Oxamflatin           PD169316            Emetine
## 9               CCCP        Doxorubicin          Colchicine
## 10          SB203580       Methotrexate      SaframycinMx1
## 11           Emetine             Velcade           Soraphen
## 12       Griseofulvin               MG132          RatjadonC
## 13       Camptothecin             Emetine         Oxamflatin
## 14          Scriptaid        Aphidicolin         Wortmannin
## 15              Taxol       MyxothiazolA          Rapamycin
## 16         TubulysinB         Vioprolide Indirubin3monoxime
## 17       ActinomycinD           Soraphen           SB202190
## 18           ArgyrinA          RatjadonC           SB203580
## 19            Velcade          Rapamycin    Podophyllotoxin
## 20              MG132           SB203580       MyxothiazolA
## 21       Neopeltolide           SB202190           ArgyrinA
```

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## 22        PurvalanolA              CCCP         Vioprolide
## 23      SaframycinMx1           Apicidin        Doxorubicin
## 24          Etoposide      SaframycinMx1        Aphidicolin
## 25          PD169316      Cycloheximide       Camptothecin
## 26       Methotrexate           LY294002          PD169316
## 27    GephyronicAcidA              Taxol         Oligomycin
## 28       Trichostatin        EpothiloneB          Etoposide
## 29         Vinblastin       Griseofulvin        ArchazolidB
## 30        OkadaicAcid         Oxamflatin           Amanitin
## 31             A23187         Vinblastin           Apicidin
## 32         Vioprolide     Alsterpaullone            Velcade
## 33          Nocodazol         Colchicine       Methotrexate
## 34        EpothiloneB         TubulysinB        CruentarenA
## 35 Indirubin3monoxime       ActinomycinD          Scriptaid
## 36          Rapamycin       Camptothecin              MG132
## 37         Colchicine          Scriptaid      Staurosporine
## 38        Aphidicolin          Nocodazol       Neopeltolide
## 39         Wortmannin             A23187           LY294002
## 40          Puromycin                H89     Alsterpaullone
## 41         Mevastatin         Wortmannin               CCCP
## 42       CyclosporinA    Podophyllotoxin        OkadaicAcid
## 43        Myriaporone        PurvalanolA         Anisomycin
## 44         Anisomycin           Amanitin                H89
## 45      Staurosporine           ArgyrinA             A23187
## 46           Apicidin        OkadaicAcid       Trichostatin
## 47     Alsterpaullone Indirubin3monoxime    GephyronicAcidA
## 48        Simvastatin       Trichostatin         Mevastatin
## 49           LY294002          Puromycin        PurvalanolA
## 50        ArchazolidB       CyclosporinA        Myriaporone
## 51                H89         Mevastatin        Simvastatin
## 52    Podophyllotoxin        ArchazolidB      Cycloheximide
## 53           Amanitin      Staurosporine       CyclosporinA
## 54      Cycloheximide        Simvastatin          Puromycin
## 55         Apicularen        ChondramidC         Rhizopodin
## 56          Cerulenin       Cytochalasin        ChondramidC
## 57        ChondramidC         Rhizopodin         Apicularen
## 58         Rhizopodin         Apicularen          Cerulenin
## 59      Chelerythrine          Cerulenin      Chelerythrine
## 60       Cytochalasin      Chelerythrine       Cytochalasin
##           OkadaicAcid         Oligomycin          Oxamflatin
## 2        Camptothecin        CruentarenA           SB202190
## 3            ArgyrinA        Doxorubicin       ActinomycinD
## 4         Trichostatin       MyxothiazolA            Soraphen
## 5         Doxorubicin            Soraphen           SB203580
## 6            Soraphen          RatjadonC             Emetine
## 7           RatjadonC                CCCP       MyxothiazolA
## 8          Mevastatin       Neopeltolide         TubulysinB
## 9        MyxothiazolA    GephyronicAcidA              Taxol
## 10          Scriptaid             Emetine      SaframycinMx1
## 11         Oligomycin           SB202190       Griseofulvin
## 12           SB203580           SB203580          Scriptaid
## 13       Methotrexate          Etoposide         Oligomycin
## 14        CruentarenA         Oxamflatin        Doxorubicin
## 15       Griseofulvin             Velcade        CruentarenA
```

