

Static_Redox_Graphs

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3 parameters \rightarrow OxD

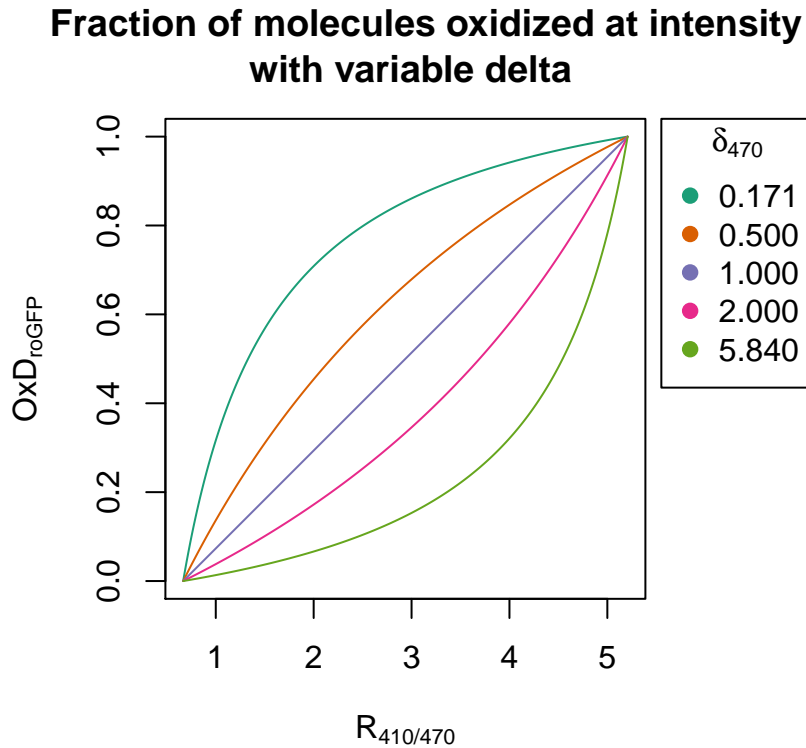
```
F0x <- function(I, RR, ROX, delta) {  
  return (  
    (I - RR)/((I - RR) + (delta*(ROX - I)))  
  )  
}
```

Plot: OxD as a function of measured intensity, with a constant maximal and minimal intensity

Assume that $R_{Red} = 0.667$ and $R_{Ox} = 5.207$. Vary δ by factors of 2.

```
require(RColorBrewer)  
  
## Loading required package: RColorBrewer  
## Warning: package 'RColorBrewer' was built under R version 3.4.1  
colors <- brewer.pal(n = 8, 'Dark2')  
  
maxRed <- 0.667  
maxOx <- 5.207  
delta_values <- c(0.171, 0.5, 1.0, 2.0, 5.84)  
  
x <- seq(maxRed, maxOx, by = 0.001)  
magX <- length(x)  
  
yOx = F0x(x, rep(maxRed, each = magX),  
          rep(maxOx, each = magX),  
          rep(delta_values[1], each = magX))  
  
par(mar=c(5, 5, 5, 8), pty = 's', bg = NA)  
plot(x, yOx,  
     type = 'l', main = "  
     Fraction of molecules oxidized at intensity \n with variable delta",  
     ylab = expression('OxD'['roGFP']), xlab = expression('R'['410/470']),  
     col = colors[1])  
  
for (i in 2:length(delta_values)) {  
  yOx_i <- F0x(x, rep(maxRed, each = magX),  
              rep(maxOx, each = magX),  
              rep(delta_values[i], each = magX))  
  points(x, yOx_i, col = colors[i], type = 'l')  
}
```

```
options(digits = 4)
legend("topright", title = expression(delta['470']), inset=c(-0.35,0), xpd=TRUE, as.character(format(de
```



```
dev.copy(pdf, 'plot1_1.pdf', compress = FALSE)
```

```
## pdf
## 3
```

