



Bradley Dean, MA, NRP
Battalion Chief / Training Division
Rowan County Emergency Services
Salisbury, NC

Being A Sugar Daddy doesn't mean you have Diabetes

#sugardaddy



FEDERAL RESERVE NOTE
THE UNITED STATES OF AMERICA

THIS NOTE IS LEGAL TENDER
FOR ALL DEBTS, PUBLIC AND PRIVATE



Splenda[®]
DADDY

THE UNITED STATES OF AMERICA

THE
THIS
FOR ALL

1

6

6

1

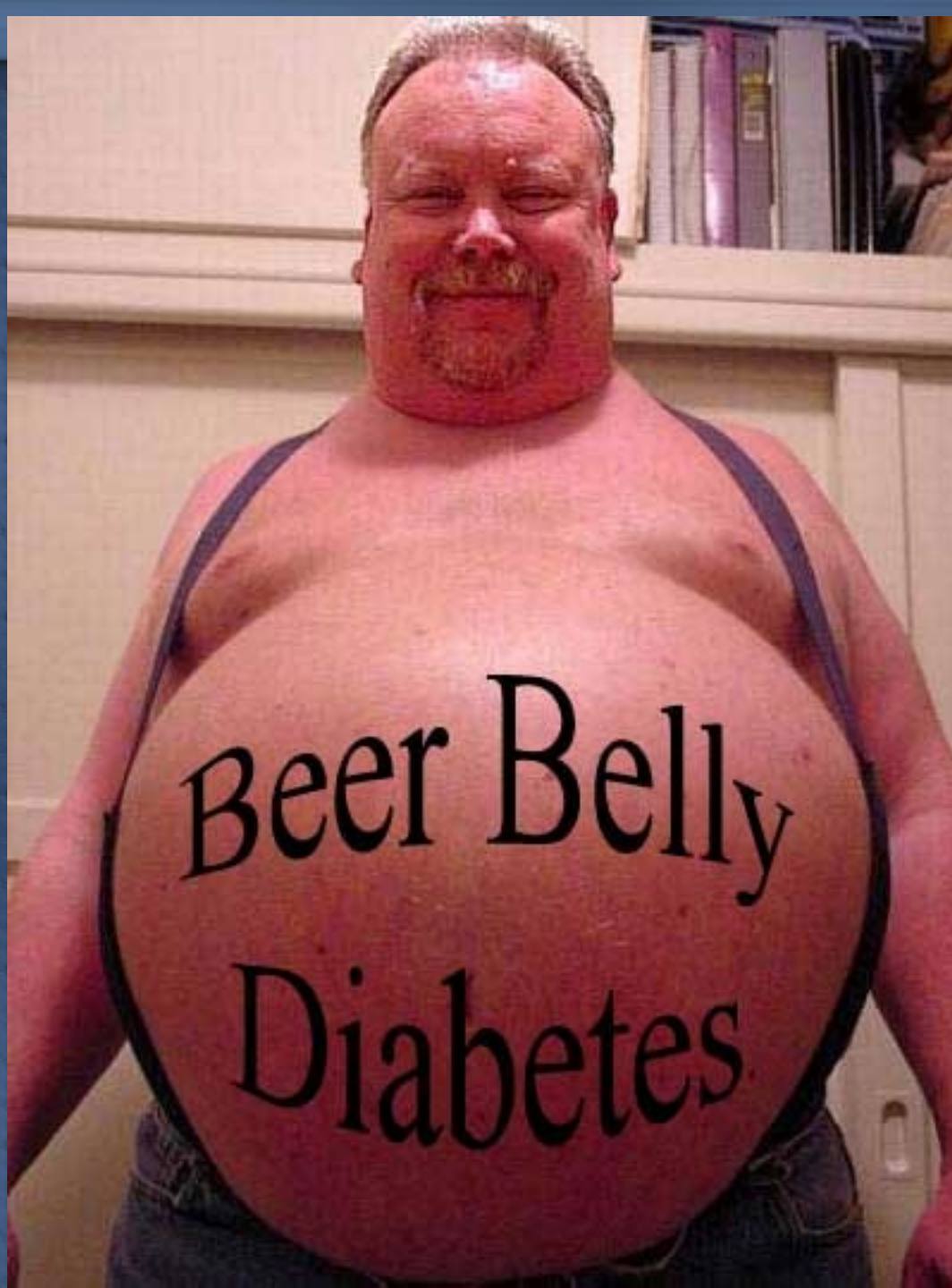
6

6

ONE

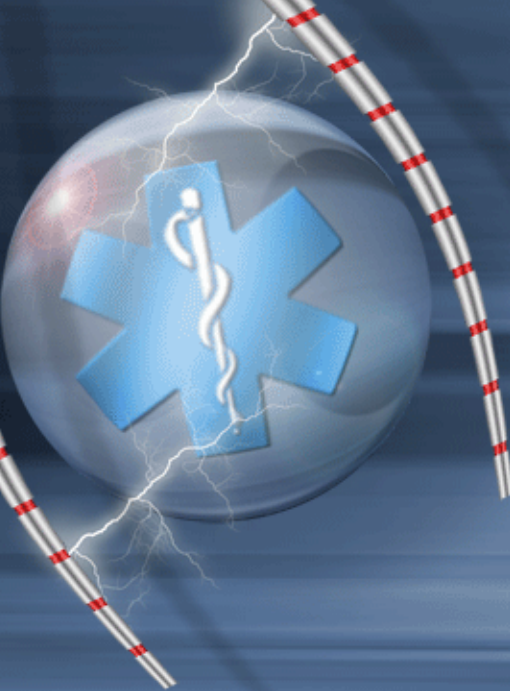
PRIVATE





Question:

The incidence of diabetes mellitus

- 
- ✦ A. Is greater than 25% of the US population
 - ✦ B. Has been steadily rising since 1990
 - ✦ C. Commonly affects only those older than 65
 - ✦ D. Is largest in the two- to five-year-old age group



Understanding the pathophysiology of diabetes mellitus

Approximately 30.3 million Americans have diabetes, which translates to about 9.4% of the US population.

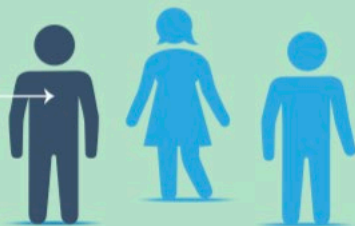
More than 7.2 million people likely have the condition but remain undiagnosed (23.8% of population).

