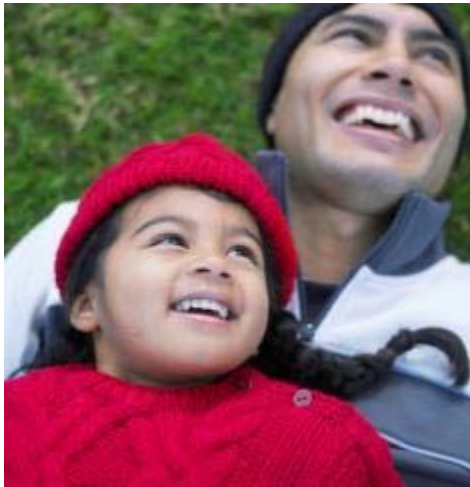


JDRF
typeone
nationsummit
IMPROVING LIVES. CURING TYPE 1 DIABETES. **T1D**

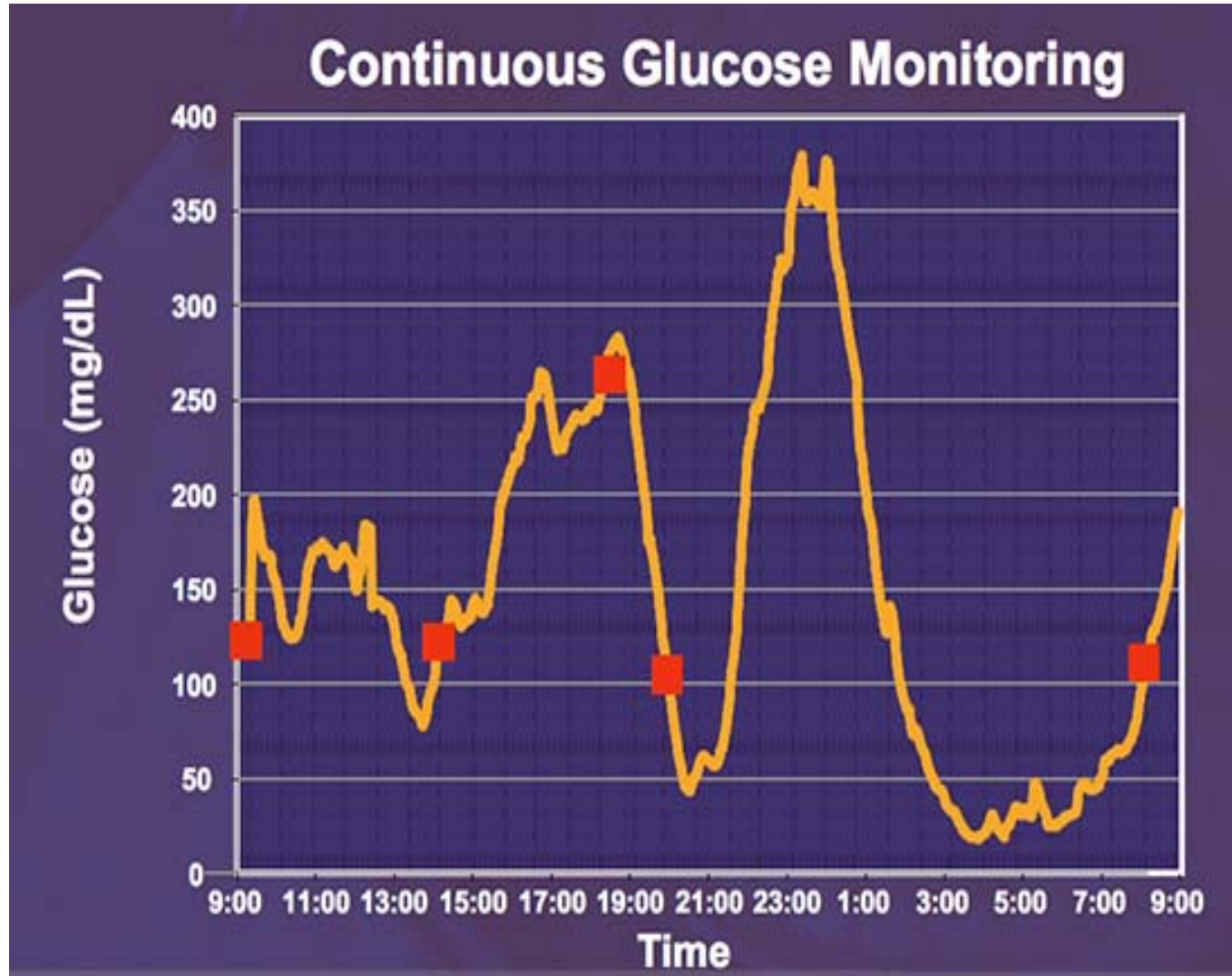


Understanding your Insulin Activity Curve—AKA Your Crystal Ball (or Timing is Everything!)

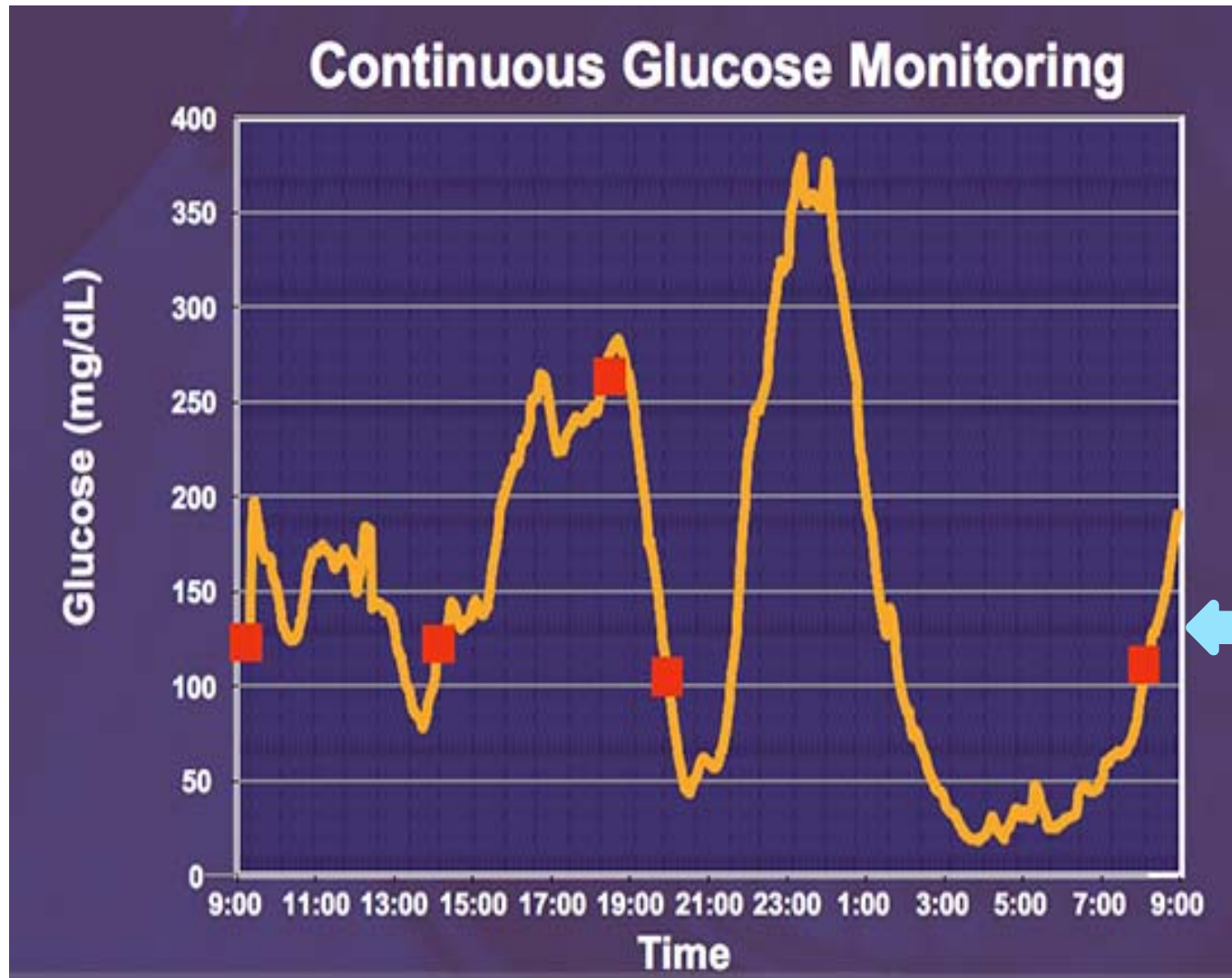
Gregory O. Clark, MD

CHICAGO DIABETES EXPERTS

Type 1 Diabetes—Controlled or Not?



Type 1 Diabetes– Controlled, Really?!