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## 16         TubulysinB              MG132         RatjadonC
## 17       CyclosporinA          Scriptaid       Camptothecin
## 18          SB202190       Camptothecin            Velcade
## 19              Taxol           PD169316           PD169316
## 20        Simvastatin       Methotrexate              MG132
## 21      Staurosporine       Griseofulvin           ArgyrinA
## 22        PurvalanolA              Taxol         Vioprolide
## 23       ActinomycinD         TubulysinB         Vinblastin
## 24         Oxamflatin       ActinomycinD         Colchicine
## 25               CCCP        PurvalanolA          Rapamycin
## 26             Emetine      SaframycinMx1          Etoposide
## 27        ArchazolidB          Vioprolide          Nocodazol
## 28 Indirubin3monoxime           ArgyrinA              A23187
## 29           Puromycin         Vinblastin Indirubin3monoxime
## 30              A23187             A23187               CCCP
## 31         Vinblastin        Aphidicolin       Trichostatin
## 32      SaframycinMx1          Rapamycin       Methotrexate
## 33          Etoposide        OkadaicAcid        Aphidicolin
## 34          Nocodazol       Trichostatin       Neopeltolide
## 35        EpothiloneB        Myriaporone        EpothiloneB
## 36         Wortmannin        EpothiloneB        PurvalanolA
## 37    GephyronicAcidA          Nocodazol         Wortmannin
## 38       Neopeltolide          Colchicine        OkadaicAcid
## 39           PD169316 Indirubin3monoxime    GephyronicAcidA
## 40             Velcade         Anisomycin     Alsterpaullone
## 41          Colchicine         Wortmannin        ArchazolidB
## 42          Vioprolide           LY294002         Mevastatin
## 43               MG132          Puromycin           Amanitin
## 44        Aphidicolin           Apicidin      Staurosporine
## 45          Rapamycin     Alsterpaullone           Apicidin
## 46           LY294002                H89        Simvastatin
## 47    Podophyllotoxin       CyclosporinA    Podophyllotoxin
## 48        Myriaporone    Podophyllotoxin         Anisomycin
## 49           Apicidin         Mevastatin         Myriaporone
## 50     Alsterpaullone           Amanitin       CyclosporinA
## 51                H89      Staurosporine                H89
## 52         Anisomycin      Cycloheximide          Puromycin
## 53         Apicularen        Simvastatin           LY294002
## 54           Amanitin        ArchazolidB      Cycloheximide
## 55      Cycloheximide         Apicularen         Apicularen
## 56          Cerulenin       ChondramidC         Rhizopodin
## 57      Chelerythrine         Rhizopodin          Cerulenin
## 58        ChondramidC          Cerulenin        ChondramidC
## 59         Rhizopodin       Cytochalasin      Chelerythrine
## 60       Cytochalasin      Chelerythrine       Cytochalasin
##             PD169316    Podophyllotoxin          Puromycin
## 2            Etoposide         Colchicine       CyclosporinA
## 3           Vioprolide        EpothiloneB        PurvalanolA
## 4            SB203580           Apicidin               CCCP
## 5              Emetine            Emetine          Scriptaid
## 6            Rapamycin        Aphidicolin       Trichostatin
## 7            SB202190         Vinblastin        CruentarenA
## 8         Neopeltolide          Nocodazol       MyxothiazolA
## 9              Velcade      SaframycinMx1        Doxorubicin
```

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## 10         Oligomycin             Taxol         Oligomycin
