

A hand holding a magnifying glass over a document, symbolizing research or investigation. The background is a soft, out-of-focus light.

# **CURRENT TECHNOLOGIES IN DIABETIC MANAGEMENT**

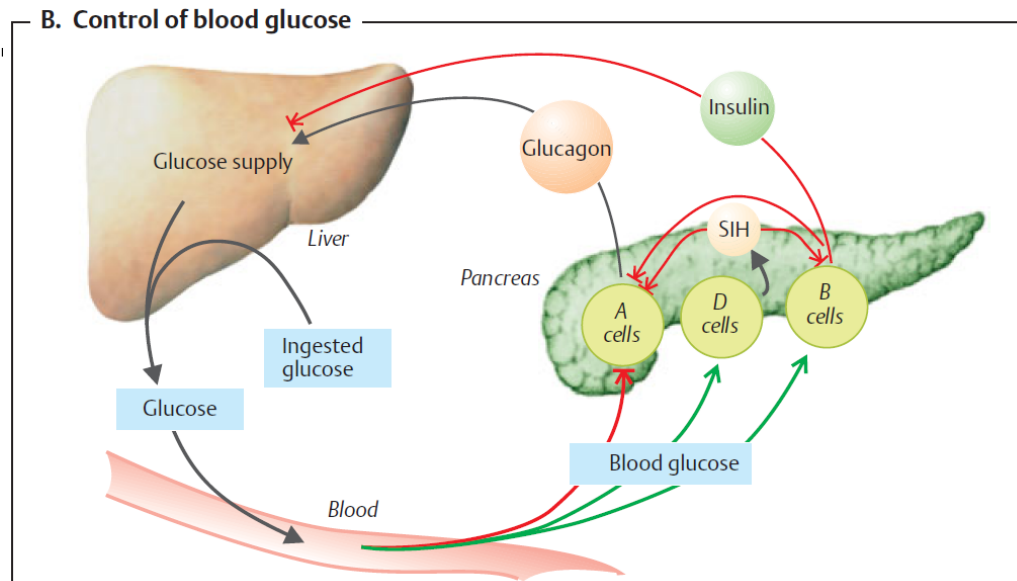
**Dr. Omer Al-Gonaid  
Pediatrician (ABHS)**

# PANCREATIC EQUATION IN NORMAL ( FULL AUTOMATIC)

- Continuous **monitoring** of blood sugar level

And

- Continuous giving insulin accordingly  
(Self **calculation** = no fluctuation)
- Self **Energy**



# TECHNOLOGIES FIELDS

- Blood glucose monitoring
  - \* intermittent
  - \*\* continuous
- Insulin administration
  - \* injections
  - \*\* pen
  - \*\*\* pump
- Technologies maintenance
  - \* source of device power
  - \*\* repair and disposable
  - \*\*\*problem-solving skills regarding daily events

# BLOOD GLUCOSE MONITORING



# GLUCOSE MONITORING

- **Lab** blood glucose measurement (LBGM) (cost, trouble,....)
- **Home** blood glucose measurement (HBGM) (prick, sample size and site, strips (physical change, chemical reaction), code (separated, combined, ... diff 4mmol/L), unit of measu., whole blood Vs plasma BG (more by 15%),  $\pm$  b.ketones/HbA1c, time & date, data save and share, processing technologies, interfering factors,



# RECENT ADVANCE IN GLUCOSE MONITORING

- Continuous glucose monitoring (CGM):  
prick - type (see below )
- Non-prick devices (infrared, near  
infrared, electrical current, US, ...)  
interfering factors e.g. sweating

# CONTINUOUS GLUCOSE MONITORING

- Sensors : **prick device** (S/C sensor and interstitial fluid analysis)
- Receivers : wrist bracelet device, ..... mobile phone, ...
- Data : send and save

## The aim

intensive  
self-  
monitoring



# INSULIN ADMINISTRATION







Insulin injection sites:

- Outer arm
- Abdomen
- Hip area

# Insulin by traditional s/c injection using syringe



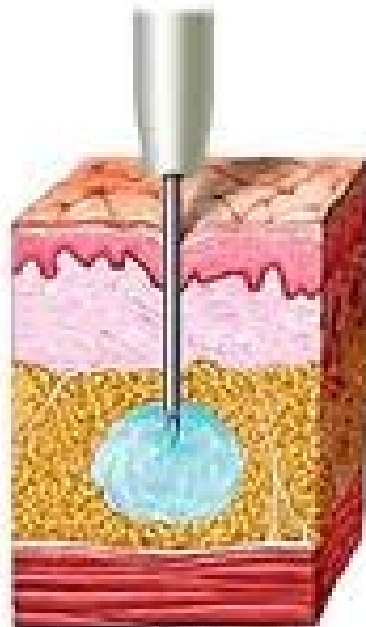
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# INSULIN PENS



SCIENCEPHOTOLIBRARY



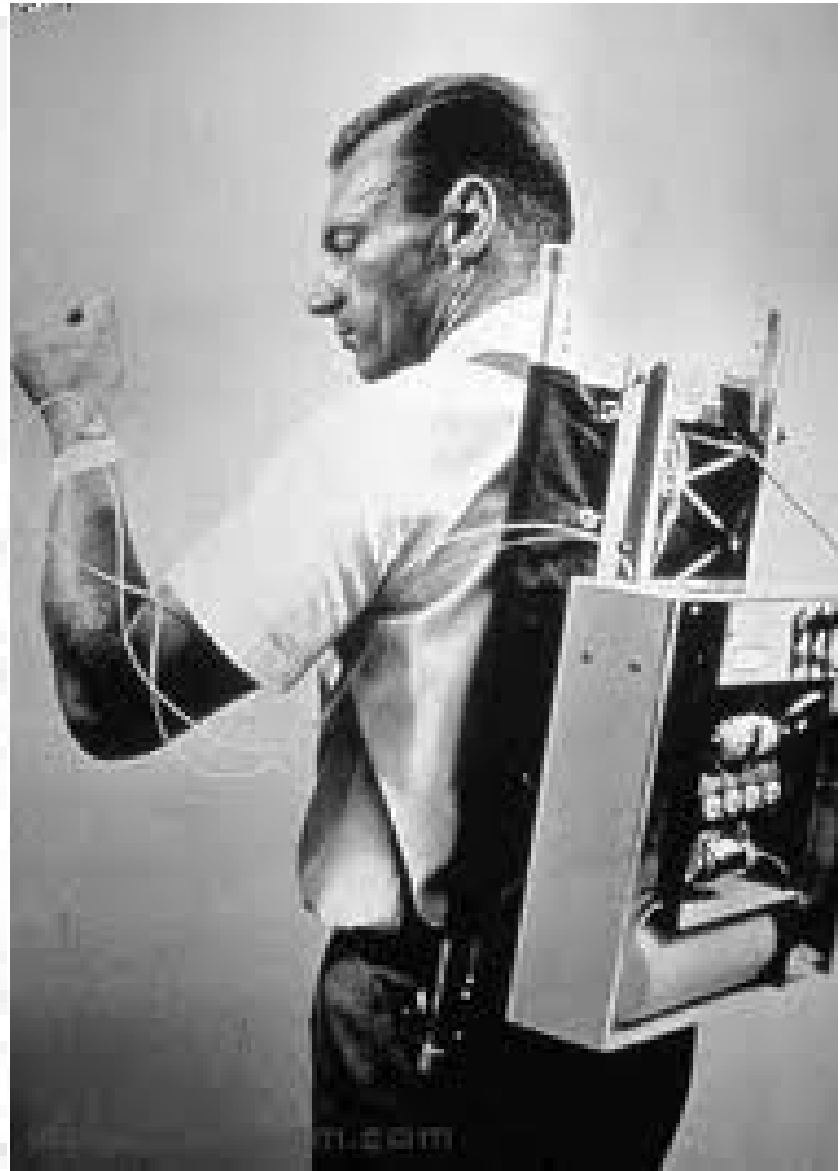


Insulin pen injector



Insulin jet injector

# EARLY INFUSIONS



Also I will not comment

# INSULIN PUMP

## Advantages of insulin pump

- Nearer to nature so better control of RBS fluctuations
- More frequent and small doses ( $\approx$ /5min)
- Basal , pre-meal and extra insulin doses
- Data save, & processing according prior setting
- Other add-on equipments