← Avg
glucose
140 =
A1c ~7

What We Expect



A Better Reflection of Reality

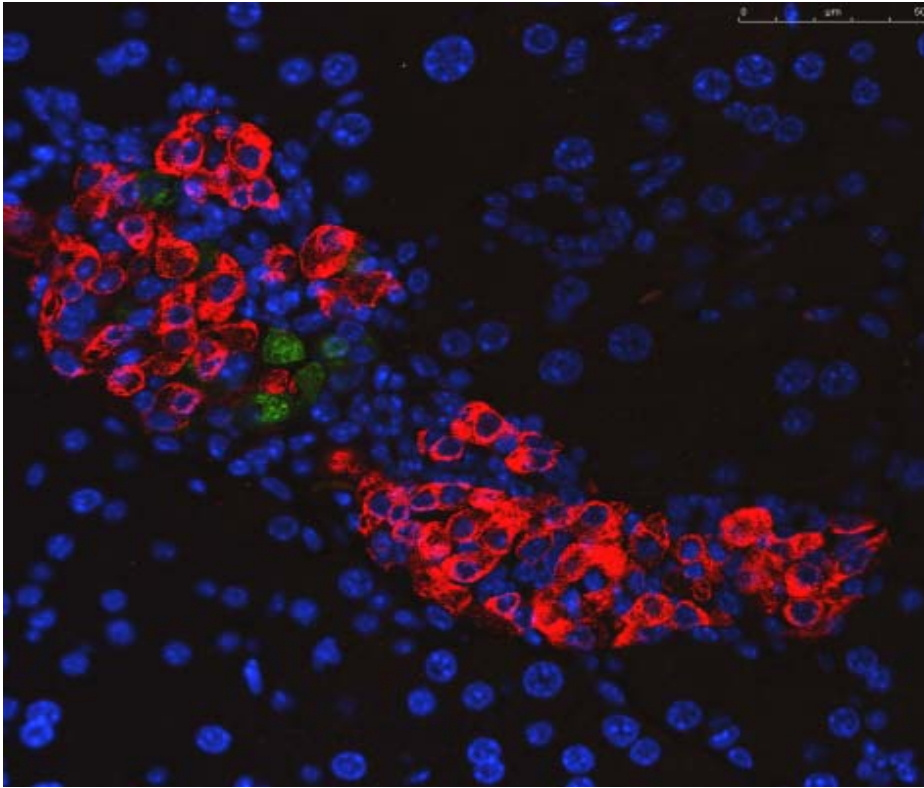


Problems In Type 1

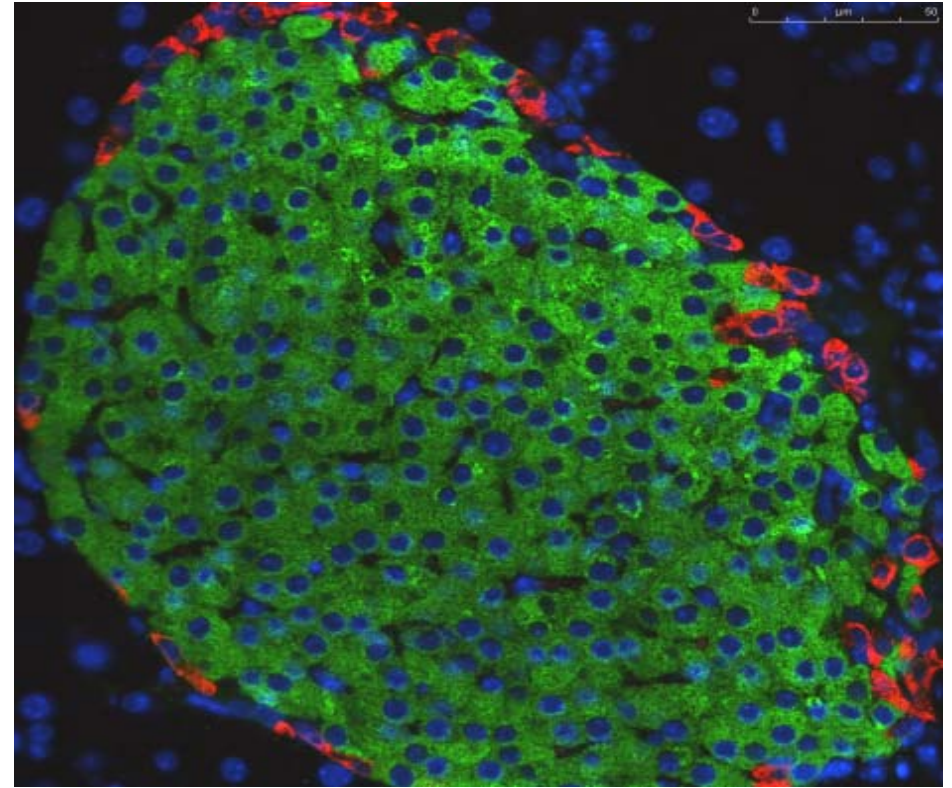
- Glucose variability
- Glucagon excess, esp. post-meal
- Insulin deficiency, less than ideal injected insulin
- Western Diet, large meals, carbohydrate heavy