Many patients are hyperglycemic for as long as six years before the disease is detected.

The CDC reports the incidence of DM has risen by 70% in adults between the ages of 30-39; by 40% in those 40-49; and by 31% in those 50-59 years of age.

PREDIABETES

84.1
MILLION



84.1 million people —
more than 1 out of 3 adults —
have prediabetes



9 **OUT OF** 10 don't know they
have prediabetes



If you have
prediabetes,
losing weight by:



**EATING
HEALTHY**



**BEING
MORE
ACTIVE**

can cut your risk of
getting type 2 diabetes in

HALF





COST



\$245
BILLION

Total medical costs and lost work and wages for people with diagnosed diabetes

Risk of death for adults with diabetes is



50%
HIGHER



than for adults without diabetes

Medical costs for people with diabetes are **more than twice as high**

\$\$



\$

as for people without diabetes

2X



People who have diabetes are at higher risk of serious health complications:



BLINDNESS



KIDNEY FAILURE



HEART DISEASE



STROKE



LOSS OF TOES, FEET, OR LEGS



- ✦ NY – 9.7% of the population has Diabetes
- ✦ NJ – 8.1% of the population has Diabetes
- ✦ NC - 11% of the population has Diabetes

- ✦ Education – Does it make a difference?
 - ✦ The population of those with less than a high-school education soars to 16%



Halle Berry





Gary Hall Jr.