Vary minimal intensity

```
maxRed_values <- c(0, .667, 1, 1.5, 2.0, 3.0, 4.0, 5.0)
maxOx <- 5.207
delta <- 0.171

x <- seq(maxRed_values[1], maxOx, by = 0.001)
magX <- length(x)

yOx = FOx(x, rep(maxRed_values[1], each = magX),
             rep(maxOx, each = magX),
             rep(delta, each = magX))

par(mar=c(5, 8, 5, 8), pty = 's', bg = NA)
plot(x, yOx,
     type = 'l', main = "
```

```

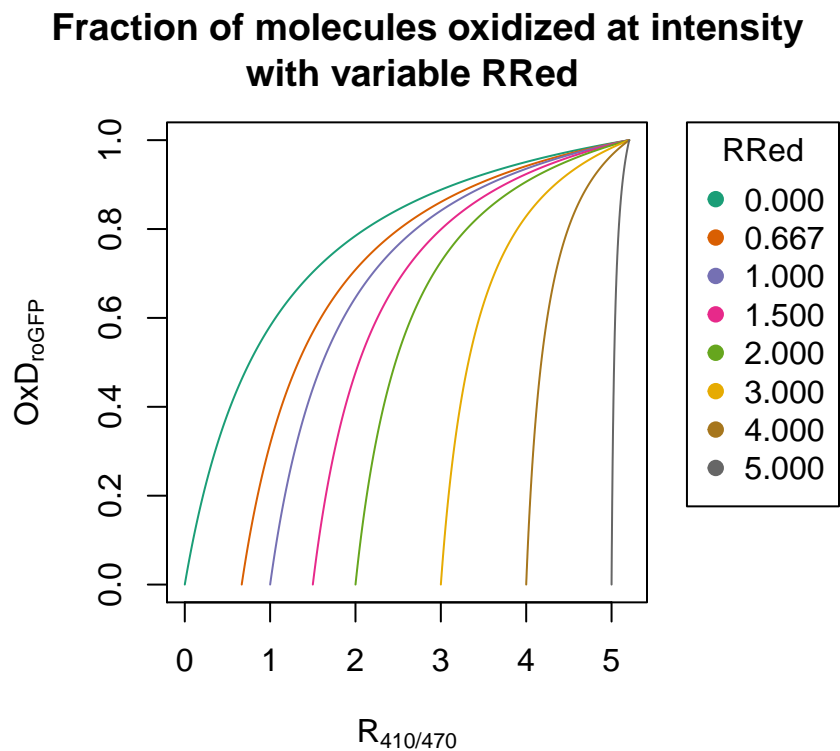
Fraction of molecules oxidized at intensity \n with variable RRed",
  ylab = expression('OxD'['roGFP']), xlab = expression('R'['410/470']),
  col = colors[1])

for (i in 2:length(maxRed_values)) {
  x <- seq(maxRed_values[i], maxOx, by = 0.001)
  magX <- length(x)

  yOx_i <- FOx(x, rep(maxRed_values[i], each = magX),
    rep(maxOx, each = magX),
    rep(delta, each = magX))
  points(x, yOx_i, col = colors[i], type = 'l')
}

options(digits = 4)
legend("topright", title = "RRed", inset=c(-0.4,0), xpd=TRUE, as.character(format(maxRed_values, nsmall

```



```
dev.copy(pdf, 'plot1_2.pdf')
```

```
## pdf
## 4
```

4 parameters → E

At fixed $E_0 = -265$, vary delta

Define the Nernst function

```
FE <- function(e0, I, RR, ROX, delta) {  
  return(e0 - 12.71 * log((1-F0x(I, RR, ROX, delta))/F0x(I, RR, ROX, delta)))  
}
```

```
maxRed <- 0.667
```

```
maxOx <- 5.207
```

```
delta_values <- c(0.171, 0.5, 1.0, 2.0, 5.84)
```

```
x <- seq(maxRed, maxOx, by = 0.001)
```

```
magX <- length(x)
```

```
yE = FE(-265, x, rep(maxRed, each = magX),  
        rep(maxOx, each = magX),  
        rep(delta_values[1], each = magX))
```

```
par(mar=c(5, 5, 5, 8), pty = 's', bg = NA)
```

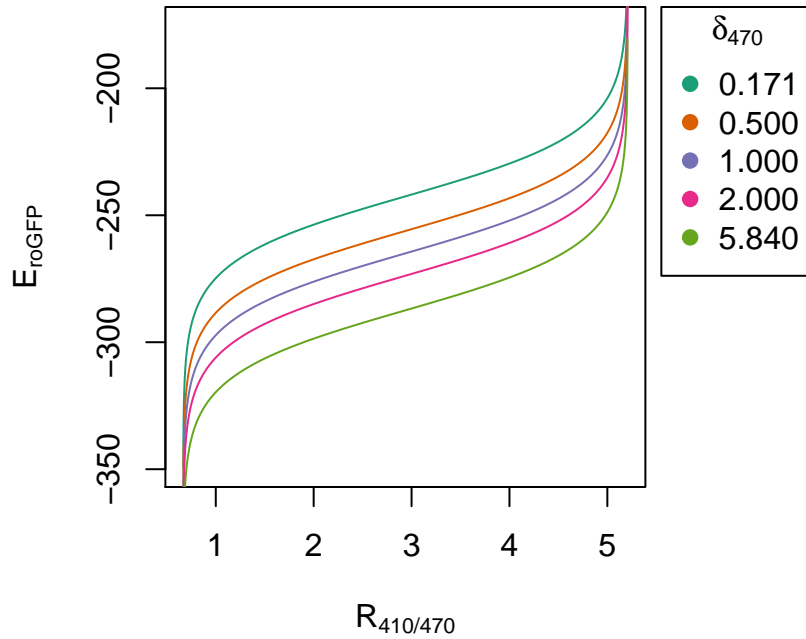
```
plot(x, yE,  
     type = 'l', main = "  
Redox potential with variable delta",  
     ylab = expression('E'['roGFP']), xlab = expression('R'['410/470']),  
     col = colors[1], ylim = c(-350, -175))
```

```
for (i in 2:length(delta_values)) {  
  yE_i <- FE(-265, x, rep(maxRed, each = magX),  
            rep(maxOx, each = magX),  
            rep(delta_values[i], each = magX))  
  points(x, yE_i, col = colors[i], type = 'l')  
}
```

```
options(digits = 4)
```

```
legend("topright", title = expression(delta['470']), inset=c(-0.35,0), xpd=TRUE, as.character(format(de
```