- Liver overproduction of glucose

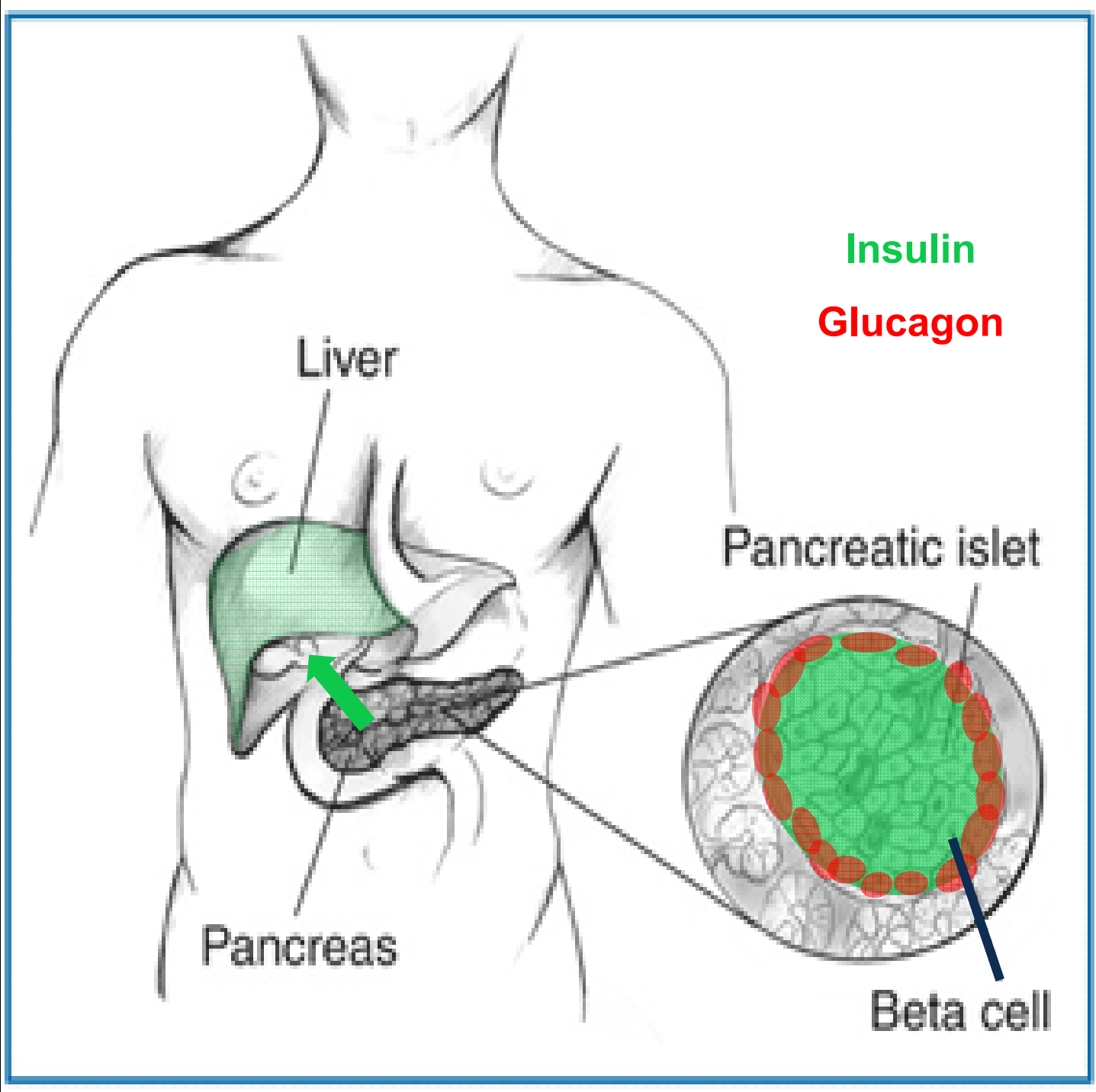
Islet Architecture



Type 1 Diabetes
Glucagon excess



Normal
Insulin predominates



Insulin

Glucagon

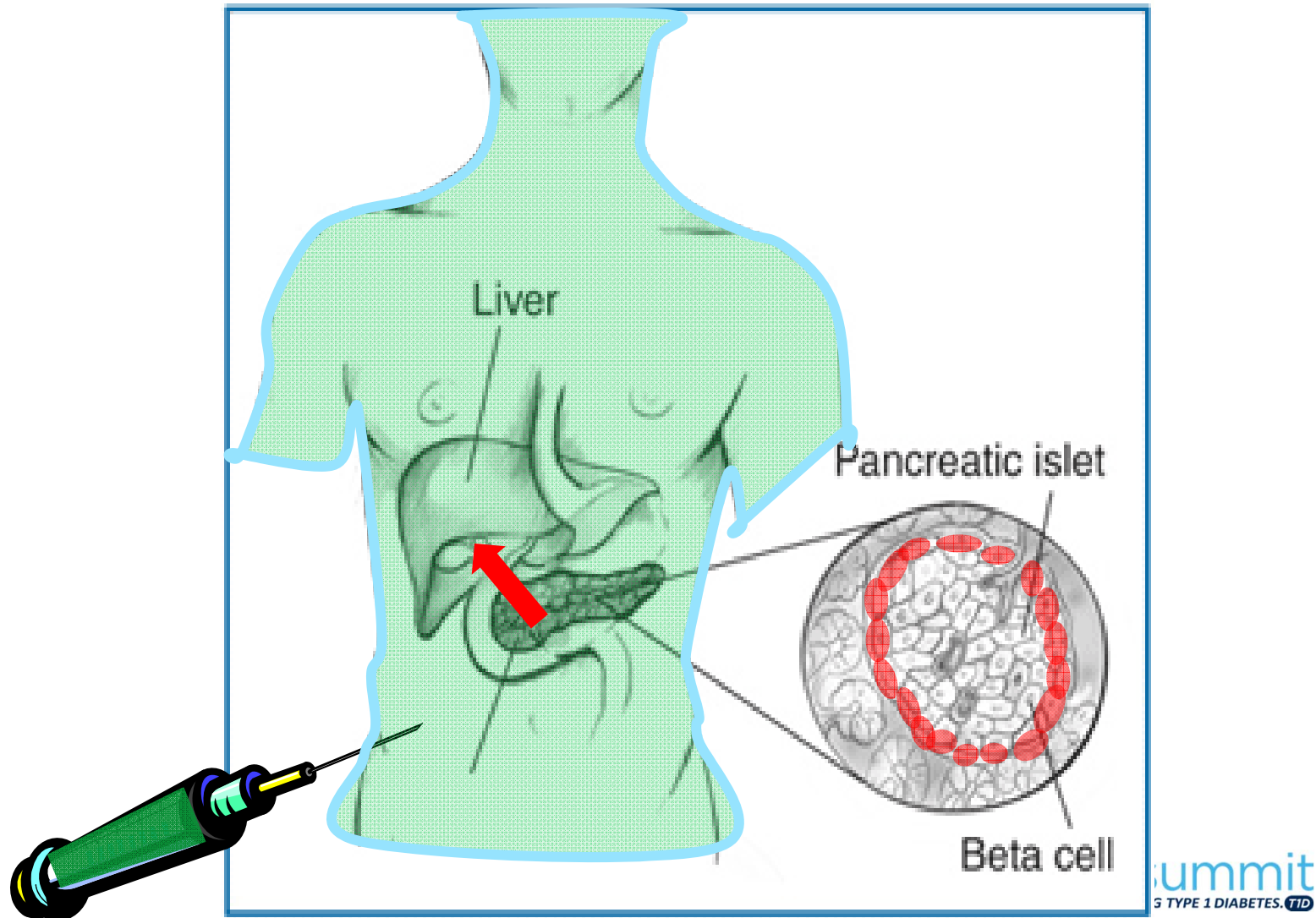
Liver

Pancreatic islet

Pancreas

Beta cell

Subcutaneous insulin leads to whole body insulin excess

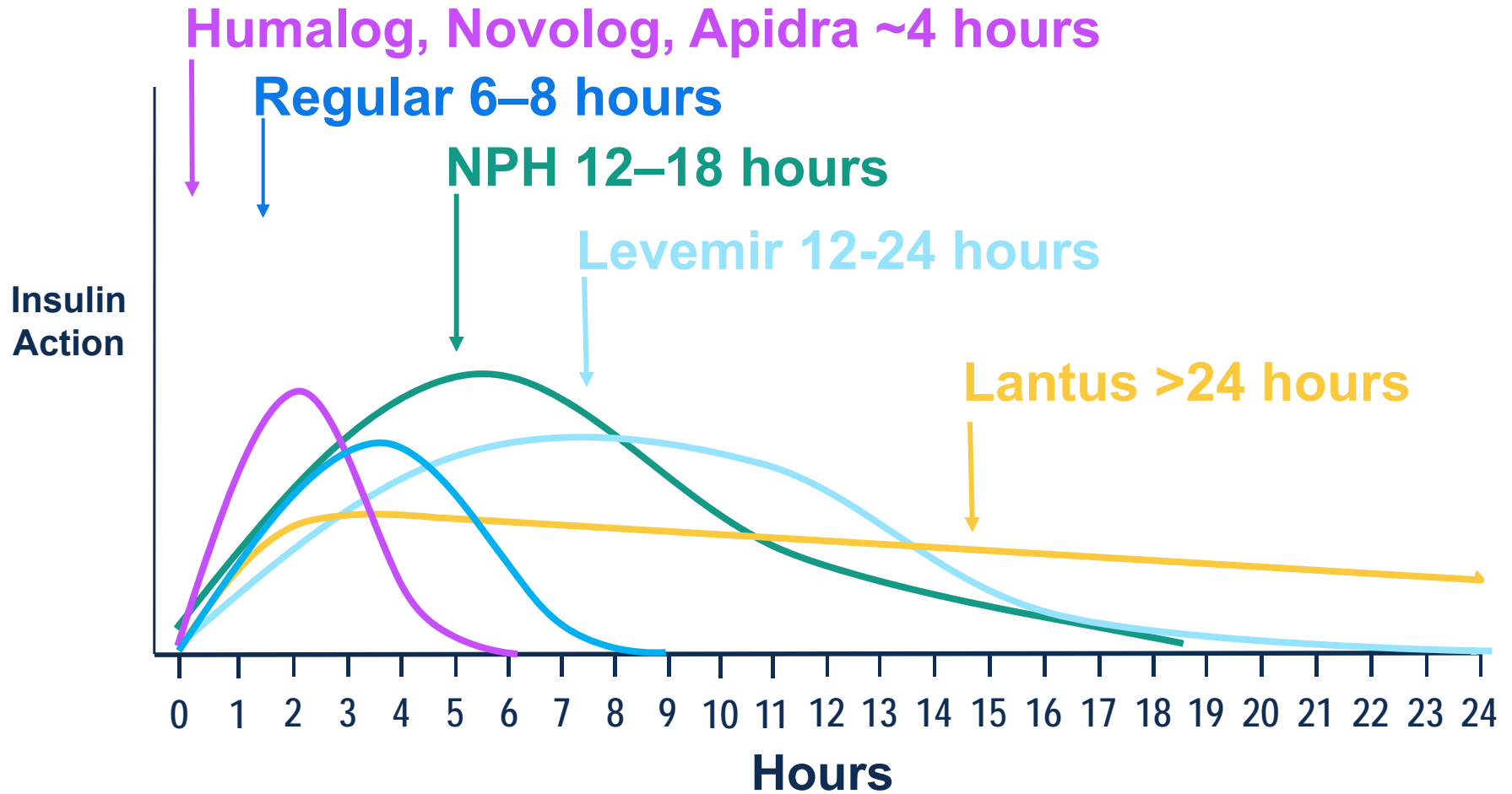


Normal is the Problem



Principles of Intensive Therapy of Type 1 Diabetes Insulin Options

Action Profiles of Insulins



Lepore M. *Diabetes*. 2000;49:2142-48; Porcellati F. *Diabetes Care*. 2007;30:2447-52;

Plank J. *Diabetes Care*. 2005;28: 1107-12; Mudaliar SR. *Diabetes Care* 1999;22:1501-06;

Becker RHA. *Exp Clin Endocrinol Diab* 2005;113:435-443

Physiologic Multiple Injection Regimens

The Basal-Bolus Insulin Concept

■ Basal insulin

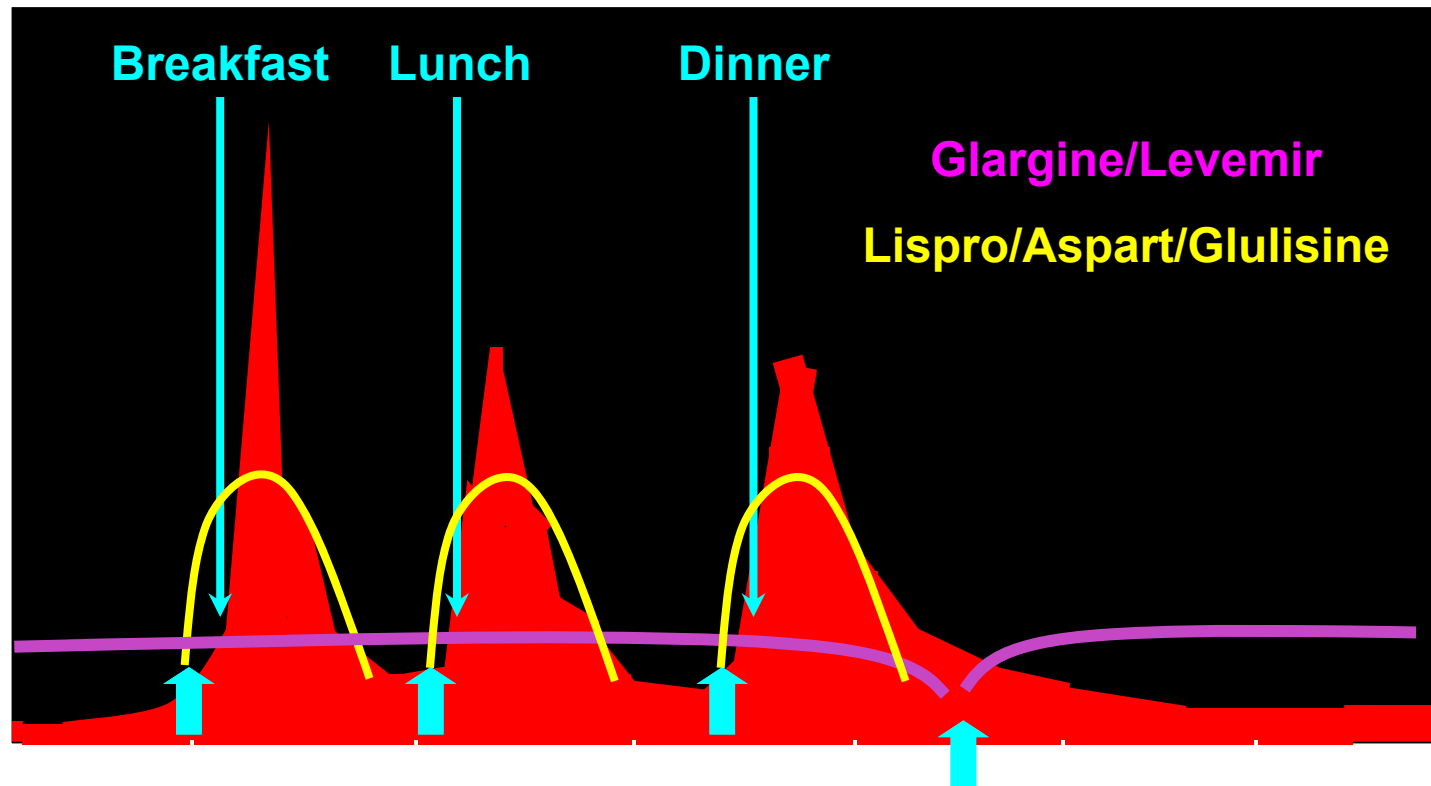
- Controls glucose production between meals and overnight
- Near-constant levels
- Usually ~50% of daily needs

■ Bolus insulin (mealtime or prandial)

- Limits hyperglycemia after meals
- Immediate rise and sharp peak at 2 hours postmeal
- 10% to 20% of total daily insulin requirement at each meal