Larry King





Nick Jonas



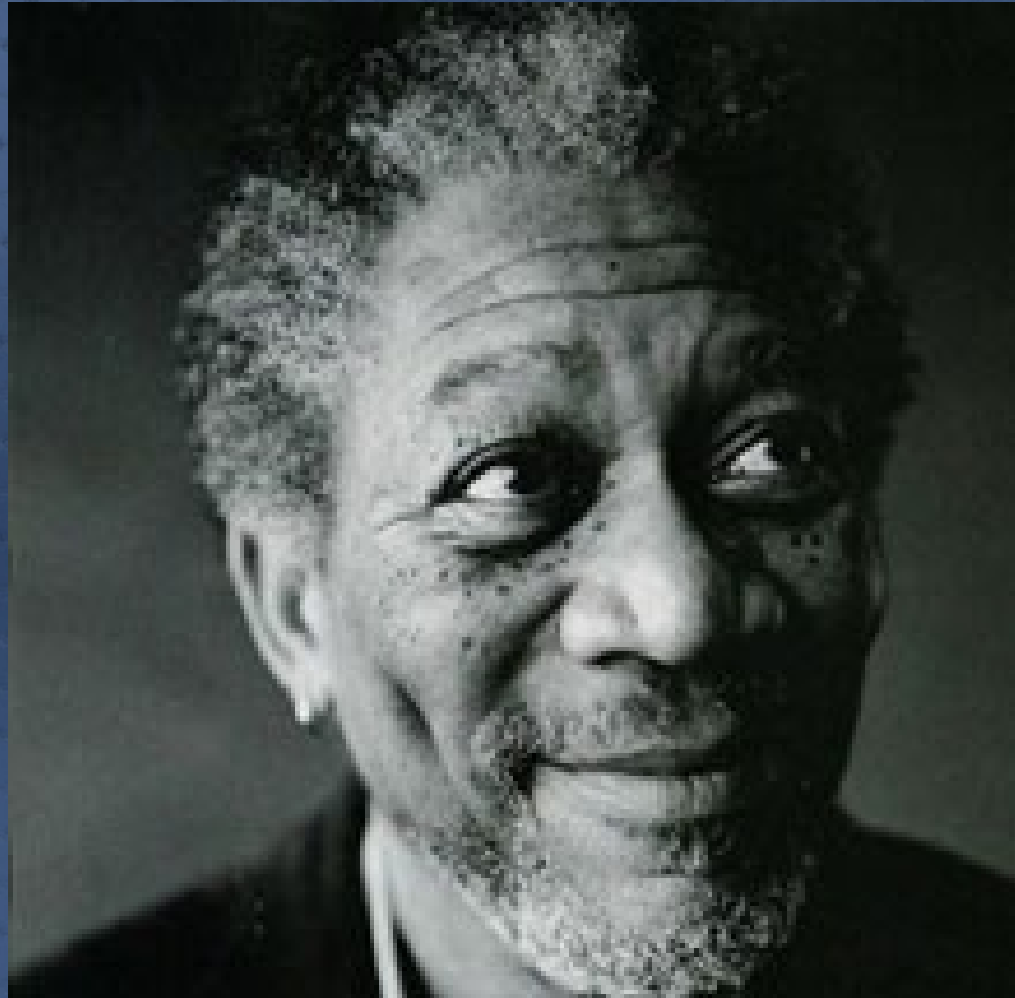


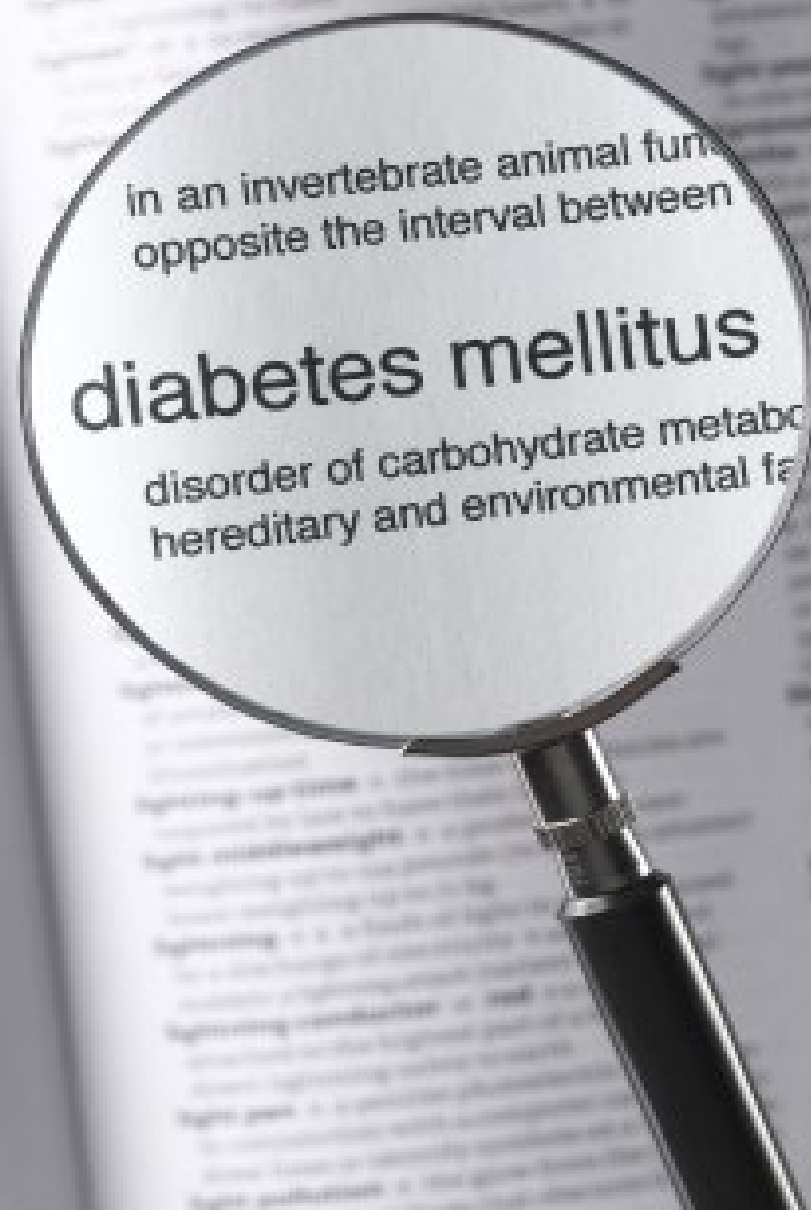
Mikhail Gorbachev





Morgan Freeman





in an invertebrate animal found
opposite the interval between

diabetes mellitus

disorder of carbohydrate metabolism
hereditary and environmental factors



DM

- ✦ DM was named in ancient times by Greek physicians who observed that affected persons produced large amounts of urine that attracted bees and other insects.
- ✦ *Diabetes* means “to siphon” or “to pass through” and *mellitus* means “honey sweet,” a reference to the sugar in the urine.



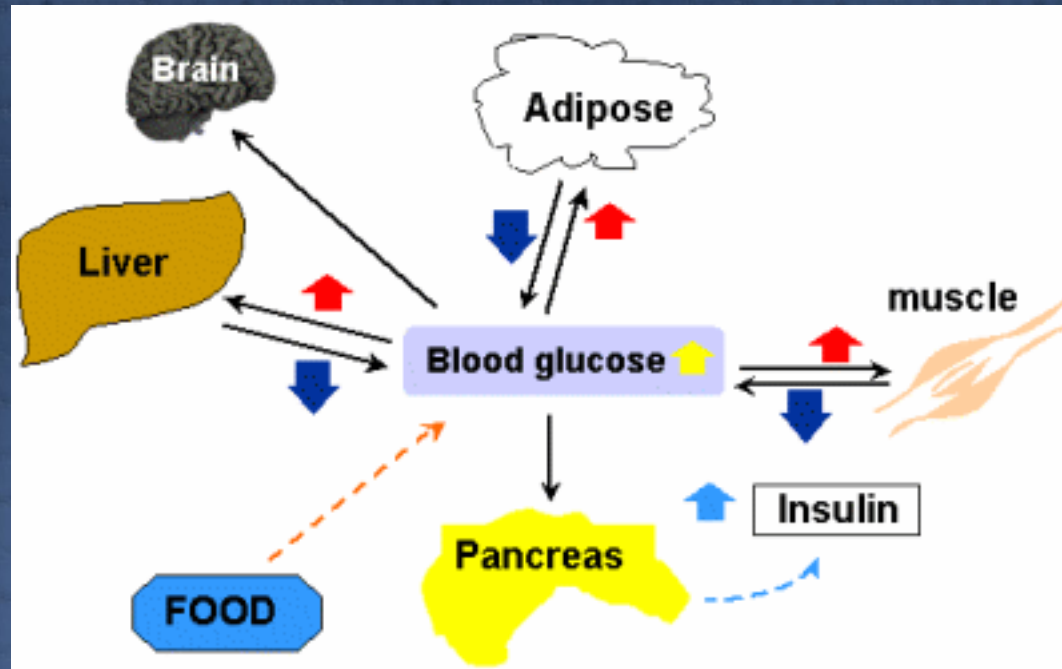
DM

- ⚡ Defined as a group of chronic metabolic diseases characterized by hyperglycemia
- ⚡ Resulting from defects in insulin secretion, and metabolism function
- ⚡ Resulting in abnormal carbohydrate, fat, and protein metabolism



Glucose metabolism

⚡ Sources of glucose have to be available and ready to meet cellular metabolic demands, and we readily get this from our diet.