## 11              MG132          Etoposide        OkadaicAcid
## 12    GephyronicAcidA          Rapamycin       Camptothecin
## 13        Aphidicolin       ActinomycinD            A23187
## 14           Soraphen        TubulysinB          ArgyrinA
## 15         Anisomycin        Wortmannin        Simvastatin
## 16        CruentarenA       Griseofulvin         Mevastatin
## 17        Doxorubicin           Amanitin           Soraphen
## 18      SaframycinMx1       Methotrexate          RatjadonC
## 19           RatjadonC         Vioprolide         Oxamflatin
## 20       MyxothiazolA           Soraphen    GephyronicAcidA
## 21     Alsterpaullone         Oxamflatin           SB203580
## 22          Oxamflatin         Anisomycin           SB202190
## 23       Griseofulvin          RatjadonC              MG132
## 24              Taxol           LY294002 Indirubin3monoxime
## 25       Methotrexate       Neopeltolide       Griseofulvin
## 26         Vinblastin           PD169316       Neopeltolide
## 27       ActinomycinD       Doxorubicin      Staurosporine
## 28         TubulysinB          SB202190            Velcade
## 29        Myriaporone          SB203580              Taxol
## 30           Apicidin        Oligomycin       Methotrexate
## 31         Colchicine       MyxothiazolA           PD169316
## 32        EpothiloneB     Alsterpaullone            Emetine
## 33           Amanitin            Velcade         TubulysinB
## 34          Nocodazol                H89          Etoposide
## 35             A23187       CruentarenA       ActinomycinD
## 36          Scriptaid       Camptothecin                H89
## 37       Camptothecin           ArgyrinA        Vinblastin
## 38 Indirubin3monoxime    GephyronicAcidA      SaframycinMx1
## 39               CCCP        Myriaporone        ArchazolidB
## 40         Wortmannin              MG132           LY294002
## 41           ArgyrinA Indirubin3monoxime         Vioprolide
## 42        PurvalanolA      Cycloheximide          Nocodazol
## 43      Cycloheximide               CCCP        Myriaporone
## 44           LY294002          Scriptaid        EpothiloneB
## 45    Podophyllotoxin        OkadaicAcid          Rapamycin
## 46               H89        ArchazolidB         Apicularen
## 47        OkadaicAcid       Trichostatin         Wortmannin
## 48       Trichostatin             A23187        Aphidicolin
## 49          Puromycin      Staurosporine         Colchicine
## 50        ArchazolidB        PurvalanolA         Anisomycin
## 51      Staurosporine         Rhizopodin     Alsterpaullone
## 52         Mevastatin         Mevastatin           Apicidin
## 53       CyclosporinA       ChondramidC    Podophyllotoxin
## 54        Simvastatin        Simvastatin      Cycloheximide
## 55        ChondramidC       CyclosporinA           Amanitin
## 56         Rhizopodin          Puromycin          Cerulenin
## 57       Cytochalasin       Cytochalasin      Chelerythrine
## 58         Apicularen         Apicularen        ChondramidC
## 59          Cerulenin          Cerulenin       Cytochalasin
## 60      Chelerythrine      Chelerythrine          Rhizopodin
##           PurvalanolA          Rapamycin          RatjadonC
## 2           Puromycin         Vioprolide           Soraphen
## 3           Scriptaid        Aphidicolin        Doxorubicin
```

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## 4         Doxorubicin      SaframycinMx1           SB203580
## 5        MyxothiazolA           Apicidin       MyxothiazolA
## 6                CCCP           Amanitin           SB202190
## 7         CruentarenA            Emetine         Oligomycin
## 8        CyclosporinA     Alsterpaullone            Emetine
## 9          Oligomycin          Etoposide              Taxol
## 10       Camptothecin           PD169316         TubulysinB
## 11           ArgyrinA            Velcade       Griseofulvin
## 12       Trichostatin         Colchicine        CruentarenA
## 13           Soraphen        EpothiloneB       Methotrexate
## 14          RatjadonC         Vinblastin       Camptothecin
## 15       Griseofulvin           SB202190       ActinomycinD
## 16        OkadaicAcid       ActinomycinD      SaframycinMx1
## 17         Oxamflatin              Taxol          Etoposide
## 18           SB203580           SB203580         Vinblastin
## 19           SB202190          Anisomycin         Oxamflatin
## 20 Indirubin3monoxime         Wortmannin             Velcade
## 21              A23187         TubulysinB           ArgyrinA
## 22               MG132           Soraphen        EpothiloneB
## 23         Mevastatin          RatjadonC         Wortmannin
## 24        Simvastatin              MG132         Vioprolide
## 25              Taxol       Griseofulvin           PD169316
## 26            Velcade       Neopeltolide       Neopeltolide
## 27    GephyronicAcidA         Oxamflatin           Rapamycin