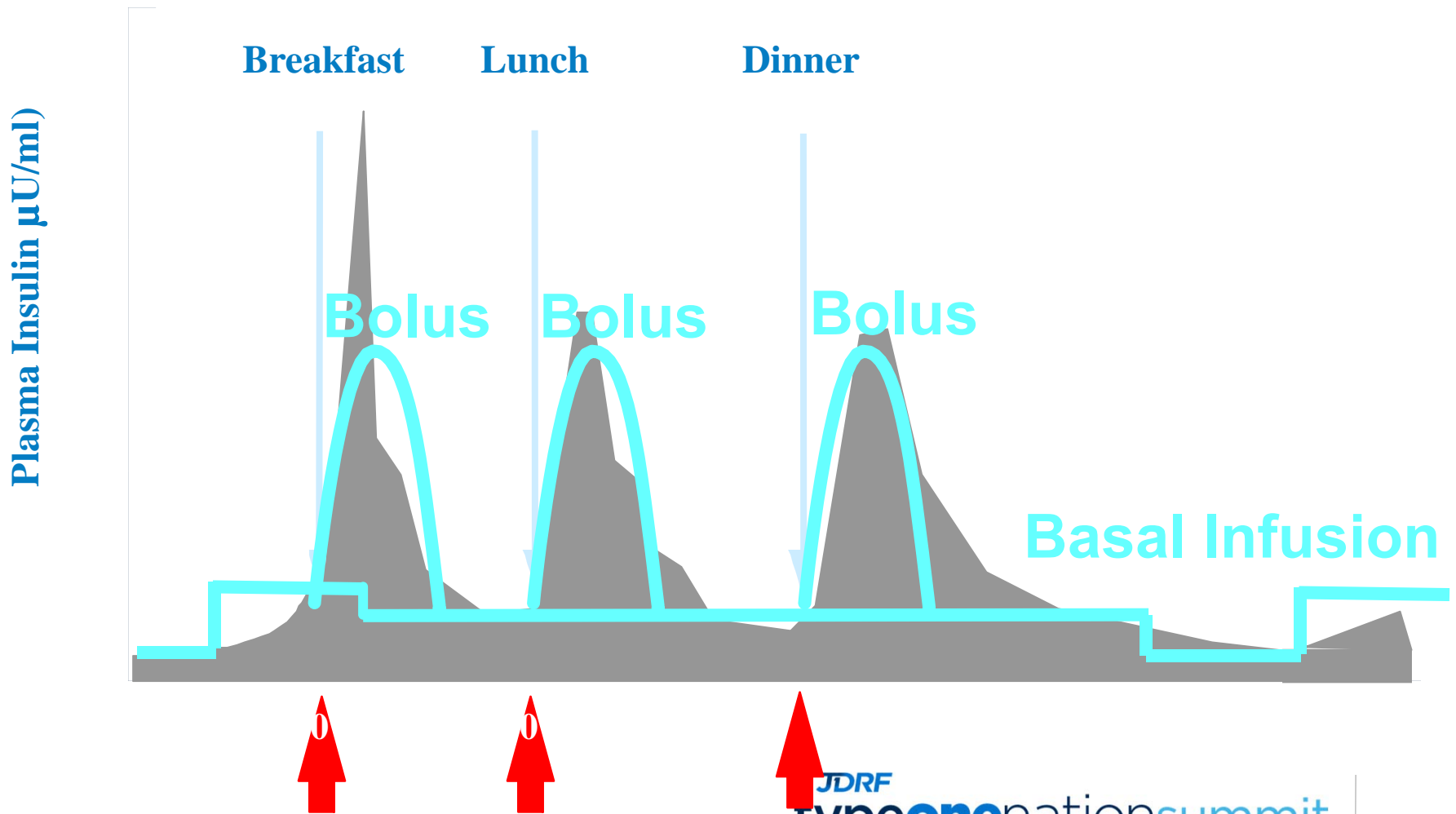
Insulin Absorption Pattern with Intensive Insulin Therapy

Basal and Bolus



Adapted from Skyler J, *Kelley's Textbook of Internal Medicine*. 2000.

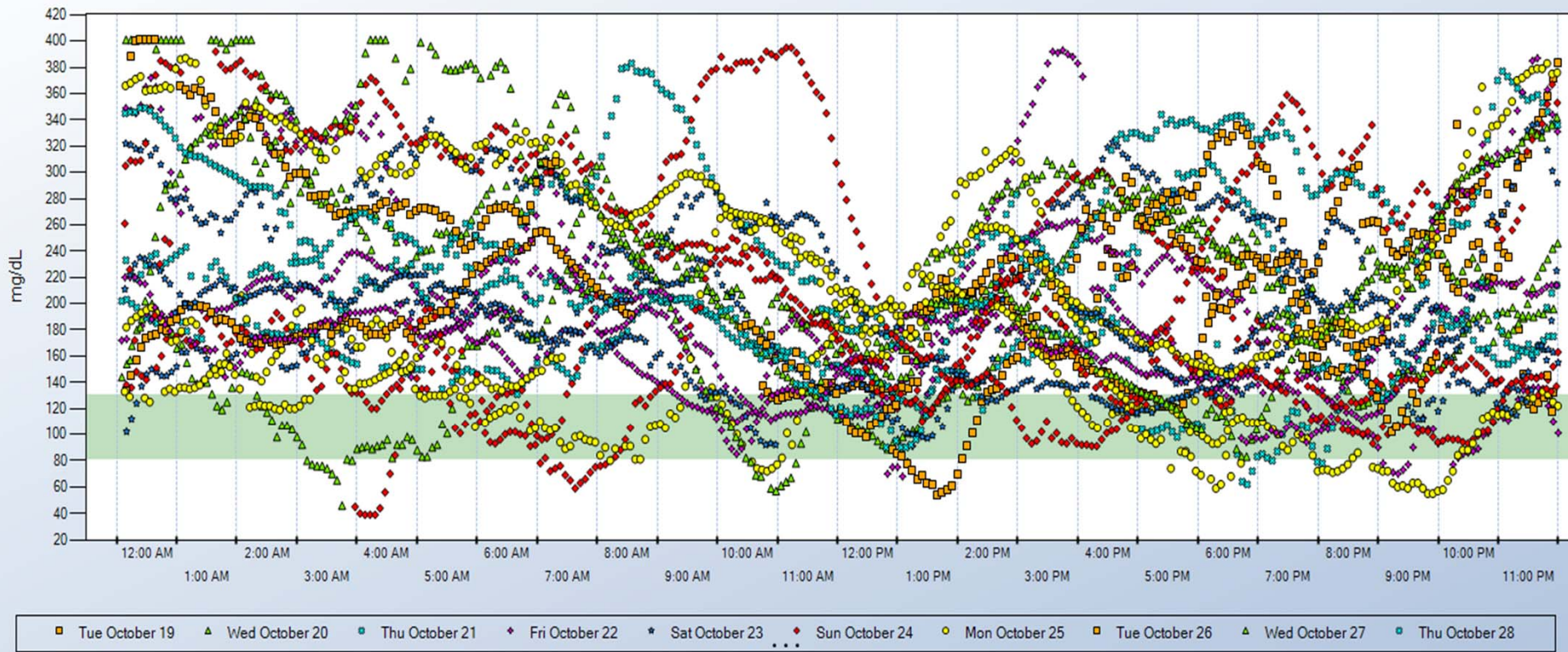
Variable Basal Rate Continuous Subcutaneous Insulin Infusion (CSII) Program-uses Rapid Acting Insulin



No Repeating Pattern

**30 yo female - Continuous glucose tracings for 21 days –
A1c 7.5**

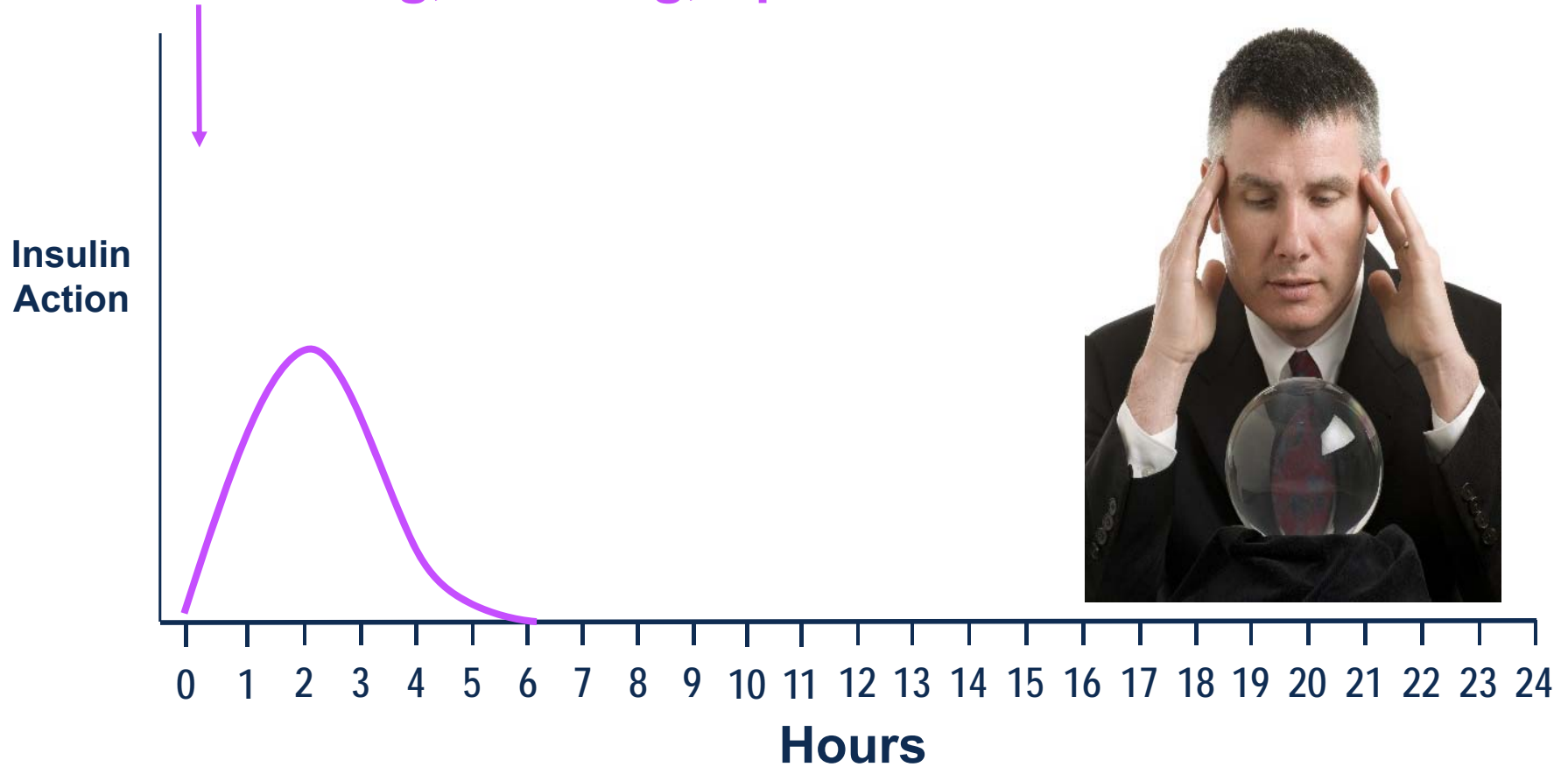
Modal Day : , [69992]