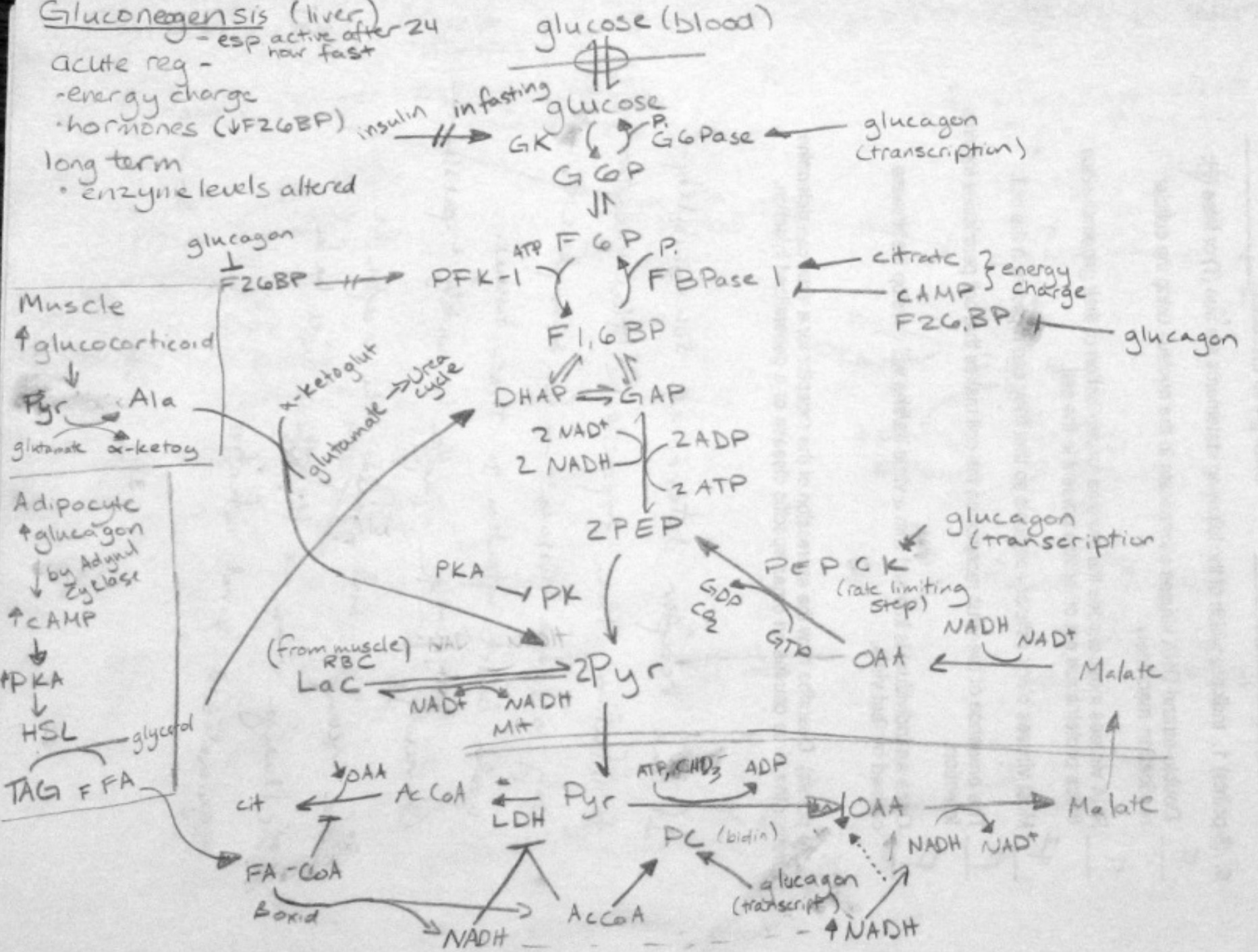


- Two additional methods of maintaining constant glucose levels:
 - Gluconeogenesis
 - Glycogenolysis

Gluconeogenesis (liver)
 - esp active after 24 hour fast

- acute reg -
 - energy charge
 - hormones (\downarrow F26BP)
- long term
 - enzyme levels altered

glucose (blood)

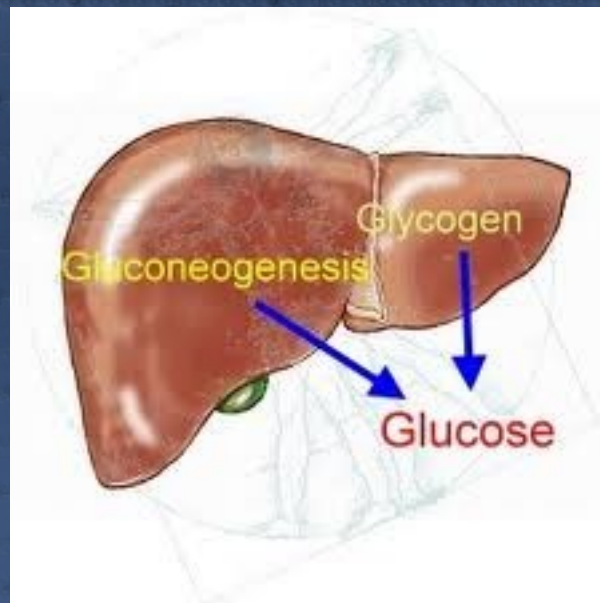




Glucose metabolism

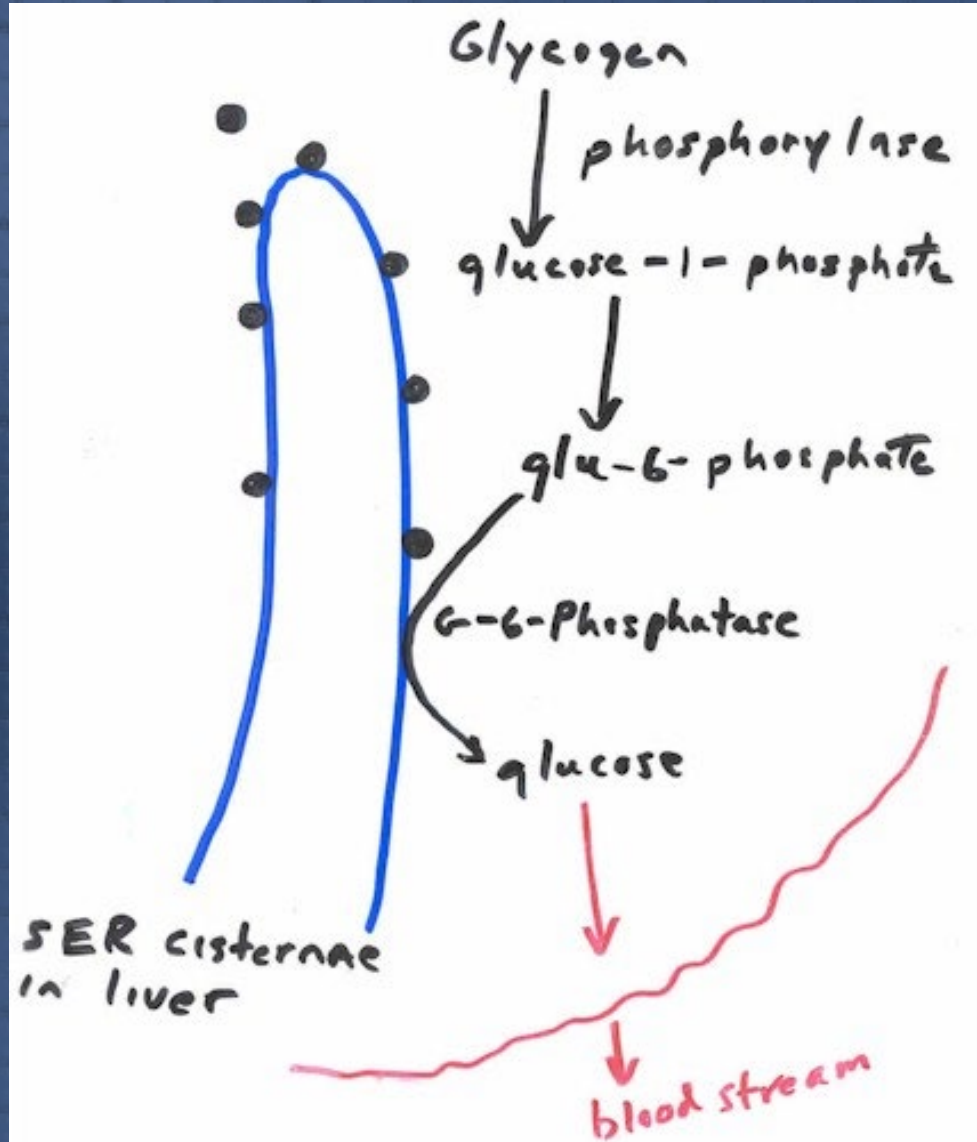
⚡ Gluconeogenesis:

- ⚡ New glucose molecules are produced from non-sugar sources in the liver





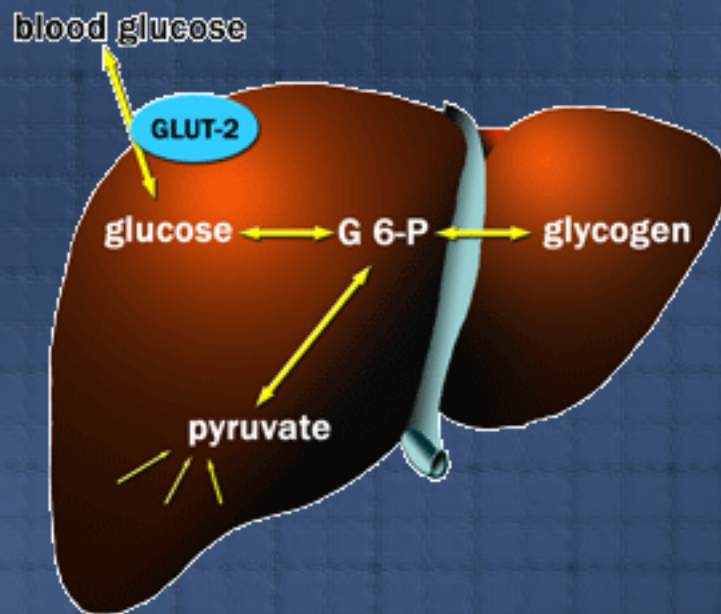
Glycogenolysis





~ Glycogenolysis:

- ~ The liver breaks down stored glycogen to its component glucose molecules

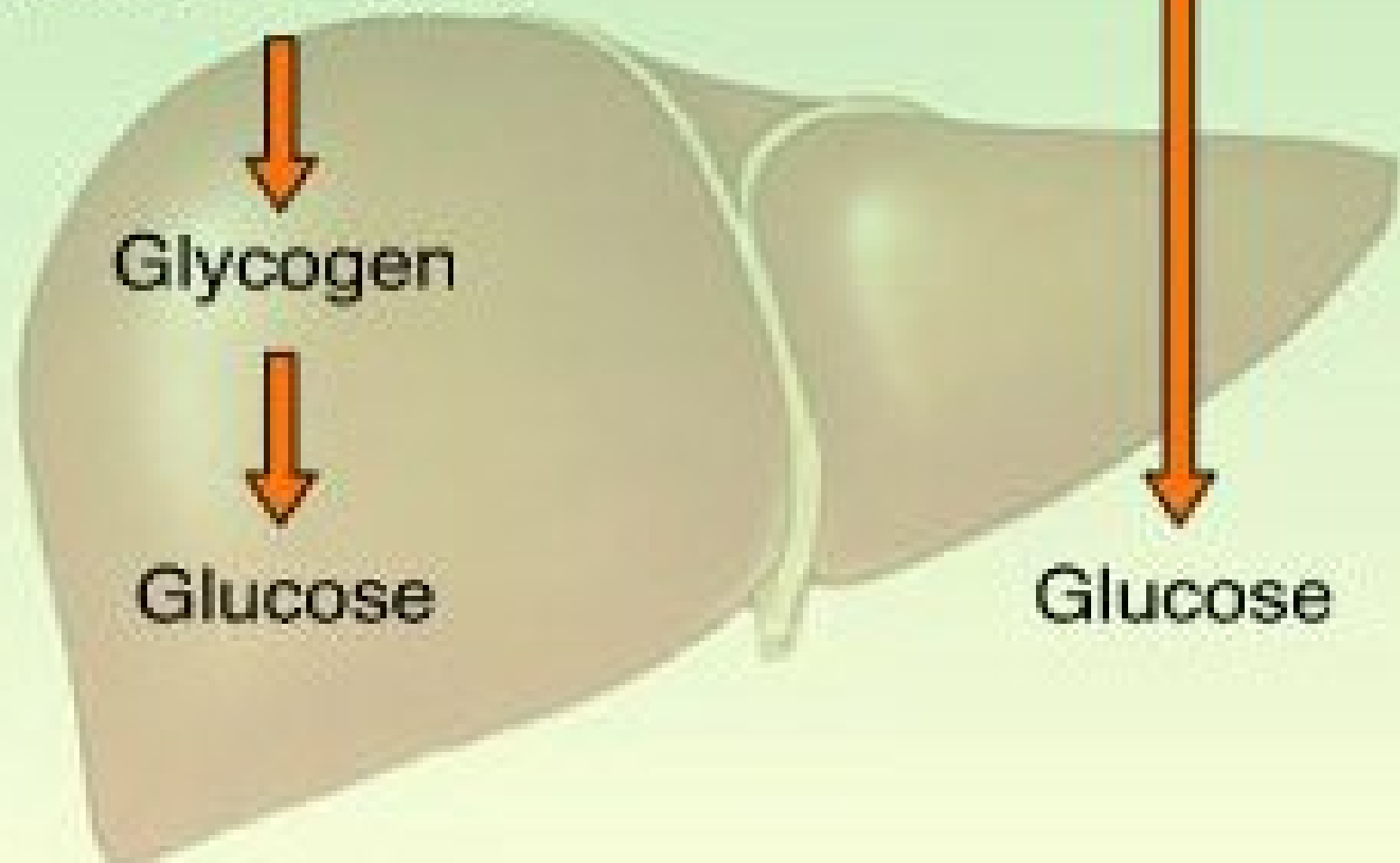


Glycogenolysis

Gluconeogenesis

Glucose
(simple sugar)

Proteins, fats





Question

- Glycogen breakdown into glucose molecules by the liver is called:
 - Metabolism
 - Glycogenolysis
 - Glycolysis
 - Gluconeogenesis



Glucose metabolism

- ✦ Serum glucose fluctuates based on the time of day, food or beverage ingested, stress level, exercise and hormone activities
- ✦ Glucose homeostasis is achieved through the interaction of insulin, glucagon, cortisol, catecholamines, growth and other hormones and their subsequent effects on hepatic, fat and muscle cells.



