

Bacillus spore transition under starvation

Jay T. Lennon

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Set working directory and load packages

```
rm(list = ls())
getwd()

## [1] "/Users/lennonj/GitHub/SporMut/code"
setwd("~/GitHub/SporMut/code")
require(bbmle)

## Loading required package: bbmle
## Loading required package: stats4
```

Load data

```
# load raw data
data <- read.table("../data/spore.transition.txt", header = TRUE)

# calculate total CFUs using dilution
tot.ab <- data$total * 10^(data$total_dil)

# calculate spore CFUs using dilution
spo.ab <- data$spore * 10^(data$spor_dil)

# calculate proportion of vegetative CFUs
prop.veg <- 1 - (spo.ab / tot.ab)

# calculate proportion of spore CFUs
prop.spor <- 1 - prop.veg

# make new data frame
trans <- data.frame(data, tot.ab, spo.ab, prop.veg, prop.spor)
```

Fit data with sigmoidal function using MLE

```
# Initial parameters
A = 0.95 # Maximum
B = 0.11 # Minimum
M = 208 # Midpoint
W = -21 # Slope
Z = 2 # Error
```

```
# Function
fit <- mle2(prop.veg ~ dnorm(mean = b + (a - b) / (1 + exp((m - time) / w)), sd = z),
  start = list(a = A, b = B, m = M, w = W, z = Z), data = trans)
```

Plot data and add sigmoidal function

```
png(filename="~/GitHub/SporMut/figures/transition.png",
  width = 1200, height = 900, res = 96*2)

par(mar = c(5, 7, 5, 7))

plot(trans$time, trans$prop.veg, pch = 22,
  bg = "white", col = "black", lwd = 2, cex.axis = 1.25, xlab = NA, ylab = NA,
  xlim = c(-10, 300), ylim = c(-0.1, 1.1), yaxt = "n", xaxt = "n")
box(lwd = 2)

axis(side = 2, lwd.ticks = 2, cex.axis = 1.25, las = 1,
  labels = expression(0.0, 0.5, 1.0),
  at = c(0, 0.5, 1.0))

axis(side = 4, lwd.ticks = 2, cex.axis = 1.25,
  at=c(0, 0.5, 1.0), labels = F)

axis(side = 1, lwd.ticks = 2, cex.axis = 1.25,
  at = c(0, 100, 200,300), labels = T)

axis(side = 3, lwd.ticks = 2, cex.axis = 1.25,
  at = c(0,100, 200, 300), labels = F)

mtext('Time (hrs)', side = 1, outer = TRUE, cex = 1.5,
  line = -2, adj = 0.5)

mtext('Proportion vegetative colonies', side = 2, outer = TRUE, cex = 1.5,
  line = -3.5, adj = 0.5)

curve(coef(fit)[[2]] + (coef(fit)[[1]] - coef(fit)[[2]]) /
  (1 + exp((coef(fit)[[3]] - x) / coef(fit)[[4]])),
  from = 0, to = 250, add = TRUE, lty = 2, lwd = 2.5)

dev.off()

## pdf
## 2

graphics.off()
```