Action Profile of “Rapid” Insulin

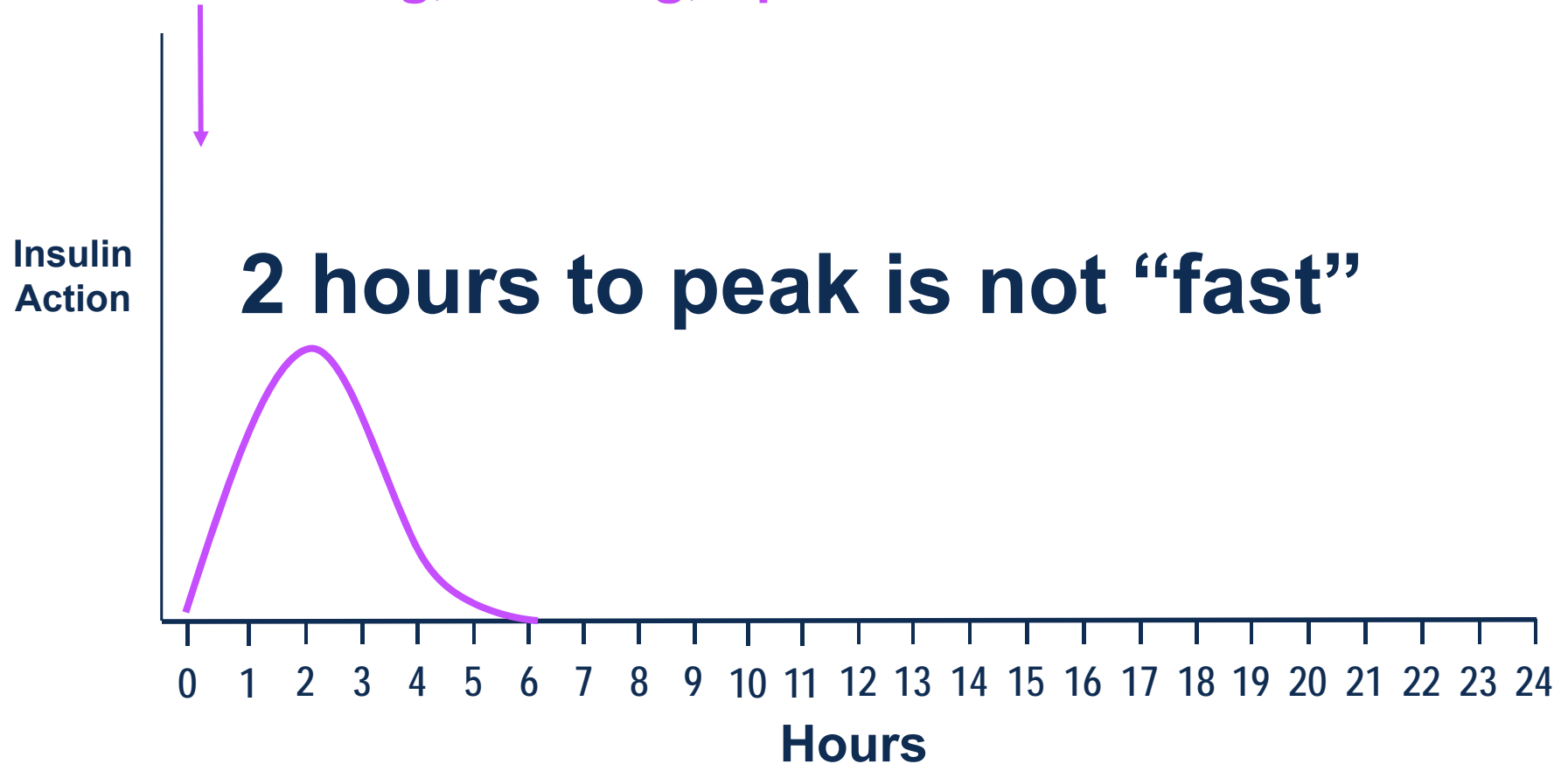
Here is your Crystal Ball

Humalog, Novolog, Apidra ~4 hours



Action Profiles of Insulins


Humalog, Novolog, Apidra 4–5 hours



Lepore M. *Diabetes*. 2000;49:2142-48; Porcellati F. *Diabetes Care*. 2007;30:2447-52;

Plank J. *Diabetes Care*. 2005;28: 1107-12; Mudaliar SR. *Diabetes Care* 1999;22:1501-06;

Becker RHA. *Exp Clin Endocrinol Diab* 2005;113:435-443

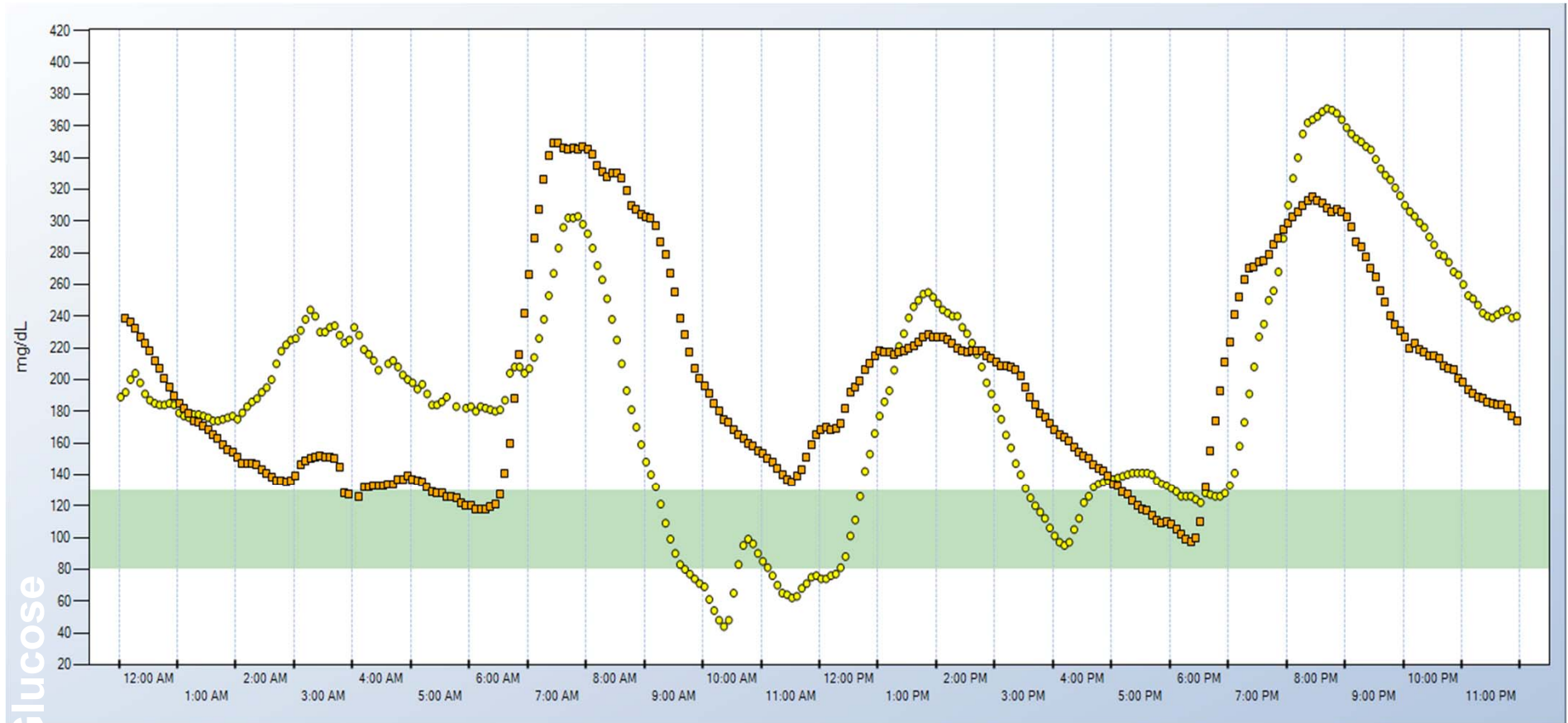
A vibrant assortment of fresh fruits and vegetables. The image features a variety of items including yellow and red bell peppers, corn on the cob, red and green tomatoes, clusters of red grapes, several red apples, a bunch of strawberries, a large pile of blueberries, yellow squash, and green cucumbers. The produce is arranged in a dense, overlapping composition, showcasing a wide range of colors and textures. The text "Carbs Delicious Nutritious" is overlaid in the center in a white, sans-serif font.

