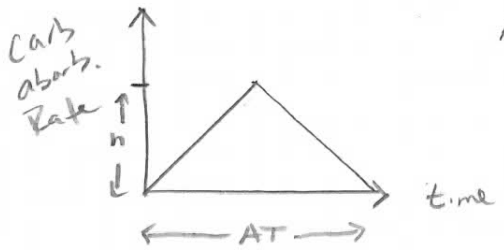
Carb Absorbtion



Approximate absorbtion curves in Think Like a Pancreas

High GI : 90 min
Medium GI : 180 min
Low GI : 240 min
> Activity Times

AT = Activity Time
D = Dose of Carbs (total)
CAR(t) = carb absorbtion rate
COB(t) = Carbs on board

$D = \frac{1}{2} AT \cdot h$

$$CAR(t) = \begin{cases} \frac{2ht}{AT} & \text{if } 0 < t < \frac{AT}{2} \\ 2h\left(1 - \frac{t}{AT}\right) & \text{if } \frac{AT}{2} < t < AT \end{cases}$$

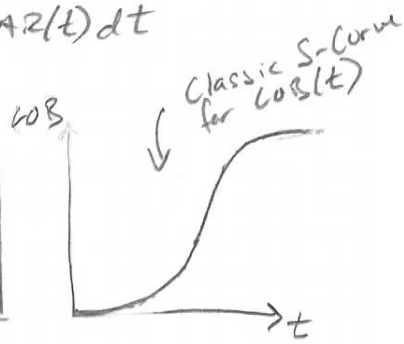
* Assume AT NOT a function of Dose

$$CAR(t) = \begin{cases} \frac{4D}{AT^2} t & \text{if } 0 < t < \frac{AT}{2} \\ \frac{4D}{AT}\left(1 - \frac{t}{AT}\right) & \text{if } \frac{AT}{2} < t < AT \end{cases}$$

$$COB(t) = \int_0^t CAR(t)\,dt = \int_0^{AT/2} CAR(t)\,dt + \int_{\frac{AT}{2}}^{AT} CAR(t)\,dt$$

skipping some algebra

$$\boxed{COB(t) = \begin{cases} \frac{2D}{AT^2} t^2 & 0 < t < \frac{AT}{2} \\ -D + \frac{4D}{AT}\left(t - \frac{t^2}{2AT}\right) & \frac{AT}{2} < t < AT \end{cases}}$$



ΔBGC = Change in Blood Glucose from Carbs

$$\boxed{\Delta BGC = \frac{SF}{CR} \cdot COB(t)}$$

* Assume SF and CR are NOT functions of BG, COB, IOB, etc

Bolus / Temp Basal

Bolus

ΔBGI = Change in Blood Glucose from Insulin

$$\Delta BGI(t) = -SF \cdot B \cdot \left(1 - \frac{IOB(t)}{100}\right)$$

* Assume SF not a function of t

SF = Sensitivity Factor
B = Bolus Amount
$IOB(t)$ = Insulin on Board $\begin{cases} 100 & \text{at } t=0 \\ 0 & \text{at } t = IDUR \end{cases}$
$IDUR$ = Insulin Duration

Temp Basal

$\Delta BGITB$ = Change in Blood Glucose from Temp Basal

$$\Delta BGITB(t) = -\int_{t_1}^{t_2} \frac{db}{dt^*}(t^*) \cdot SF(t^*) \left(1 - \frac{IOB(t-t^*)}{100}\right) dt^*$$

$\frac{db}{dt}$ = basal flux, $t_1 \to t_2$ = time of temp basal

Assume $\frac{db}{dt}$, SF are constant during $t_1 \to t_2$

$$= -\frac{db}{dt} \cdot SF \int_{t_1}^{t_2} \left(1 - \frac{IOB(t-t^*)}{100}\right) dt^*$$

$$\Delta BGITB(t) = -\frac{db}{dt} \cdot SF \left[(t_2 - t_1) - \frac{1}{100} \int_{t_1}^{t_2} IOB(t-t^*)\, dt^*\right]$$

Since IOB function may change in future to something else, just integrate numerically. Can solve closed form with 4th Order Polynomial fit currently being used if more speed is required