## Disadvantages :

- Expensive? ,difficult programming !!!, some restriction, technical problems and malfunction, local scar....,

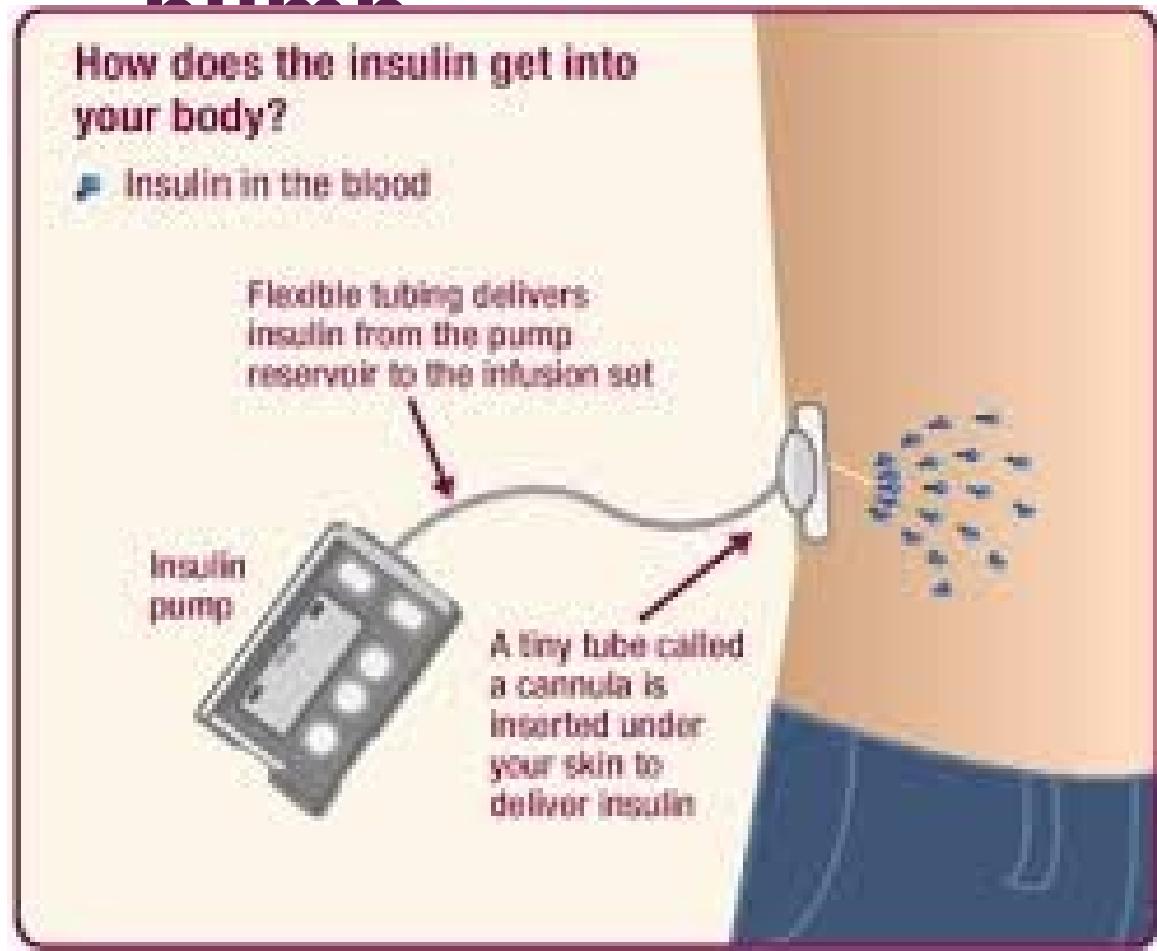
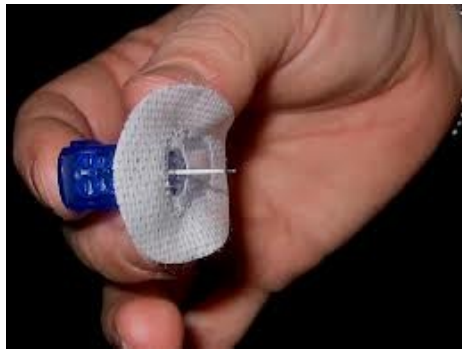