Carbs
Delicious
Nutritious

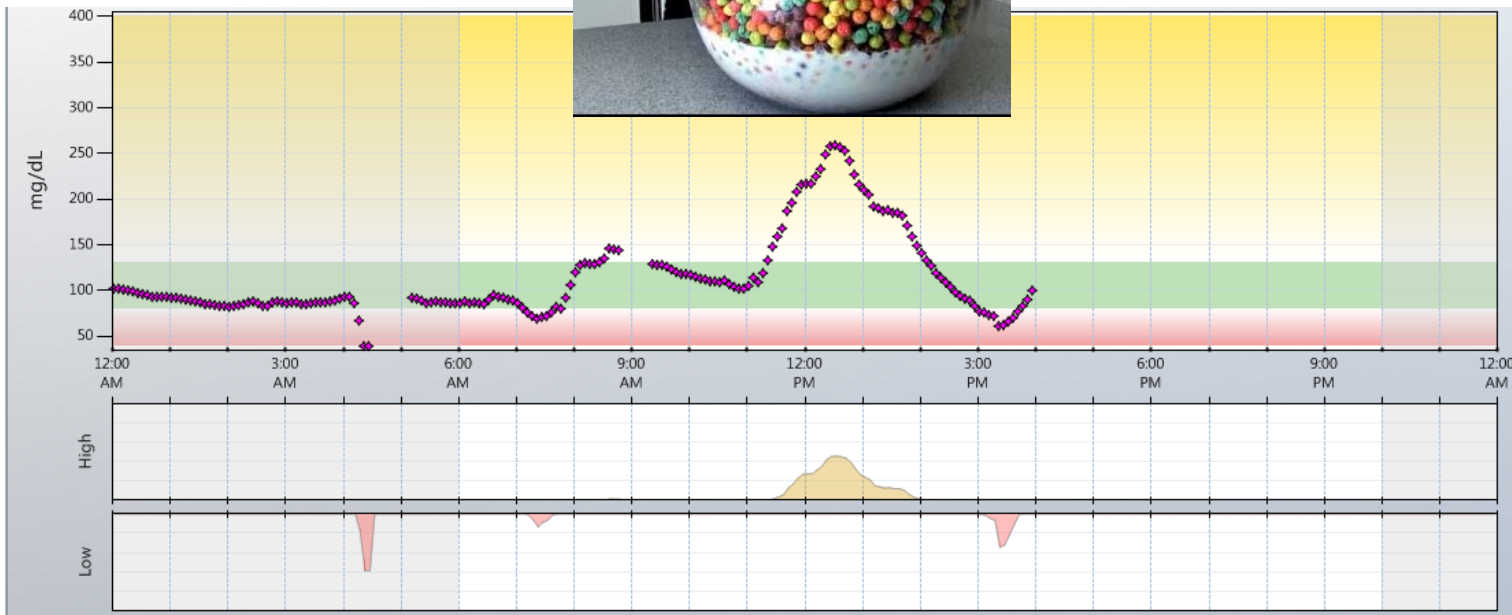
Carbohydrates – Some are Only Delicious



A Glucose Spike with Every Meal



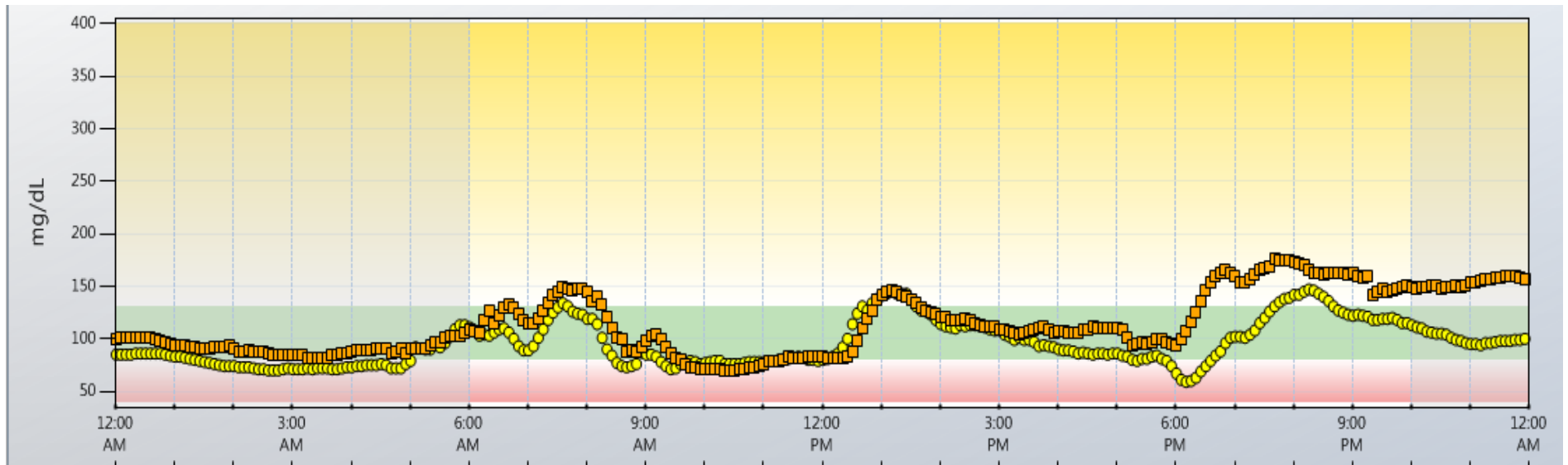
Pure Carbs Meals are Most Tricky



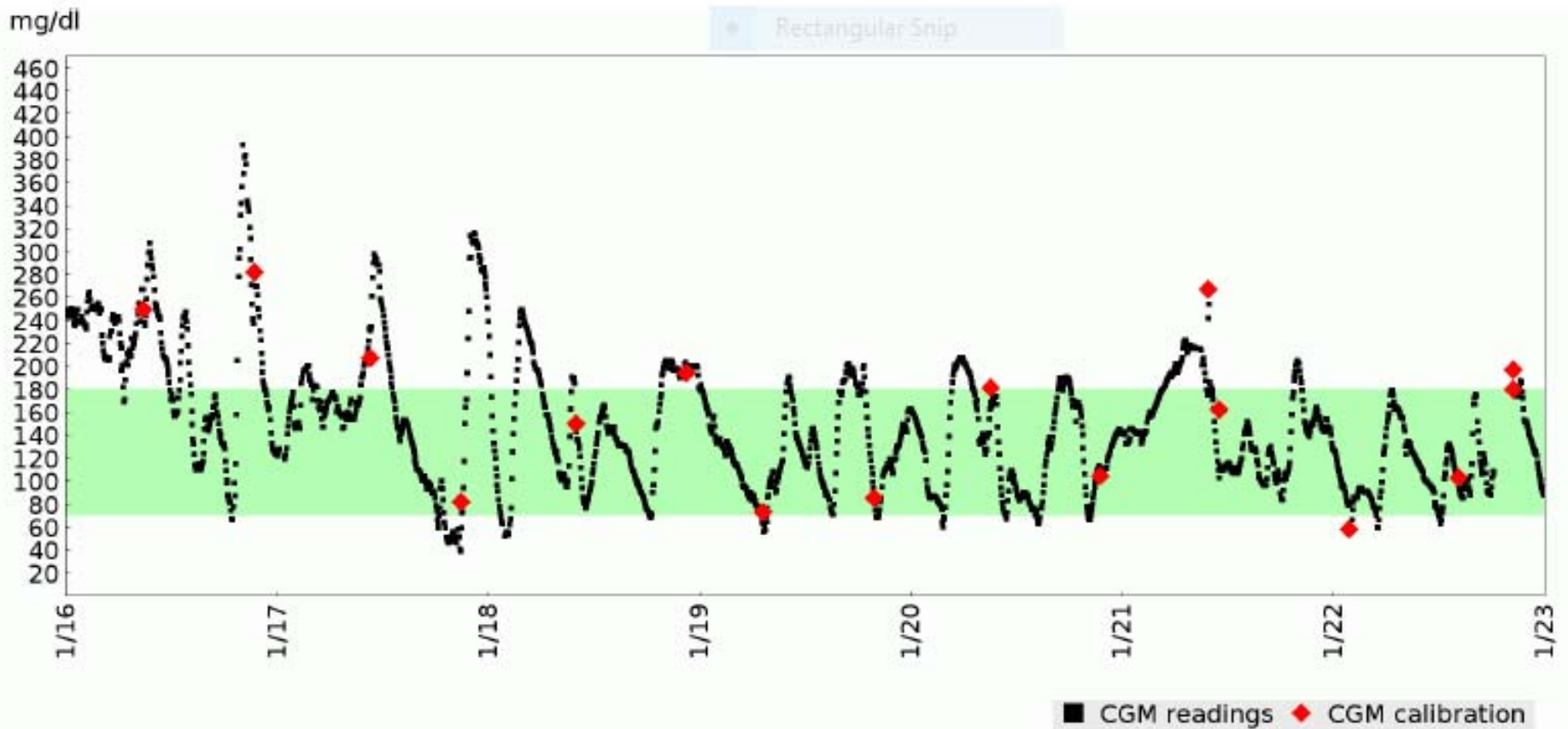
Low (0 Found)	No significant patterns detected
Daytime Low (0 Found)	No significant patterns detected
Nighttime High (0 Found)	No significant patterns detected
Daytime High (0 Found)	No significant patterns detected

Statistics	
Glucose Average	114 mg/dL
Sensor Usage	1 of 1 Days
Calibrations / day	4.0
Standard Deviation	± 47 mg/dL
	22 % High
	68 % Target
	10 % Low
Target Range	80 - 130 mg/dL
Nighttime Range	10:00 PM - 6:00 AM

