Let \( f(t) = Y_t \) be the activity at time \( t \), normalized to time 0 and control

\[
f(t) \geq 0, \quad f(0) = 1, \quad \lim_{x \to \infty} f(t) = d
\]

### Hyperactivity

\[
Y_t = f(t) = e^{bt}(at + 1 - d) + d \quad a > -b, \ b < 0, \ d \geq 0
\]

**Time of p\% of control:**

\[
ET_P = \frac{W\left(-\frac{b(d-p)e^{(b-bd)/a}}{a}\right)}{b} + \frac{d-1}{a}
\]

*Example 1 (hyperactivity compound):* \( a = 1.7, \ b = -0.5, \ d = 0.2 \)

- **Time of p\% of control:**
  
  \[
  ET_P = \frac{W\left(-\frac{1.7(0.2-p)e^{(1.7-1.7)(0.2)/1.7}}{1.7}\right)}{1.7} + \frac{0.2-1}{1.7}
  \]

  *Example 1 (hyperactivity compound):* \( a = 1.7, \ b = -0.5, \ d = 0.2 \)

  - **Time of p\% of control:**
    
    \[
    ET_P = \frac{W\left(-\frac{1.7(0.2-p)e^{(1.7-1.7)(0.2)/1.7}}{1.7}\right)}{1.7} + \frac{0.2-1}{1.7}
    \]

  *Example 1 (hyperactivity compound):* \( a = 1.7, \ b = -0.5, \ d = 0.2 \)

- **Time of peak:**
  
  \[
  t_P = \frac{-a-bd+b}{ab}
  \]

- **Peak activity value:**
  
  \[
  P = e^{-\frac{a-bd+b}{a}} \left(-\frac{a}{b}\right) + d
  \]

- **Time of end of hyperactivity phase:**
  
  \[
  t_H = ET_1 \frac{W\left(-\frac{b(d-1)e^{(b-bd)/a}}{a}\right)}{b} + \frac{d-1}{a}
  \]

  *Note: if \( d > 1 \), i.e. activity remains above the \( y=1 \) line for the study period (16 hours), replace \( d \) with .99999 in the above equation.*

- **Minimum activity:**
  
  \( d \)

### Hypoactivity

\[
Y_t = f(t) = e^{bt}(1-d) + d \quad b < 0, \ d \geq 0
\]

This is simply the hyperactivity model without the \( a \) parameter.

**Time of p\% of control:**

\[
ET_P = \frac{\log\left(d-p\right)}{b}
\]

- **Time of peak:**
  
  N.A.

- **Peak activity value:**
  
  N.A.

- **Time of end of hyperactivity phase:**
  
  N.A.

- **Minimum activity:**
  
  \( d \)
Example 1: Compound induced hyperactivity followed by hypoactivity. Hyperactivity model fit: \(a=1.7, b=-0.5, d=0.2\)

![Graph of Compound induced hyperactivity followed by hypoactivity]

- \(P=f(x=1.41)=1.78\)
- \(d=0.2\)
- \(t_H = ET_t = 4.85\) hours
- \(ET_{50}=7.66\) hours

Example 2: Compound induced hypoactivity. Hypoactivity model fit: \(b=-0.5, d=0.2\)

![Graph of Hypoactivity inducing compound]

- \(d=0.2\)
- \(ET_{50}=1.96\) hours