## 28         TubulysinB       Methotrexate        OkadaicAcid
## 29             Emetine          Nocodazol    GephyronicAcidA
## 30       ActinomycinD        Myriaporone           Nocodazol
## 31           PD169316         Oligomycin        Aphidicolin
## 32      Staurosporine        Doxorubicin              MG132
## 33       Neopeltolide    GephyronicAcidA           Scriptaid
## 34         Vinblastin        CruentarenA               CCCP
## 35       Methotrexate       MyxothiazolA        PurvalanolA
## 36          Etoposide    Podophyllotoxin         Colchicine
## 37      SaframycinMx1      Cycloheximide       Trichostatin
## 38          Nocodazol       Camptothecin Indirubin3monoxime
## 39         Vioprolide           LY294002           Apicidin
## 40                H89           ArgyrinA        Myriaporone
## 41        ArchazolidB           Scriptaid     Alsterpaullone
## 42           LY294002 Indirubin3monoxime         Anisomycin
## 43           Rapamycin                CCCP              A23187
## 44        EpothiloneB              A23187           LY294002
## 45         Wortmannin                 H89           Amanitin
## 46        Myriaporone         OkadaicAcid    Podophyllotoxin
## 47        Aphidicolin        PurvalanolA         ArchazolidB
## 48         Colchicine        ArchazolidB         Mevastatin
## 49         Anisomycin       Trichostatin      Staurosporine
## 50     Alsterpaullone      Staurosporine           Puromycin
## 51           Apicidin         Mevastatin        Simvastatin
## 52    Podophyllotoxin        Simvastatin       CyclosporinA
## 53           Amanitin        ChondramidC                H89
## 54      Cycloheximide          Rhizopodin      Cycloheximide
## 55         Apicularen           Puromycin         Apicularen
## 56          Cerulenin       CyclosporinA        ChondramidC
## 57      Chelerythrine       Cytochalasin          Rhizopodin
```

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## 58        ChondramidC         Apicularen          Cerulenin
## 59         Rhizopodin          Cerulenin       Cytochalasin
## 60       Cytochalasin      Chelerythrine      Chelerythrine
##           Rhizopodin      SaframycinMx1           SB202190
## 2         ChondramidC            Emetine           SB203580
## 3            Amanitin       ActinomycinD           Soraphen
## 4            Apicidin         TubulysinB         Oxamflatin
## 5     Podophyllotoxin          Rapamycin          RatjadonC
## 6          Wortmannin              Taxol       ActinomycinD
## 7         Aphidicolin           SB202190             Emetine
## 8          Colchicine         Vioprolide         TubulysinB
## 9            Rapamycin          Colchicine      SaframycinMx1
## 10        EpothiloneB           SB203580       MyxothiazolA
## 11     Alsterpaullone        Aphidicolin              Taxol
## 12      SaframycinMx1           Soraphen        Doxorubicin
## 13         Vioprolide         Vinblastin         Oligomycin
## 14          Nocodazol         Oxamflatin       Griseofulvin
## 15         Vinblastin        EpothiloneB        CruentarenA
## 16      Cycloheximide       Griseofulvin           PD169316
## 17            Emetine         Wortmannin            Velcade
## 18         Anisomycin          RatjadonC       Camptothecin
## 19       ActinomycinD          Nocodazol         Vioprolide
## 20          Etoposide           Amanitin          Rapamycin
## 21              Taxol           Apicidin          Etoposide
## 22         TubulysinB          Etoposide       Methotrexate
## 23       Methotrexate             Velcade         Vinblastin
## 24        Myriaporone     Alsterpaullone           Scriptaid
## 25             Velcade           PD169316               MG132
## 26       Griseofulvin       MyxothiazolA           ArgyrinA
## 27           PD169316       Methotrexate        Aphidicolin
## 28           SB202190        Doxorubicin     Alsterpaullone
## 29          RatjadonC         Oligomycin         Wortmannin
## 30           Soraphen        CruentarenA        EpothiloneB
## 31           SB203580               MG132          Nocodazol
## 32         Oxamflatin    Podophyllotoxin       Neopeltolide
## 33           LY294002       Neopeltolide    GephyronicAcidA
## 34       Neopeltolide       