Glucose metabolism

- 70 – 120 mg/dL
- The lowest levels occur when food has not been eaten for a number of hours
- The highest levels occur one to two hours after eating...especially if a meal contained a high carbohydrate load



Mechanisms governing metabolism

✦ Pancreas

- ✦ Located behind the stomach and between the duodenum and spleen
- ✦ Largely responsible for maintaining a specific blood glucose
- ✦ Regulates glucose metabolism through the release of three hormones from Islets of Langerhans



Pancreas Hormone Secretions

✦ Islet cell type and %

✦ Alpha 25%

✦ Beta 60%

✦ Delta 10%

✦ Hormone secreted

Glucagon: secreted in response to decreased blood glucose levels to increase blood sugar

Insulin (antagonist of glucagon): secreted in response to increased blood glucose levels to decrease blood sugar

Somatostatin: inhibits secretion of insulin and glucagon



✦ Insulin

- ✦ Carbohydrates convert to simple sugars stimulating insulin secretion (high-insulin/low-glucagon state)
- ✦ Glucose must enter the cell – large molecule needing a facilitator (facilitated diffusion)
- ✦ The glucose attaches to the receptor site – insulin opens the gate – glucose enters
- ✦ Cardiac, skeletal, and fat tissues need insulin to actively transport glucose into the cell – used by the mitochondria to produce adenosine triphosphate (ATP)



⚡ The brain uses more glucose than any other organ system....but its uptake of glucose is not insulin-dependent



- ✦ Insulin prompts liver cells to stop producing glucose and convert excess to glycogen for storage in the liver and muscle cells.
- ✦ It is the only hormone that leads to lipogenesis.
- ✦ Insulin also stimulates the use of amino acids for protein synthesis and prevents tissues from catabolizing – anabolic hormone



- ✦ Insulin has a half-life of only minutes
- ✦ Healthy liver removes circulating insulin within 10-15 minutes from the time of secretion
- ✦ A normal pancreas must continuously produce small amounts of insulin to control excess glucose output and keep levels constant



Factors that Control Insulin Release

✦ Factors that stimulate insulin release

- ✦ Increased blood glucose levels
- ✦ Presence of ketone bodies or free fatty acids
- ✦ Glucagon release
- ✦ Gastric secretions
- ✦ hyperkalemia

✦ Factors that inhibit insulin release

- ✦ Hypoglycemia
- ✦ Hypokalemia
- ✦ Hydrochlorothiazide
- ✦ Beta – and calcium-channel blockers
- ✦ Phenytoin (Dilantin)
- ✦ Alcohol



Glucagon (gluco = glucose; agon = to drive)

- ✦ In a fasting state, serum glucose drops suppressing insulin secretion and causing the release of glucagon.
- ✦ Glucagon serves as the *on switch*, causing glycogen in the liver to break down to glucose (glycogenolysis)



Glucagon

- ✦ Also serves as the *on switch* for the hepatic *ketogenic pathway*, where fatty acids convert into ketoacids and ketone bodies, which are oxidized for energy (gluconeogenesis).
- ✦ The activation of lipolysis and the ketogenic pathways serve as a feedback loop stimulus for insulin secretion.



- ✦ The initial fall in insulin, followed by increased glucagon release, stimulates additional insulin secretion protecting the body from ketoacidosis, and hyperglycemia in non-diabetics.
- ✦ The link between carbohydrate and lipid metabolism is of great significance in uncontrolled diabetes.



Somatostatin

✦ Also called growth-hormone-release-inhibiting hormone inhibits insulin and glucagon secretion keeping them in balance



- ✦ Epinephrine stimulates hepatic glucose production, stimulates glucagon secretion, suppresses insulin secretion, inhibits peripheral glucose use and stimulates lipolysis.
- ✦ Cortisol functions much like glucagon, but with less potency.



Diabetes classifications

- ✦ Eliminate the confusing terms IDDM and NIDDM
- ✦ Replace IDDM with type 1 diabetes
- ✦ Replace NIDDM with type 2 diabetes
- ✦ Retain the term *gestational diabetes mellitus* (GDM)
- ✦ Add impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) as risk categories for DM.



Type 1 diabetes mellitus

- ✦ Type 1 accounts for 5-10% of all diagnosed
- ✦ Genetic, environmental, and autoimmune factors
- ✦ Insulin-producing islet cells are depleted or destroyed in an autoimmune response to a viral or environmental insult.
- ✦ Characterized by an absolute lack of functioning insulin or insulin-secretion deficiency due to pancreatic beta cell depletion.



Type 1

- ✦ The onset usually occurs prior to age 40 with the peak onset at 13....but can be developed as early as 1, or as late as 70.
- ✦ When the cells cannot use circulating glucose they transition to using fat for energy (lipolysis) resulting in ketone formation....causing metabolic acidosis...and ultimately DKA.



Signs and symptoms of type 1

- Postprandial hyperglycemia transitioning to fasting hyperglycemia
- Weight loss (catabolic state)
- Fatigue
- Polyuria
- Polydipsia
- Polyphagia
- Abdominal pain with vomiting
- Blurred vision
- Ketones in the urine
- Frequent, persistent infections





Treatment of type 1 DM

- ⚡ Prescribed insulin
- ⚡ Oral anti-hyperglycemic agents
- ⚡ Animal-source insulins are made from the pancreas glands of cows and pigs



Type 2 DM

- ✦ 90% of the diabetic population has type 2 DM.
- ✦ The incidence increases with age, usually striking adults older than 40-45 years of age.
- ✦ A distressing new trend is the rising incidence in children who are obese, spend more than five hours per day in front of the TV or computer, rarely exercise and eat poor diets (low in fiber) – the same risk factors that lead to diabetes in adults.



