2.1 Who Controls the Settings?					
AID System	**Basal Rate**	**CarbF**	**CorrF**	**DIA**	**BG Targets**
Beta Bionics*	AID	AID	AID	AID	110, 120, 130
DIY Open-source Systems	Both	User	Both	User	80 to 150
Medtronic 780G	AID	User	AID	Both	100, 110, 120
Insulet Omnipod 5	Both	User	Both	AID	110-150
Sequel medTech twiist	Both	Both	Both	User	87 to 180
Tandem t:slim and Mobi	Both	User	Both	AID	112.5-160
Both = User and AID share control	* Body weight & glucose target are the only user settings.				

2.2 AID Settings – Specific Setting Options that Lower Highs and Stop Lows		
AID System	**To Lower a High Average Glucose, Give More Insulin**	**To Reduce Excess Hypoglycemia (Lows), Give Less Insulin**
All AID Systems	Do not reduce recommended bolus unless covering activity or excess IOB. Bolus 15 to 20 min. before all meals. Select the lowest target glucose.	Do not increase recommended boluses. Don't enter fake carbs to get a larger bolus. Raise the CarbF* and target glucose.
Beta Bionics iLet ACE Pump	Set target glucose to "lower", 110 mg/dL (6.1 mmol/L). Use consistent meal sizes.	Set target glucose to "usual" 120 (6.7) or "higher" 130 mg/dL (7.2 mmol/L). Use consistent meal sizes, no fake carbs.
Insulet Omnipod 5	Lower the target glucose. Lower the CarbF or CorrF (ISF).* Turn reverse correction off. Shorten the DIA time.	Set target glucose to 130 or 140 mg/dl. Raise CarbF or CorrF (ISF).* Turn reverse correction on. Start Activity Mode (24 hrs).
Tandem Diabetes Control-IQ	Lower CarbF.* Use a CorrF* as low as 1400/TDD. Raise basal rates. Use Sleep Mode (112.5 target) all day.	Raise CarbF* or CorrF.* Lower basal rates. Turn on Activity Exercise (140 to 160 mg/dL, on/off).
Medtronic 780G SmartGuard	Lower the CarbF (IAT).* Shorten the DIA time, especially if premeal boluses are often missed. Lower target glucose. Turn on auto-correction.	Raise the CarbF (IAT).* Lengthen the DIA time. Raise target glucose. Turn off auto-correction.
* CarbF and CorrF values are lowered when more insulin is needed and raised when less insulin is needed.		

2.3 Features for Major AID Brands							
Features:	**Beta Bionics iLet ACE Pump**	**CamDiab CamAPS FX**	**Medtronic 780G SmartGuard**	**Omnipod 5 SmartAdjust**	**Sequel MedTech twiist**	**Tandem t:slim X2**	**Tandem Mobi**
AID Algorithm	Dosing Decision Soft.	CamAPS FX	SmartGuard	Automated Mode	Tidepool Loop	Control-IQ+	Control-IQ+
Size & Weight	3.58 x 2.32 x 0.59 in, 3.88 oz.	3.35 x 1.73 x 0.75-0.87 in, 2.9 oz	3.81 x 2.18 x 1.01 in, 3.74 oz.	1.53 x 2.05 x 0.57 in, 0.92 oz.	2 in. diameter, 2 oz.	3.13 x 2 x 0.6 in, 3.6 oz.	2.02 x 1.47 x 0.56 in, 1.06 oz.
Cartridge Size	180 units	160u YpsoPump, or 300u Sooil DANA-i	300 units	200 units	300 units	300 units	200 units
Algorithm	Adaptive basal & correction + meals	MPC, treat-to-target + adaptive basal Q10 min	PID + adaptive basal & model controls	MPC + adaptive basal every 5 min	DEKA Loop MPC	MPC + adaptive basal 30 min BG prediction	MPC + adaptive basal 30 min BG prediction
Approved for	6 yrs and older	1 yr +, pregnancy	7 yrs and older	2 yrs and older	6 yrs and older	2 yrs and older	2 yrs and older
CGM (wear time, warm-up)	Dexcom G7 (10 days, 30 m), Libre 3 (14 days, 1 hr)	Dexcom G7 (10 days, 30 m), Libre 3 (14 days, 1 hr)	Simplera (7 days, 2 hrs), Libre 3+ (15 days, 1 hr)	Dexcom G7 (10 days, 30 m), Libre 2+ (15 days, 1 hr)	Pending	Dexcom G7 & G6 (10 days, 30 m) & Libre 3+ (15 days, 1 hr)	Dexcom G7 (10 days, 30 m) & G6 (10 days, 2 hr)
Bolus Max/Increm	24 u / NA	0.01 u/hr	25 u / 0.025 u	30 u / 0.05 u	25 u / 0.01 u	25 u / 0.01 u	25 u / 0.01 u
Basal Max/Increm	11.5 u/hr / 0.01 u/hr	0.01 u/hr	35 u/hr / 0.025 u/hr	30 u/hr / 0.05 u/hr	30 u/hr	15 u/hr / 0.001 u/hr	15 u/hr / 0.001 u/hr
Water Tolerance	IPX8: 12 ft, 30 mins	IPX8: 3 ft, 60 mins	IPX8: 8 ft for 24 hrs	IP28: 25 ft, 60 min	IPX8: 12 ft for 1 hr	IPX7: 3 ft, 30 min	IP28: 8 ft for 2 hrs
Target Glucoses	110, 120, or 130.	104 default 80 to 198 every 30 min.	100, 110, or 120. for SmartGuard, 120 for auto-corrections	110, 120, 130, 140, or 150 for different times of day	87 to 180 mg/dL	Corrections to 110 112.5 to 160, Sleep: 112.5-120	Corrections to 110 112.5 to 160, Sleep: 112.5-120
Exercise Target	130 mg/dL	140 to 200 mg/dL	Temp Target 150 mg/dL (2-24 hrs)	150 mg/dL (2-12 hrs), lower basal	150 to 180 mg/dL	Exercise Activity 140-160 mg/dL	Exercise Activity 140-160 mg/dL
Extended boluses?	No	Yes, up to 8 hrs	No	No,	Yes, using emojis	Yes, up to 8 hrs	Yes, up to 8 hrs
DIA/IAT	AID controlled	2-6 hrs, AID control	2-6 hrs	2-6 hrs, but AID controlled	6 hrs	AID controlled, about 5 hrs	AID controlled, about 5 hrs
Phone Bolusing	Not yet.	CamAPS FX app on Android phone	Not yet.	Android and iPhone	iPhone and Apple Watch	iPhone & Android + Quick Bolus (u or g)	iPhone + Quick Bolus (u or g)
Remote viewing		Diasend, SMS alerts, Dexcom Follow	Carelink Connect app	Dexcom Follow app, Glooko	iPhone app	Tandem Source Website & Dexcom Follow	Tandem Source Website & Dexcom Follow
Cloud data	iLet Bionic Pancreas app	Diasend/Glooko	MiniMed app	Omnipod 5 app	Tidepool AGP	t:slim Mobile App, Tandem Source Website	Mobi App, Tandem Source Website