# INSULIN PUMP

## Components of insulin

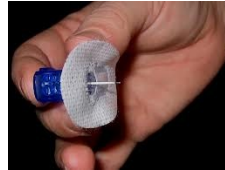


- Standard



# TECHNICAL HINT

- S/C cannula insertion
- insulin reservoir : disconnect, **Filling**, and reconnect
- Priming the delivering tube set
- Pump setting
  - basal dose
  - boluses doses



**most data here depends  
on  
the manufacturer**

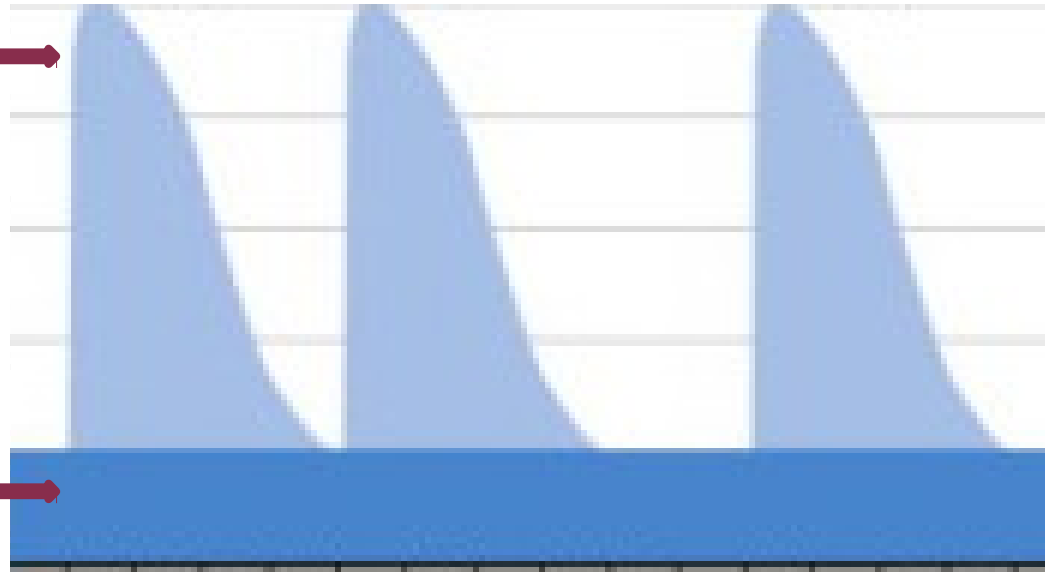
# E.G. CANNULA INSERTION





# MECHANISM OF PUMP WORK

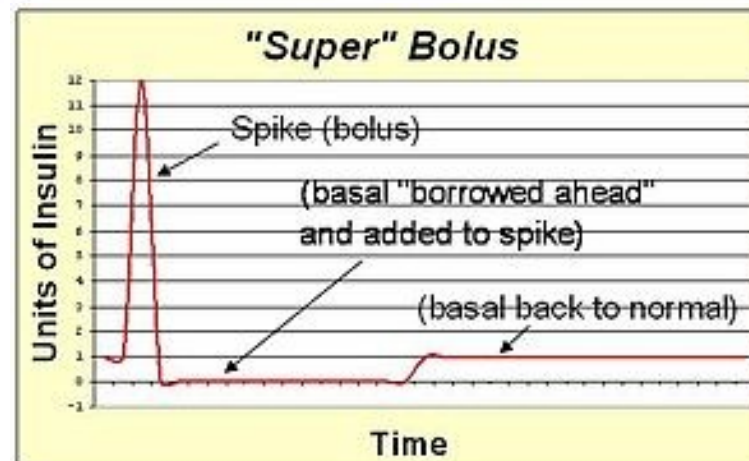
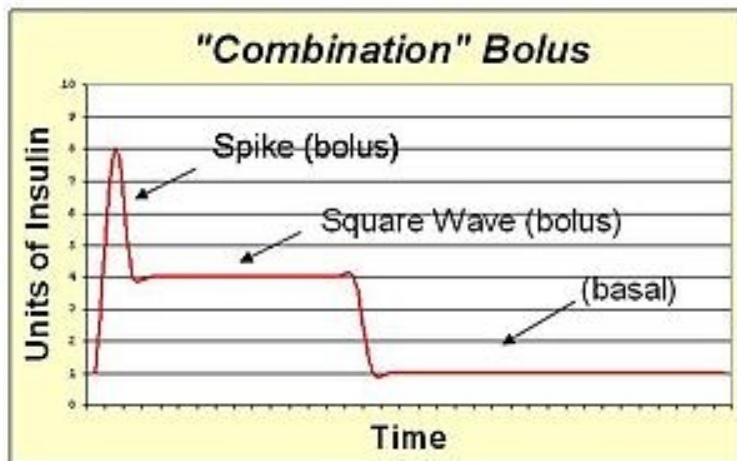
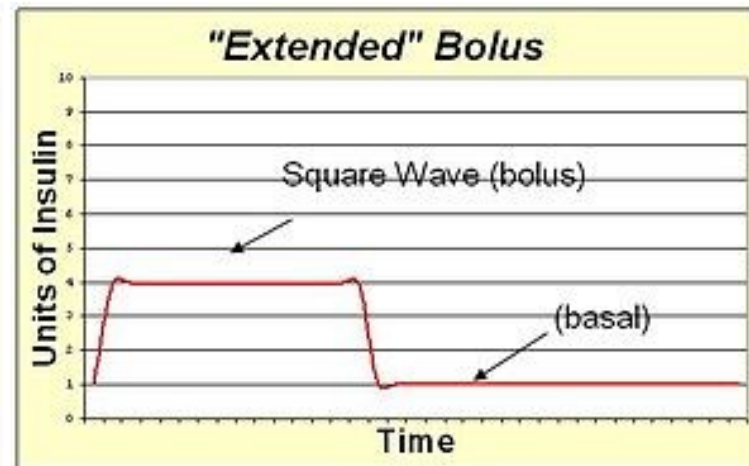
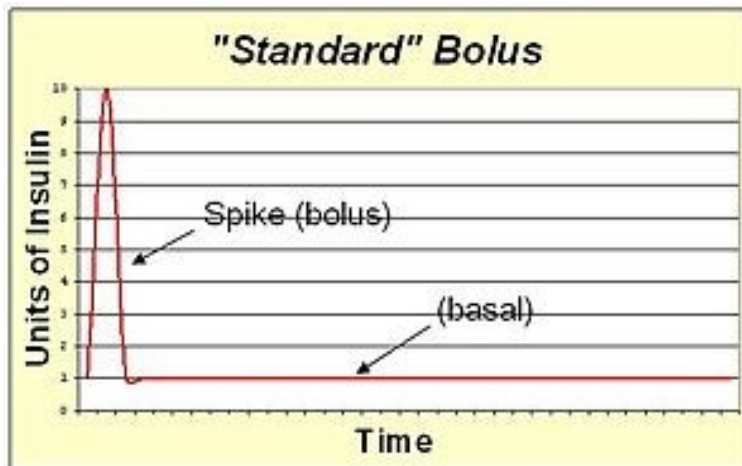
- Bolus doses



- Basal doses

# MECHANISM OF PUMP WORK

- **Bolus** dose, shape and timing



# MECHANISM OF PUMP WORK

## Basal rate patterns

- can also be customized (how much ??)
- ↓ basal at night to prevent low RBS in infants and toddlers.
- ↑ basal at night to counteract high blood sugar levels due to growth hormone in teenagers.
- A pre-dawn increase to prevent high blood sugar due to the dawn effect in adults and teens.
- In a proactive plan **before** regularly scheduled exercise times such as morning gym for elementary school children or **after**-school basketball practice for high school children.

# MECHANISM OF PUMP WORK

## Basal rate(BR) determination & adjustment

- The basal rate for a particular time period(by **fasting**): Neither food nor bolus insulin must be taken for 4hours before or during the evaluation period.
- Factors for **adjustment** to the basal rate:
  1. Honeymoon period
  2. growth spurts particularly during puberty
  3. weight gain or loss
  4. any drug treatment that affects insulin sensitivity (e.g. corticosteroid)
  5. eating, sleeping, or exercise routine changes
  6. whenever the control over hyperglycemia is degrading
  7. and according to the seasons.