Type 2 DM

⚡ Pathophysiology

- ⚡ Insulin resistance
- ⚡ The pancreas produces insulin – the body can not use it appropriately.
- ⚡ Glucose can not enter the cells resulting hyperglycemia
- ⚡ As blood sugar rises, the pancreas increases its output of insulin, triggering a *hyperinsulinemic* state.



Major causes of insulin resistance

Obesity – truncal obesity

- ✦ Risk increases by 20% for each 5% gain in weight from ages 20-53
- ✦ Fat tissue decreases the number of insulin receptors



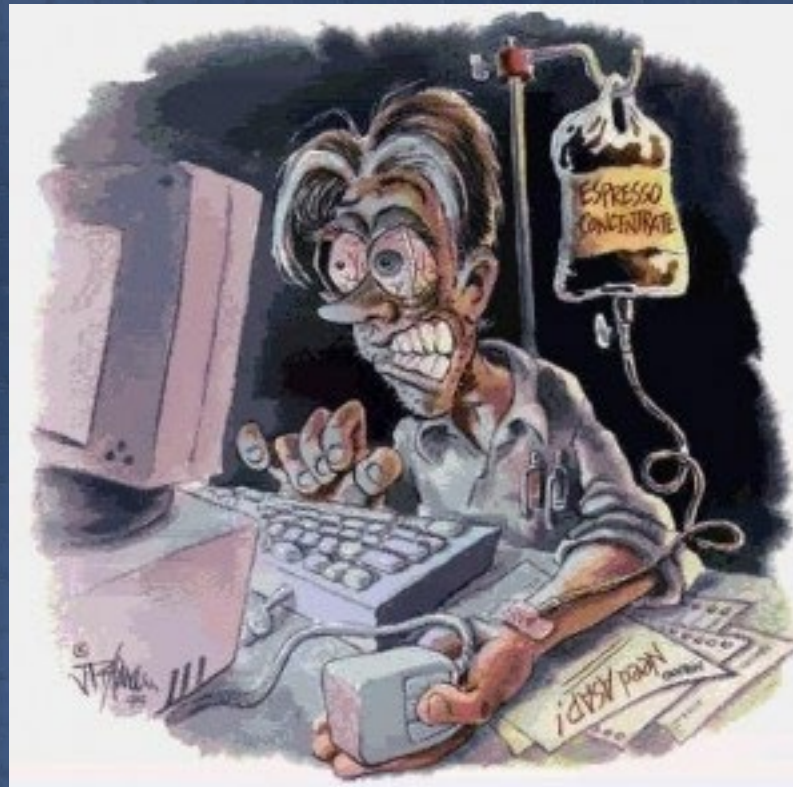


⚡ Hyperglycemia – greater than 300 mg/dL triggers insulin resistance





- ⚡ Stress increases release of insulin-neutralizing, counter-regulatory hormones





- ✦ Later in the disease, beta cells fail and patients experience insulin deficiency due to pancreatic beta cell dysfunction.
- ✦ The combination of insulin resistance and alteration in beta cell function leads to impaired glucose tolerance (IGT).
- ✦ Only one of four patients with IGT will progress to type 2 DM.
 - ✦ Hyperinsulinemia, hypertension, high triglycerides, low HDL (good), and a change in the size and density of LDL (bad) cholesterol.



Damaging effects of hyperinsulinemia

- ✦ **Insulin acts as an oxidant**
 - ✦ Vascular beds increase production of plasminogen activator inhibitor-1 (PAI-1)
 - ✦ Microthrombi and endothelial inflammation
 - ✦ Plaque formation and atherosclerosis



Damaging effects of hyperinsulinemia

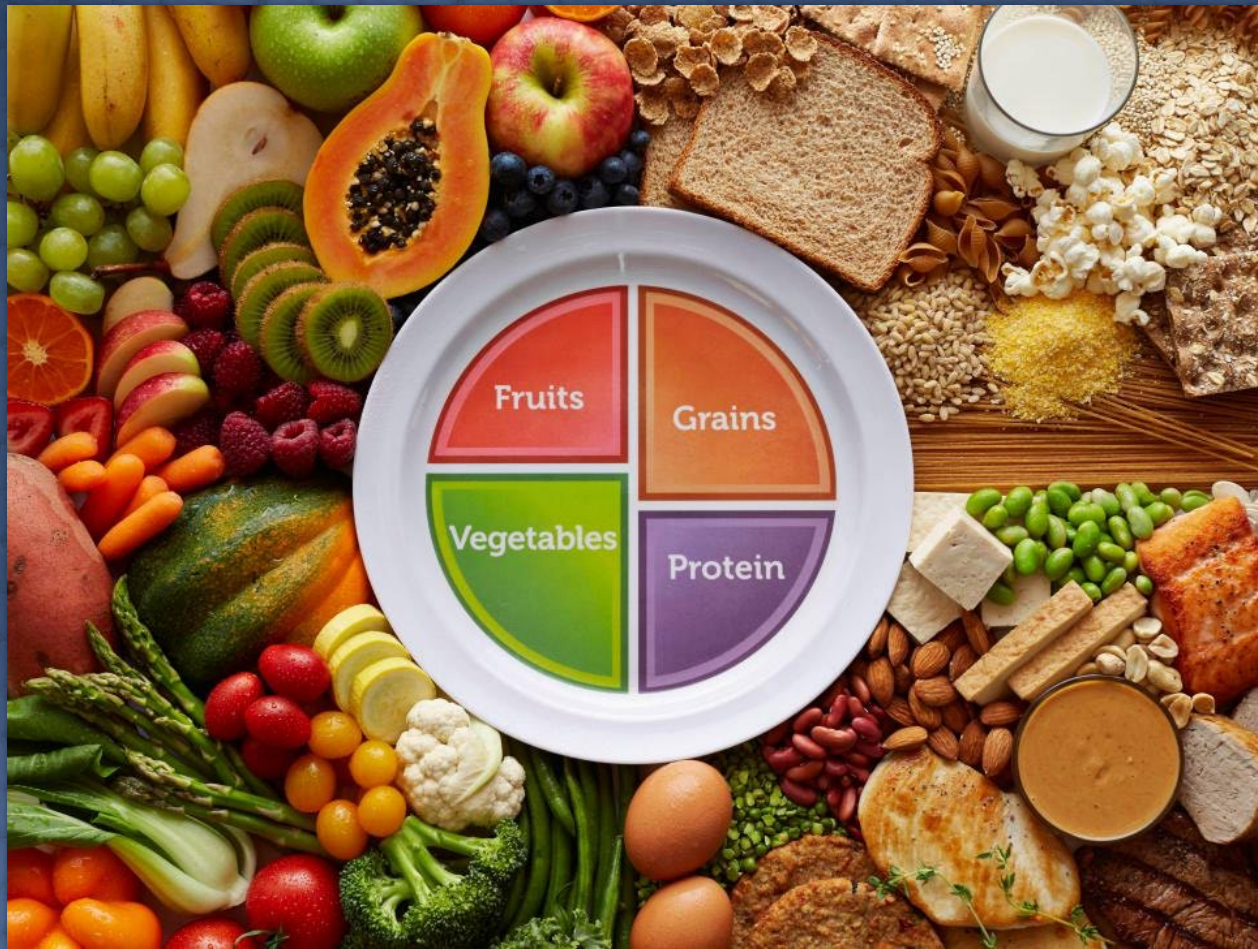
- ✦ Increase in plasma calcium
 - ✦ Increases vascular tone – HTN
 - ✦ CHF
 - ✦ Stroke
- ✦ Insulin is also an important salt retaining hormone
 - ✦ Weight gain from fluid retention
 - ✦ Electrolyte imbalances