Camptothecin          Colchicine
## 35       Cytochalasin           ArgyrinA              A23187
## 36              MG132         Anisomycin        OkadaicAcid
## 37         Oligomycin    GephyronicAcidA Indirubin3monoxime
## 38    GephyronicAcidA          Scriptaid           Apicidin
## 39         Doxorubicin        Myriaporone        PurvalanolA
## 40       MyxothiazolA Indirubin3monoxime           Amanitin
## 41        ArchazolidB        ArchazolidB               CCCP
## 42        CruentarenA        OkadaicAcid       Trichostatin
## 43                H89               CCCP          Anisomycin
## 44       Camptothecin             A23187        Myriaporone
## 45           ArgyrinA       Trichostatin        ArchazolidB
## 46 Indirubin3monoxime           LY294002         Mevastatin
## 47        OkadaicAcid      Cycloheximide      Staurosporine
## 48          Scriptaid        PurvalanolA    Podophyllotoxin
## 49      Staurosporine      Staurosporine         Simvastatin
## 50               CCCP         Mevastatin       CyclosporinA
## 51             A23187                H89          Puromycin
```

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## 52       Trichostatin        Simvastatin          LY294002
## 53         Mevastatin       CyclosporinA      Cycloheximide
## 54        PurvalanolA          Puromycin               H89
## 55        Simvastatin         Rhizopodin         Apicularen
## 56       CyclosporinA        ChondramidC        ChondramidC
## 57          Puromycin         Apicularen         Rhizopodin
## 58         Apicularen       Cytochalasin          Cerulenin
## 59      Chelerythrine          Cerulenin      Chelerythrine
## 60          Cerulenin      Chelerythrine       Cytochalasin
##             SB203580          Scriptaid        Simvastatin
## 2           SB202190       Trichostatin         Mevastatin
## 3           Soraphen         Oxamflatin      Staurosporine
## 4           RatjadonC       MyxothiazolA       Trichostatin
## 5          TubulysinB             A23187        ArchazolidB
## 6             Emetine        Doxorubicin       CyclosporinA
## 7        ActinomycinD       Camptothecin           ArgyrinA
## 8         Oxamflatin         Oligomycin          Scriptaid
## 9         Doxorubicin        CruentarenA        OkadaicAcid
## 10       MyxothiazolA               CCCP       Camptothecin
## 11      SaframycinMx1           ArgyrinA        PurvalanolA
## 12              Taxol        PurvalanolA         Oxamflatin
## 13       Griseofulvin           Soraphen Indirubin3monoxime
## 14         Oligomycin           SB202190       MyxothiazolA
## 15           PD169316           SB203580         Apicularen
## 16       Camptothecin       Griseofulvin       Griseofulvin
## 17        CruentarenA Indirubin3monoxime          Puromycin
## 18       Methotrexate        OkadaicAcid             A23187
## 19          Etoposide         Mevastatin         TubulysinB
## 20          Vioprolide          RatjadonC       ActinomycinD
## 21             Velcade       CyclosporinA           Soraphen
## 22          Rapamycin       ActinomycinD           SB202190
## 23           ArgyrinA              Taxol        Doxorubicin
## 24         Vinblastin             Emetine               Taxol
## 25          Scriptaid         TubulysinB           SB203580
## 26        Aphidicolin          Puromycin          RatjadonC
## 27              MG132        Simvastatin               CCCP
## 28       Neopeltolide           PD169316         Oligomycin
## 29        EpothiloneB              MG132        CruentarenA
## 30    GephyronicAcidA      Staurosporine           Nocodazol
## 31     Alsterpaullone          Etoposide            Emetine
## 32          Nocodazol      SaframycinMx1          Cerulenin
## 33         Wortmannin       Methotrexate      SaframycinMx1
## 34        OkadaicAcid    GephyronicAcidA         Vinblastin
## 35             A23187            Velcade       Methotrexate
## 36          Colchicine       Neopeltolide             Velcade
## 37 Indirubin3monoxime         Vinblastin         Wortmannin
## 38        PurvalanolA          Nocodazol               MG132
## 39       Trichostatin        ArchazolidB           PD169316
## 40           Apicidin         Vioprolide        EpothiloneB
## 41               CCCP         Colchicine         Colchicine
## 42           Amanitin          Rapamycin      Chelerythrine
## 43         Anisomycin        Aphidicolin           Etoposide
## 44        Myriaporone        EpothiloneB         Vioprolide
## 45        ArchazolidB                H89       Neopeltolide
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## 46         Mevastatin         Wortmannin    GephyronicAcidA