# MECHANISM OF PUMP WORK

## Temporary basal rates (BR)

- As a **passenger** during a long car drive (↓ BR due to inactivity)
- While **driving** on an extended trip, (↓ BR to decrease risk of hypoglycemia)
- During and after spontaneous **exercise** or sports activities, when the body needs less insulin.
- During illness or **stress**, (↑ BR due to insulin resistance).
- When blood **ketones** are present, (↑ BR)
- When on an extended **fast** (such as Ramadan, Lent, or Yom Kippur) when basal requirements may be lower.
- During **menses** when (↑ BR needed ?)

# CGM WITH INSULIN COMBINATION

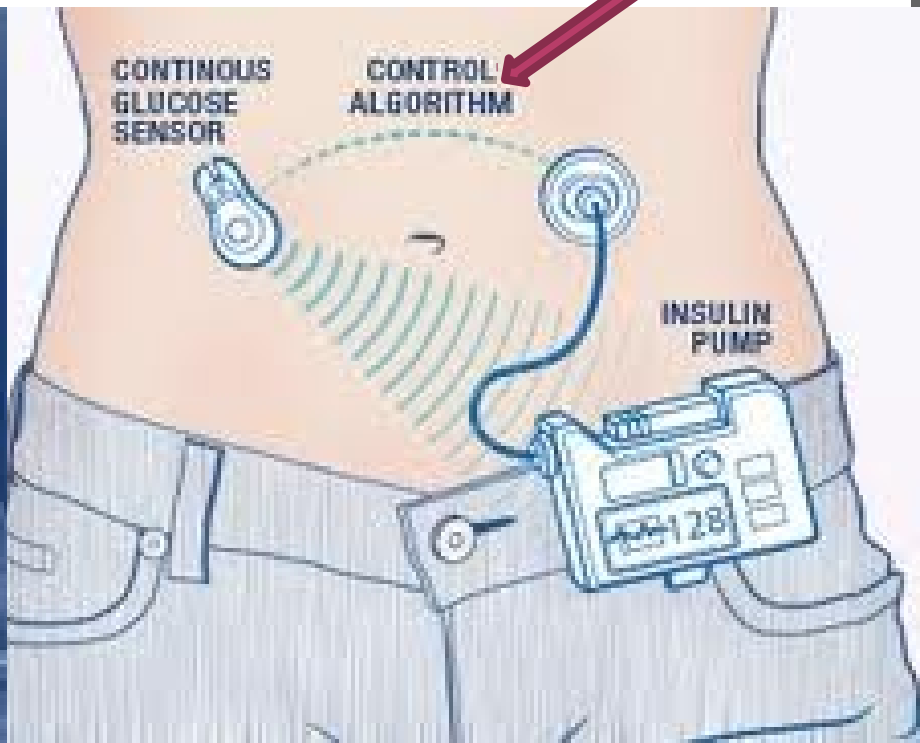
2nd Edition  
**UNDERSTANDING INSULIN PUMPS & CONTINUOUS GLUCOSE MONITORS**  
by H. Peter Chase, MD & Laurel Messer, RN, MPH, CDE