Use of Advance Insulin

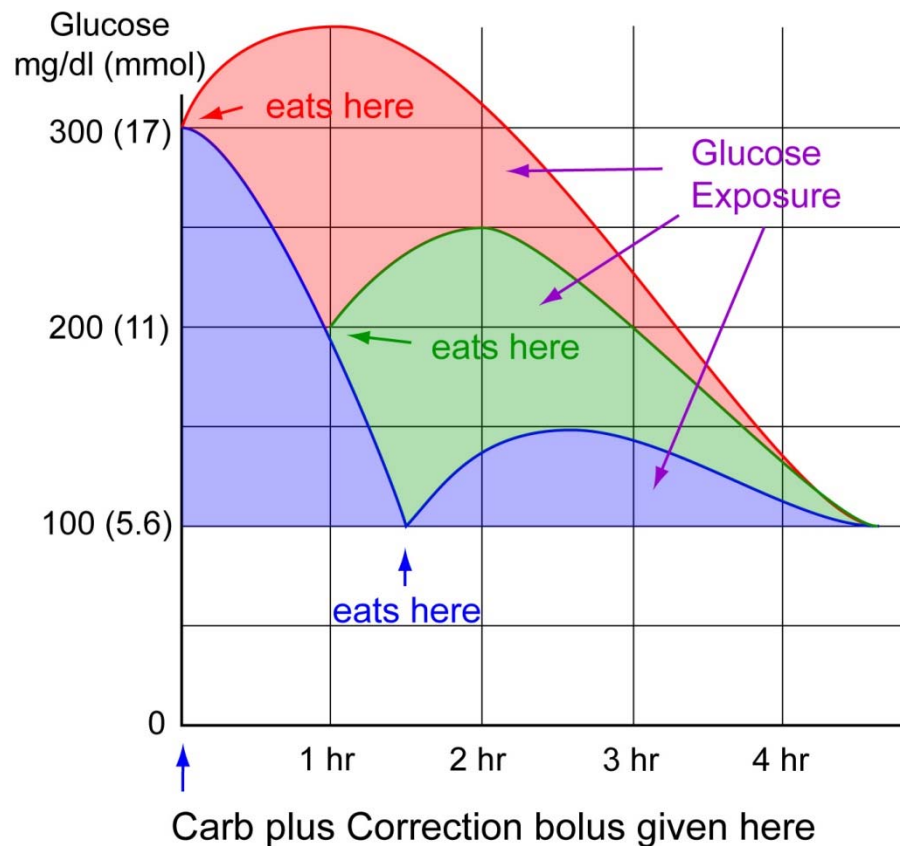


When Do You Think This Patient Started Using Insulin In Advance of Meals?



Delay the Meal After Insulin if Glucose is High

When a BG is high before a meal, how soon a person eats determines their exposure to glucose



A lower glucose at the start of a meal reduces glucose exposure.

Rules:

Test early

Bolus early

Don't forget to eat on time

Don't forget you've already bolused

Proteins and Fats are not Free!

Proteins

Intermediate Effect on Blood Glucose

Proteins



ADAM.

FATS ARE SLOOOOOOW.....



Action Profiles of Insulins

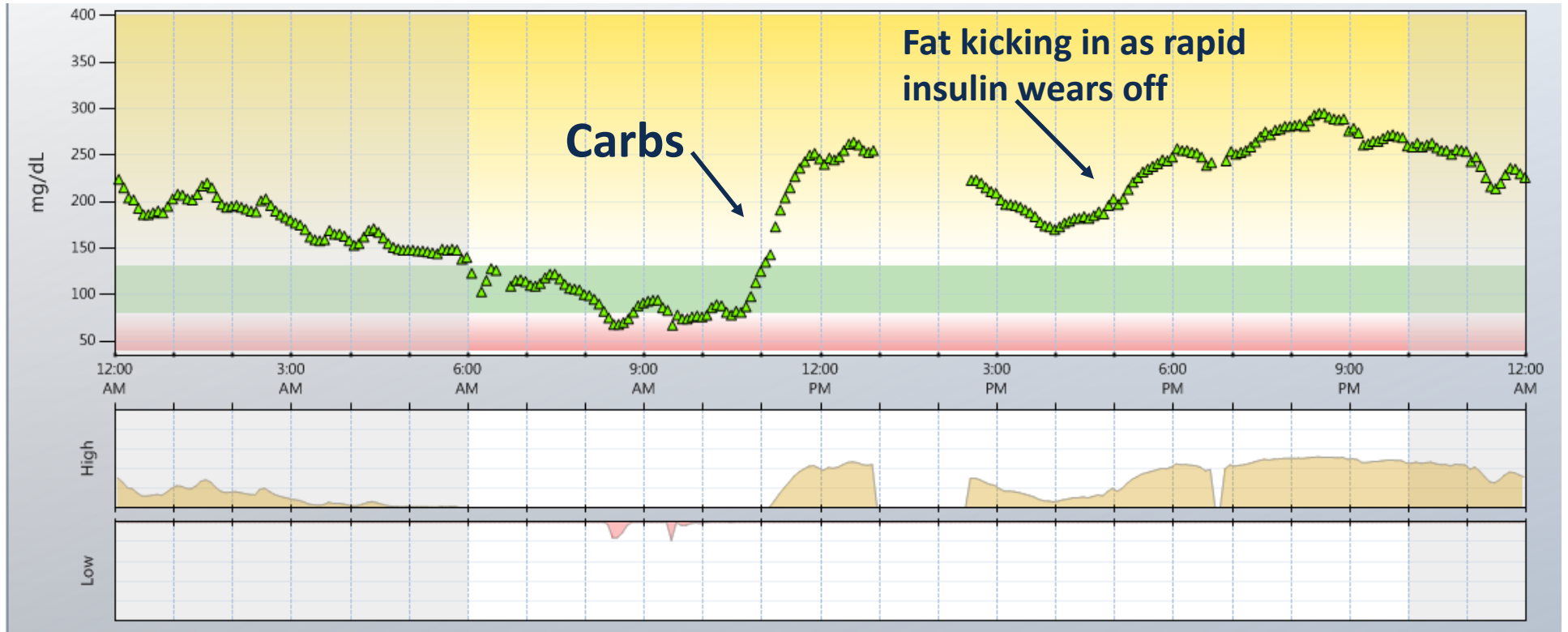


Lepore M. *Diabetes*. 2000;49:2142-48; Porcellati F. *Diabetes Care*. 2007;30:2447-52;

Plank J. *Diabetes Care*. 2005;28: 1107-12; Mudaliar SR. *Diabetes Care* 1999;22:1501-06;

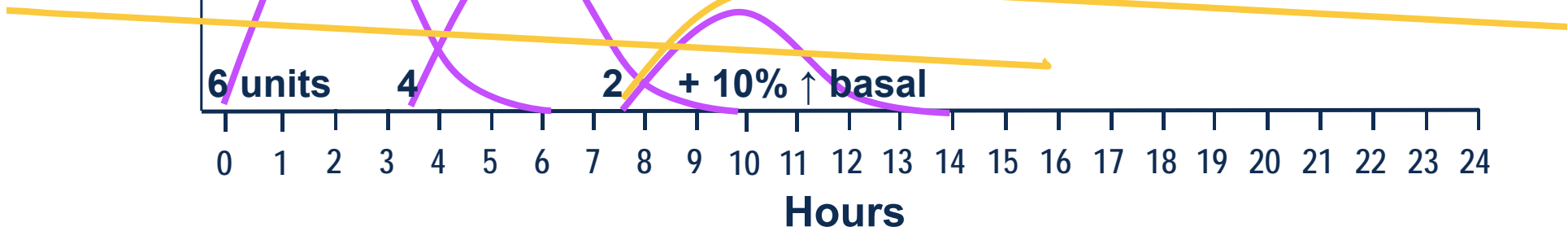
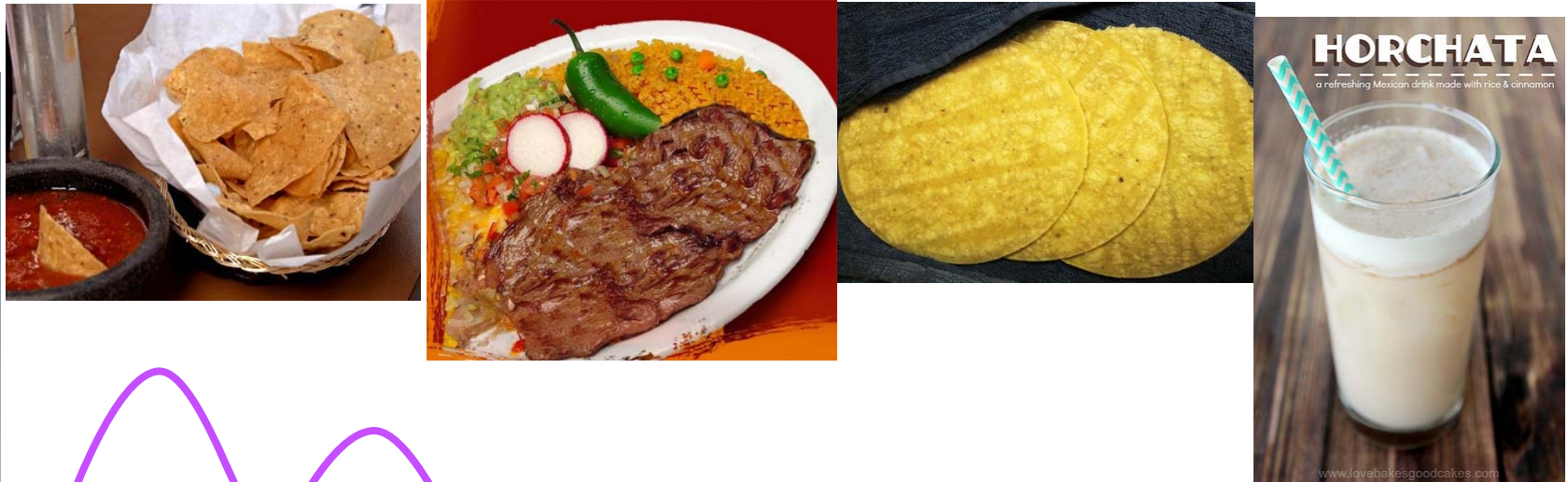
Becker RHA. *Exp Clin Endocrinol Diab* 2005;113:435-443

High Carb + High fat Carbs Spike Fast Fats Keep You Up



The Ultimate Test!