2.4 AID Algorithms Explained

Automated Insulin Delivery (AID) systems are changing diabetes management. Like the effect of self-driving cars and smart appliances on other aspects of our lives, AID systems are revolutionizing diabetes management. Two major algorithms form the base for different AID systems: **Model Predictive Control (MPC) and Proportional-Integral-Derivative (PID)**.

One way AID systems differ is in their use of predictions and/or historical data. MPC algorithms in Beta Bionics, Omnipod, and Tandem regulate glucose through 30 or 60 minute glucose predictions, while PID in Medtronic looks back at more historical data. Some algorithms combine MPC for lowering glucose with PID for preventing lows.

Algorithms work as glucose guardians. MPC is more complex, handling the trials of daily life, including meals, exercise, and stress. It uses equations to predict and maintain glucose levels within a safe range while minimizing the risk of low glucose. The PID algorithm acts as a quick responder, rapidly calculating insulin dose adjustments based on the difference between your target and current glucose levels. Both MPC and PID consider uncertainties in glucose dynamics through **controls**.

Unlike the straightforward math and coding in MPC and PID algorithms, **machine learning and neural network controls behave differently, making them harder to explain**. These controls learn from historical glucose and insulin dosing data to improve glucose control and enhance algorithm operation. They identify patterns, relationships, and trends in the data that may not be apparent to human observers. Controllers provide increasingly accurate and individualized insulin dose recommendations by adapting to the user's changing needs and circumstances. Systems combine different controls to minimize hypoglycemia and correct hyperglycemia.

Adaptive and robust controls deal with the uncertainty and imprecision in meals, exercise, insulin delivery, and many other factors. They provide adaptive and robust management for changing glucose dynamics related to prior personal preferences and habits.

Different AID systems combine various controls into their base algorithm. For example, the Tandem Control-IQ system integrates a treat-to-range MPC module with an **adaptive component** that features basal-rate modulation, automated correction boluses, and a dedicated hypoglycemia safety system.

2.5 Tips for Using an AID System or Insulin Pump

- Keep quick carbs like SweetTarts, Smarties, or Rockets handy (all contain glucose as dextrose) to treat lows.
- When low, your AID system has already reduced basal insulin and IOB, **so you need fewer carbs to treat low glucose. DON'T OVERTREAT LOWS**.
- Likewise, you will need smaller boluses when treating high glucose because your AID has already increased insulin delivery. **DON'T OVERTREAT HIGHS**.
- **Do not stop your pump to treat low glucose.** The stoppage has little or no effect until more than an hour later, with a glucose spike two or three hours later.
- Unexpected high glucose? Check your infusion set or pod.
- Avoid micro-management.
- Remember how to manage glucose if the AID fails or supplies are unavailable.
- Frequent lows? Temporarily raise your target glucose until you identify the cause.

2.6 How Many Carbs Do You Really Need for a Low Glucose?

1. Grams needed for a low glucose

On a pump, take 1 gram of a quick carb for each 10 lbs (4.5 kgs) of body weight, while half these amounts are typically needed on AID. For example, someone who weighs 160 lb (72 kg) needs 16 grams (8 grams on an AID), while someone who weighs 220 lb (100 kg) needs 22 grams for the low glucose. Use at least 6 grams for a small child.

2. Grams needed to cover excess IOB with a low glucose.

Multiply the units of IOB times your CarbF for how many extra carbs you need.

For example, if someone weighs 130 lbs (59 kg) and has a glucose of 50 mg/dL (2.7 mmol/L) with 2 units of IOB and a CarbF of 1u/11 grams:

a) 130 lbs = 13 grams for the low glucose
b) IOB x CarbF = 2 units x 11 grams/unit = 22 grams to cover the IOB
c) 13 g + 22 g = up to 35 grams to treat this low glucose.

Eat these carbs and recheck your glucose 20 to 30 min. later.

3. Bolus for any carb grams greater than #1 plus #2.

4. Recent physical activity requires additional free carbs. (See Chap. 18.)

5. AID systems lower basal delivery to prevent going low. Because this reduces IOB, fewer carbs are needed to treat lows.