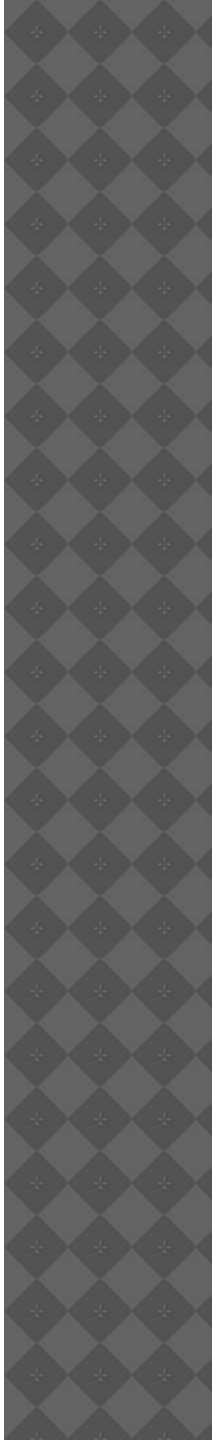
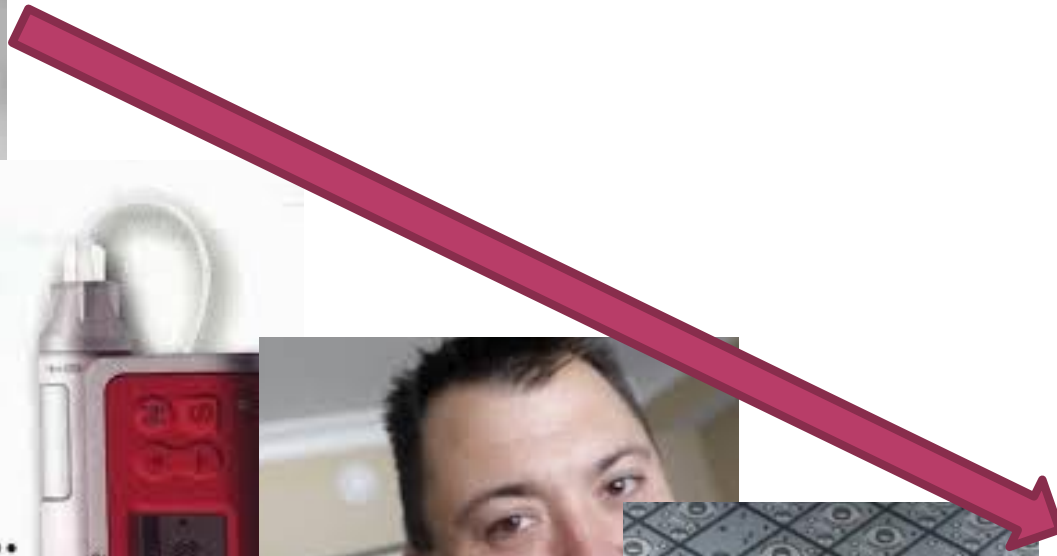
← Open circle

# DIABETES INFORMATION MANAGEMENT SOFTWARE

- Close circle ... **artificial pancreas**
  - 1- CGM
  - 2- insulin pump
  - 3- **software** control algorithms (panel)



# SMALLER HIDDEN INSULIN PUMP





# URINE STRIPS FOR KETONES

- Useful
- **Technique** is manufacturer dependent
- **Positive** urine for ketones means:  
Alcoholism, Anorexia, Diabetes mellitus, Diarrheam Fasting, Fever, High protein diet, Hyperthyroidism, Postanesthesia, Pregnancy, Starvationm Vomiting
- **False positive** : some drugs like bromosulfophthalein, isoniazid, levodopa, phenazopyridine, phenothiazines, phenolsulfonphthalein,mesna and captopril

# REMEMBER

1. Intermittent BGM (Glucometer , ...)
2. Continuous BGM (S/C sensor)
3. Continuous BGM (non-prick type )
4. Insulin pen
5. Insulin pump (open circle)
6. Artificial pancreas (closed circle pump)
7. Urine strips for ketones

# ALL EXPLAINED

**ELSE**

**??**

**THE**

**REST OF**

**TEN**

# ABOUT PUMP

- Disposable pump (Insulin patch)
- Pump powered by blood glucose
- More than one Hormone by single pump



# QUIZ

1. At which historical time HBGM used with trust?
2. low RBS without s/s of hypoglycemia . Are the glucometer reading important here ??
3. If your pt ask you ; which device mark is best ??
4. Are there Curative medicine for DM1 ?
5. Who much diabetic pt world wide ??
6. Are there non-injectable insulin for DM1??

# REFERENCES

- **Nelson text 19<sup>th</sup> ed**
- ^ <http://www.artificialpancreasproject.com/>
- ^ [http://en.wikipedia.org/wiki/Insulin\\_pump](http://en.wikipedia.org/wiki/Insulin_pump)
- ^  
[http://en.wikipedia.org/wiki/Blood\\_glucose\\_monitoring#Continuous\\_blood\\_glucose\\_monitoring](http://en.wikipedia.org/wiki/Blood_glucose_monitoring#Continuous_blood_glucose_monitoring)
- ^  
<http://type1diabetes.about.com/od/insulinandmedications/a/prosconspump.htm>



Thank  
you for  
attention