## 47      Staurosporine    Podophyllotoxin          Rapamycin
## 48    Podophyllotoxin        Myriaporone        Aphidicolin
## 49        Simvastatin     Alsterpaullone                H89
## 50       CyclosporinA         Anisomycin    Podophyllotoxin
## 51           LY294002           LY294002     Alsterpaullone
## 52          Puromycin            Apicidin           LY294002
## 53      Cycloheximide            Amanitin           Amanitin
## 54                H89      Cycloheximide            Apicidin
## 55         Apicularen         Apicularen        Myriaporone
## 56        ChondramidC          Cerulenin         Anisomycin
## 57         Rhizopodin      Chelerythrine      Cycloheximide
## 58          Cerulenin         Rhizopodin         Rhizopodin
## 59       Cytochalasin        ChondramidC        ChondramidC
## 60      Chelerythrine       Cytochalasin       Cytochalasin
##              Soraphen      Staurosporine              Taxol
## 2           RatjadonC         Mevastatin       Griseofulvin
## 3          Doxorubicin        ArchazolidB         TubulysinB
## 4            SB203580        Simvastatin       ActinomycinD
## 5            SB202190           ArgyrinA         Vinblastin
## 6         MyxothiazolA       Trichostatin            Emetine
## 7           Oligomycin       Camptothecin           Nocodazol
## 8               Emetine Indirubin3monoxime           Soraphen
## 9                 Taxol        OkadaicAcid      SaframycinMx1
## 10       Griseofulvin       Griseofulvin           RatjadonC
## 11         TubulysinB         TubulysinB           SB202190
## 12        CruentarenA       ActinomycinD           SB203580
## 13       ActinomycinD          Scriptaid        EpothiloneB
## 14       Camptothecin              Taxol         Oxamflatin
## 15         Oxamflatin         Oxamflatin       MyxothiazolA
## 16      SaframycinMx1       CyclosporinA        Doxorubicin
## 17       Methotrexate            Soraphen       Camptothecin
## 18           ArgyrinA          Nocodazol           ArgyrinA
## 19          Etoposide       MyxothiazolA         Colchicine
## 20         Vinblastin            SB202190         Wortmannin
## 21           PD169316            SB203580         Oligomycin
## 22              Velcade         PurvalanolA          Rapamycin
## 23         Vioprolide          RatjadonC         Vioprolide
## 24          Scriptaid        Doxorubicin          Etoposide
## 25        EpothiloneB         Vinblastin        CruentarenA
## 26       Neopeltolide              A23187           PD169316
## 27          Rapamycin             Emetine       Methotrexate
## 28          Nocodazol      SaframycinMx1        Aphidicolin
## 29        OkadaicAcid          Apicularen Indirubin3monoxime
## 30    GephyronicAcidA         Oligomycin             Velcade
## 31              MG132                CCCP          Scriptaid
## 32         Wortmannin         CruentarenA    Podophyllotoxin
## 33        Aphidicolin          Wortmannin              MG132
## 34               CCCP        EpothiloneB        ArchazolidB
## 35        PurvalanolA          Puromycin       Neopeltolide
## 36         Colchicine          Colchicine        OkadaicAcid
## 37       Trichostatin          Cerulenin            Apicidin
## 38 Indirubin3monoxime       Methotrexate            Amanitin
## 39             A23187           PD169316                CCCP
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## 40           Apicidin            Velcade       Trichostatin