Signs & Symptoms of type 2 DM

- Polyuria, polydipsia, and polyphagia (as in type 1 DM, but may be more subtle)
- Blurred vision
- Muscle cramps
- Non-healing infections
- Fatigue that progresses to exhaustion
- Dry, itchy skin
- Impotence
- Nighttime diarrhea

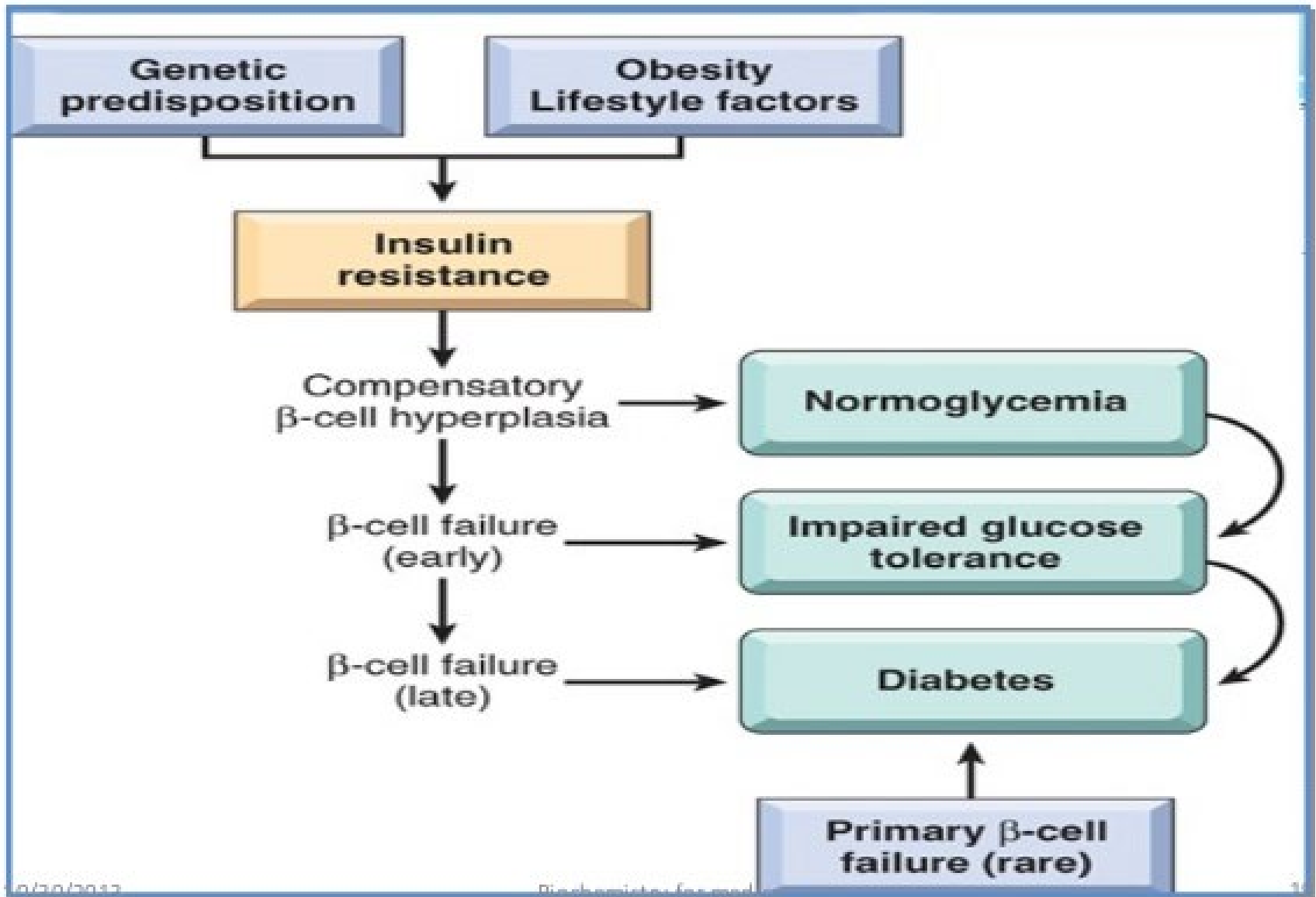
Treatment of type 2 DM





- ✦ **Healthy eating**
- ✦ **Exercise and weight loss**
 - ✦ **Even a 5-10% loss of total body weight may lead to better blood glucose**
 - ✦ **Surgical options have all but eliminated some patients issues with DM**
- ✦ **Oral antihyperglycemia agents**
- ✦ **Physicians prescribe insulin for about 40%**

Pathophysiology of Type 2 DM





Summary

- ⚡ Watch yourself!! Good diet, exercise, and a healthy lifestyle
- ⚡ Keep an eye on your glucose / a1c
 - ⚡ So you don't have to continually prick your finger!!



**Glucose -- Oh, sugar sugar --
You are my favorite fuel
From the blood-borne substrate pool.**