Redox potential with variable delta



```
dev.copy(pdf, 'plot2_1.pdf', compress = FALSE)
```

```
## pdf
```

```
## 5
```

```
** At fixed  $\delta = 0.171$ , vary  $E_0$  **
```

```
maxRed <- 0.667
```

```
maxOx <- 5.207
```

```
delta <- 0.171
```

```
x <- seq(maxRed, maxOx, by = 0.001)
```

```
magX <- length(x)
```

```
E0_values <- c(200, 100, 0, -100, -200, -300, -400)
```

```
yE = FE(E0_values[1], x, rep(maxRed, each = magX),
        rep(maxOx, each = magX),
        rep(delta, each = magX))
```

```
par(mar=c(5, 5, 5, 8), pty = 's', bg = NA)
```

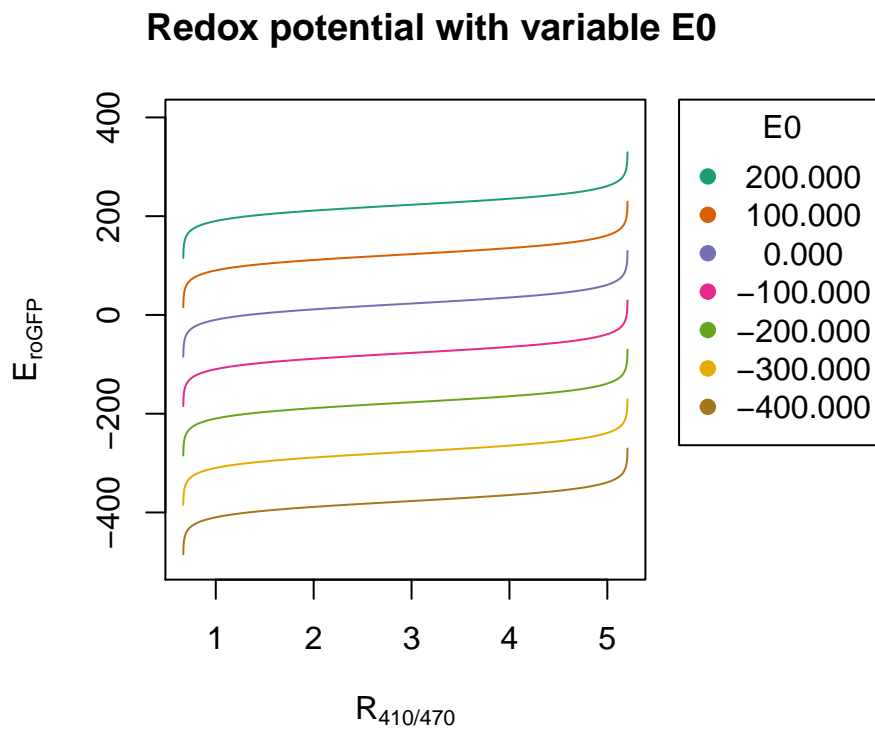
```
plot(x, yE,
      type = 'l', main = "
      Redox potential with variable  $E_0$ ",
      ylab = expression('E'['roGFP']), xlab = expression('R'['410/470']),
      col = colors[1], ylim = c(-500, 400))
```

```

for (i in 2:length(E0_values)) {
  yE_i <- FE(E0_values[i], x, rep(maxRed, each = magX),
    rep(maxOx, each = magX),
    rep(0.171, each = magX))
  points(x, yE_i, col = colors[i], type = 'l')
}

options(digits = 4)
legend("topright", title = 'E0', inset=c(-0.5,0), xpd=TRUE, as.character(format(E0_values, nsmall = 3))

```



```

dev.copy(pdf, 'plot2_2.pdf', compress = FALSE)

```

```

## pdf
## 6

```