## 41     Alsterpaullone          Rapamycin      Staurosporine
## 42        Myriaporone          Etoposide    GephyronicAcidA
## 43         Anisomycin              MG132     Alsterpaullone
## 44         Mevastatin         Vioprolide        PurvalanolA
## 45           Amanitin    Podophyllotoxin             A23187
## 46    Podophyllotoxin        Aphidicolin           LY294002
## 47        ArchazolidB     Chelerythrine         Mevastatin
## 48           LY294002      Neopeltolide         Anisomycin
## 49      Staurosporine    GephyronicAcidA        Myriaporone
## 50         Simvastatin               H89                H89
## 51           Puromycin           Amanitin         Simvastatin
## 52       CyclosporinA     Alsterpaullone       CyclosporinA
## 53                H89           LY294002      Cycloheximide
## 54      Cycloheximide           Apicidin          Puromycin
## 55         Apicularen         Anisomycin         Rhizopodin
## 56        ChondramidC        Myriaporone         Apicularen
## 57         Rhizopodin      Cycloheximide        ChondramidC
## 58          Cerulenin         Rhizopodin          Cerulenin
## 59      Chelerythrine        ChondramidC      Chelerythrine
## 60       Cytochalasin       Cytochalasin       Cytochalasin
##          Trichostatin         TubulysinB            Velcade
## 2         OkadaicAcid       ActinomycinD              MG132
## 3        Camptothecin               Taxol         Vioprolide
## 4            ArgyrinA       Griseofulvin            Emetine
## 5           Scriptaid      SaframycinMx1          Rapamycin
## 6           Mevastatin             Emetine         Oligomycin
## 7        CyclosporinA           Soraphen           PD169316
## 8         Simvastatin           SB202190           SB202190
## 9        MyxothiazolA          Nocodazol       Neopeltolide
## 10        Doxorubicin           SB203580        CruentarenA
## 11      Staurosporine         Vinblastin          RatjadonC
## 12        PurvalanolA          RatjadonC           Soraphen
## 13               CCCP         Oxamflatin       MyxothiazolA
## 14           Soraphen        EpothiloneB          Etoposide
## 15         Oligomycin       MyxothiazolA      SaframycinMx1
## 16         Oxamflatin       Camptothecin        Aphidicolin
## 17        CruentarenA           ArgyrinA           SB203580
## 18             A23187         Wortmannin        Doxorubicin
## 19           Puromycin        Doxorubicin    GephyronicAcidA
## 20           RatjadonC         Colchicine          Oxamflatin
## 21       Griseofulvin          Rapamycin        Myriaporone
## 22           SB203580          Oligomycin              Taxol
## 23           SB202190          Vioprolide     Alsterpaullone
## 24 Indirubin3monoxime        Methotrexate       Griseofulvin
## 25         TubulysinB           PD169316       ActinomycinD
## 26              Taxol        CruentarenA         TubulysinB
## 27       ActinomycinD          Etoposide         Anisomycin
## 28        ArchazolidB        Aphidicolin           Apicidin
## 29            Emetine             Velcade         Vinblastin
## 30       Methotrexate         ArchazolidB           Amanitin
## 31         Vinblastin Indirubin3monoxime        Methotrexate
## 32      SaframycinMx1           Scriptaid        EpothiloneB
## 33          Nocodazol         OkadaicAcid         Wortmannin
```

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## 34          Etoposide           Amanitin         Colchicine
## 35    GephyronicAcidA           Apicidin              CCCP
## 36       Neopeltolide    Podophyllotoxin          Nocodazol
## 37          PD169316      Staurosporine      Cycloheximide
## 38           Velcade     Alsterpaullone          Scriptaid
## 39             MG132             MG132       Camptothecin
## 40       EpothiloneB       Neopeltolide        PurvalanolA
## 41         Colchicine       Trichostatin           ArgyrinA
## 42         Wortmannin             A23187             A23187
## 43         Vioprolide         Mevastatin           LY294002
## 44          Rapamycin               CCCP    Podophyllotoxin
## 45         Apicularen    GephyronicAcidA                H89
## 46        Aphidicolin        PurvalanolA Indirubin3monoxime
## 47    Podophyllotoxin         Anisomycin        OkadaicAcid
## 48                H89        Simvastatin       Trichostatin
## 49           LY294002           LY294002          Puromycin
## 50       Myriaporone        Myriaporone        ArchazolidB
## 51           Apicidin                H89         Mevastatin
## 52     Alsterpaullone       CyclosporinA      Staurosporine
## 53          Anisomycin          Puromycin       CyclosporinA
## 