Insulin Action



2pm	530pm	9pm	6am
100	160	120	90

The Ultimate Test



Minimize Variables to Minimize Variance

- Variables: food and insulin
- If the doses of food and insulin are kept small, the variance in blood glucose is minimized

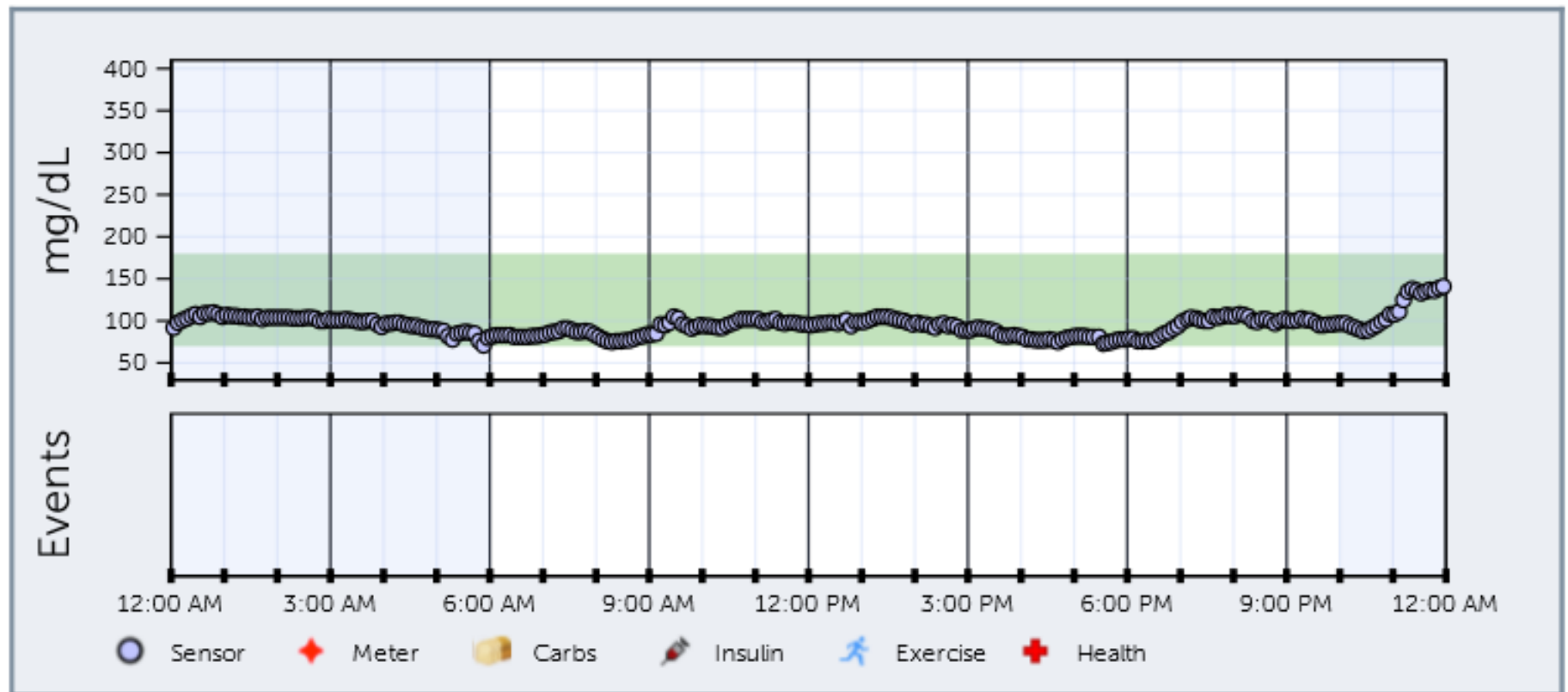


My strategy for success

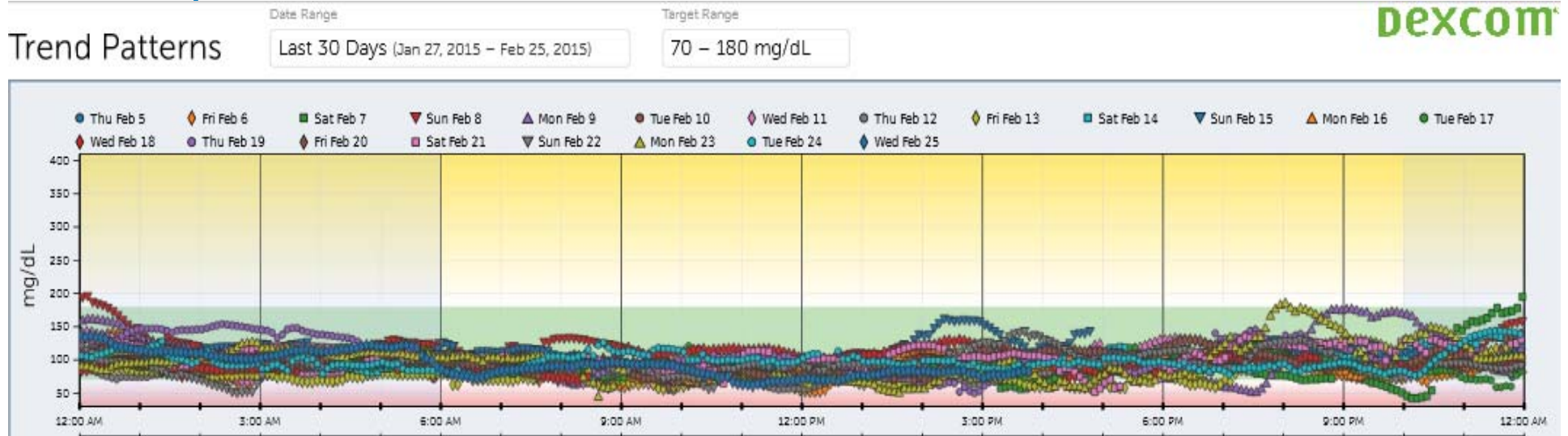


**A protein and 2 veggies
Veggies are very important!**

This is More Flat than People Without Diabetes



Low Carbohydrate Diets are Often an Important Consideration



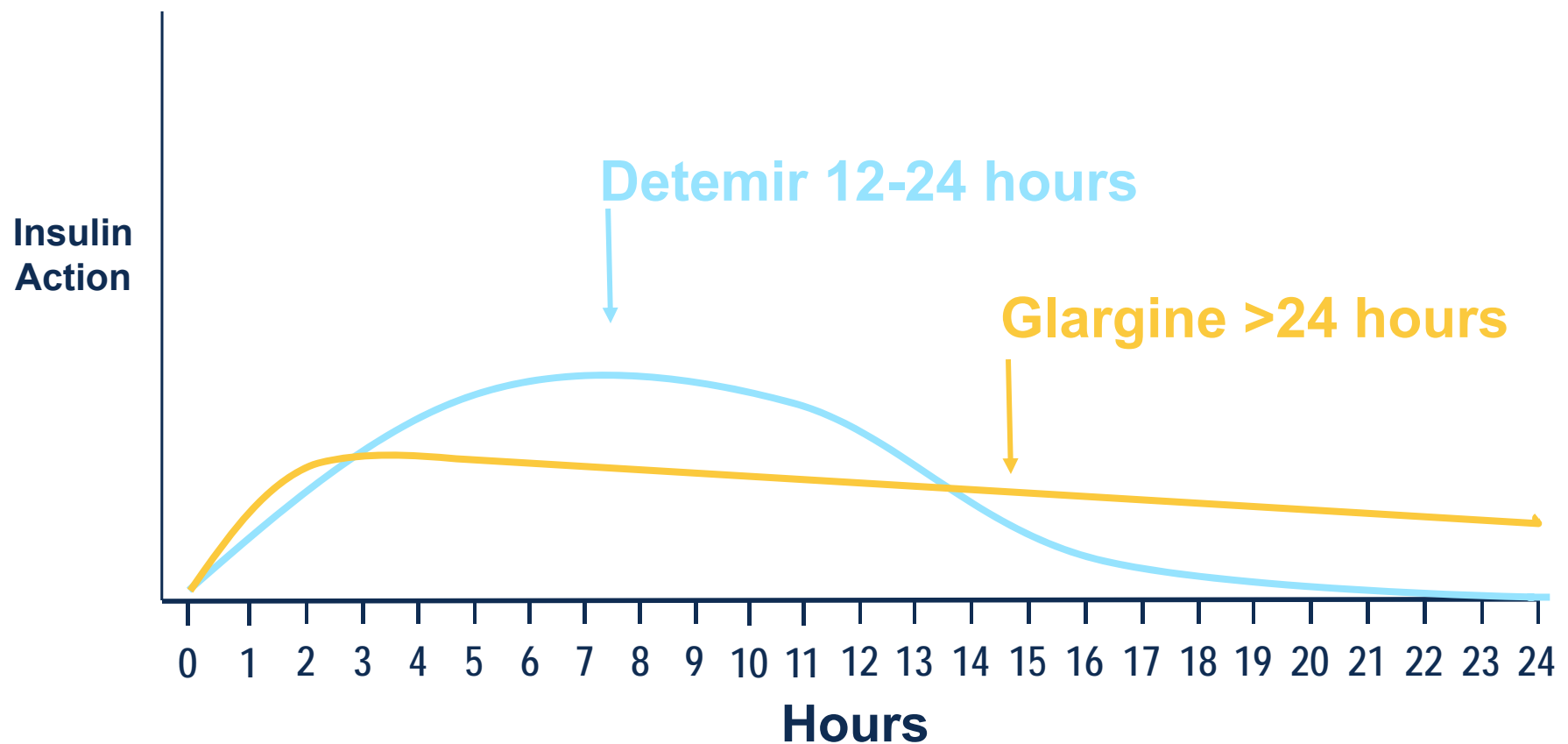
Statistics	
Average Glucose	97 mg/dL
Sensor Usage	21 of 30 days
Calibrations / Day	5.48
Standard Deviation	± 20 mg/dL
	0% High
	93% Target
	6% Low

New Devices Make It Easier to Remember Where You Are on the Insulin Activity Curve



Action Profiles of Insulins

Even Basal Insulins Require Consideration



Lepore M. *Diabetes*. 2000;49:2142-48; Porcellati F. *Diabetes Care*. 2007;30:2447-52;

Plank J. *Diabetes Care*. 2005;28: 1107-12; Mudaliar SR. *Diabetes Care* 1999;22:1501-06;

Becker RHA. *Exp Clin Endocrinol Diab* 2005;113:435-443



Thank you!