54           Amanitin      Cycloheximide         Simvastatin
## 55          Cerulenin         Rhizopodin        ChondramidC
## 56      Cycloheximide         Apicularen         Rhizopodin
## 57      Chelerythrine        ChondramidC       Cytochalasin
## 58         Rhizopodin          Cerulenin         Apicularen
## 59        ChondramidC      Chelerythrine          Cerulenin
## 60       Cytochalasin       Cytochalasin      Chelerythrine
##             Vinblastin          Vioprolide         Wortmannin
## 2                Taxol          Rapamycin      SaframycinMx1
## 3           Nocodazol         Aphidicolin        EpothiloneB
## 4         Griseofulvin             Velcade              Taxol
## 5           TubulysinB      SaframycinMx1       ActinomycinD
## 6         ActinomycinD           Emetine         TubulysinB
## 7              Emetine          PD169316         Vinblastin
## 8         EpothiloneB          Etoposide            Emetine
## 9       SaframycinMx1              MG132          RatjadonC
## 10           Soraphen           Amanitin          Rapamycin
## 11          RatjadonC           Apicidin         Aphidicolin
## 12         Colchicine     Alsterpaullone           Soraphen
## 13          Rapamycin           SB202190         Vioprolide
## 14         Wortmannin           Soraphen       Griseofulvin
## 15         Vioprolide           SB203580          Nocodazol
## 16           SB203580          RatjadonC           SB202190
## 17           SB202190       Neopeltolide       Methotrexate
## 18        Aphidicolin         Vinblastin           SB203580
## 19          Etoposide               Taxol         Colchicine
## 20        Doxorubicin         Anisomycin           Apicidin
## 21          PD169316        Myriaporone           Amanitin
## 22        Oxamflatin       ActinomycinD          Etoposide
## 23       MyxothiazolA        EpothiloneB            Velcade
## 24         Oligomycin         Wortmannin         Oxamflatin
## 25           ArgyrinA         Oligomycin    Podophyllotoxin
## 26    Podophyllotoxin         Oxamflatin         Doxorubicin
## 27       Methotrexate         TubulysinB       Camptothecin
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## 28       Camptothecin         Colchicine       MyxothiazolA
## 29 Indirubin3monoxime    GephyronicAcidA     Alsterpaullone
## 30            Velcade       Griseofulvin         Oligomycin
## 31           Apicidin        CruentarenA           ArgyrinA
## 32        CruentarenA       Doxorubicin          PD169316
## 33           Amanitin       Methotrexate        CruentarenA
## 34           LY294002       MyxothiazolA       Neopeltolide
## 35       Neopeltolide          Nocodazol              MG132
## 36              MG132     Cycloheximide        OkadaicAcid
## 37         Anisomycin    Podophyllotoxin        Myriaporone
## 38          Scriptaid       Camptothecin    GephyronicAcidA
## 39     Alsterpaullone          Scriptaid        ArchazolidB
## 40    GephyronicAcidA           LY294002         Anisomycin
## 41        ArchazolidB               CCCP           LY294002
## 42                H89           ArgyrinA          Scriptaid
## 43               CCCP Indirubin3monoxime      Cycloheximide
## 44        OkadaicAcid        PurvalanolA Indirubin3monoxime
## 45        Myriaporone                H89       Trichostatin
## 46        PurvalanolA             A23187      Staurosporine
## 47      Staurosporine        OkadaicAcid               CCCP
## 48             A23187       Trichostatin        PurvalanolA
## 49       Trichostatin        ArchazolidB         Mevastatin
## 50         Mevastatin      Staurosporine                H89
## 51      Cycloheximide         Mevastatin             A23187
## 52        Simvastatin          Puromycin        Simvastatin
## 53       CyclosporinA        Simvastatin         Rhizopodin
## 54          Puromycin       CyclosporinA       CyclosporinA
## 55         Rhizopodin        ChondramidC          Puromycin
## 56        ChondramidC         Rhizopodin        ChondramidC
## 57         Apicularen       Cytochalasin         Apicularen
## 58          Cerulenin         Apicularen       Cytochalasin
## 59       Cytochalasin          Cerulenin          Cerulenin
## 60      Chelerythrine      Chelerythrine      Chelerythrine
```