

Functional Medicine Deep Dive

Insulin Resistance Deep Dive
Elizabeth Boham, MD, MS, RD

Dr. Hyman +
2021

Welcome!

Dr. Hyman +

1st Functional Medicine Deep Dive

Insulin Resistance



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Insulin Resistance

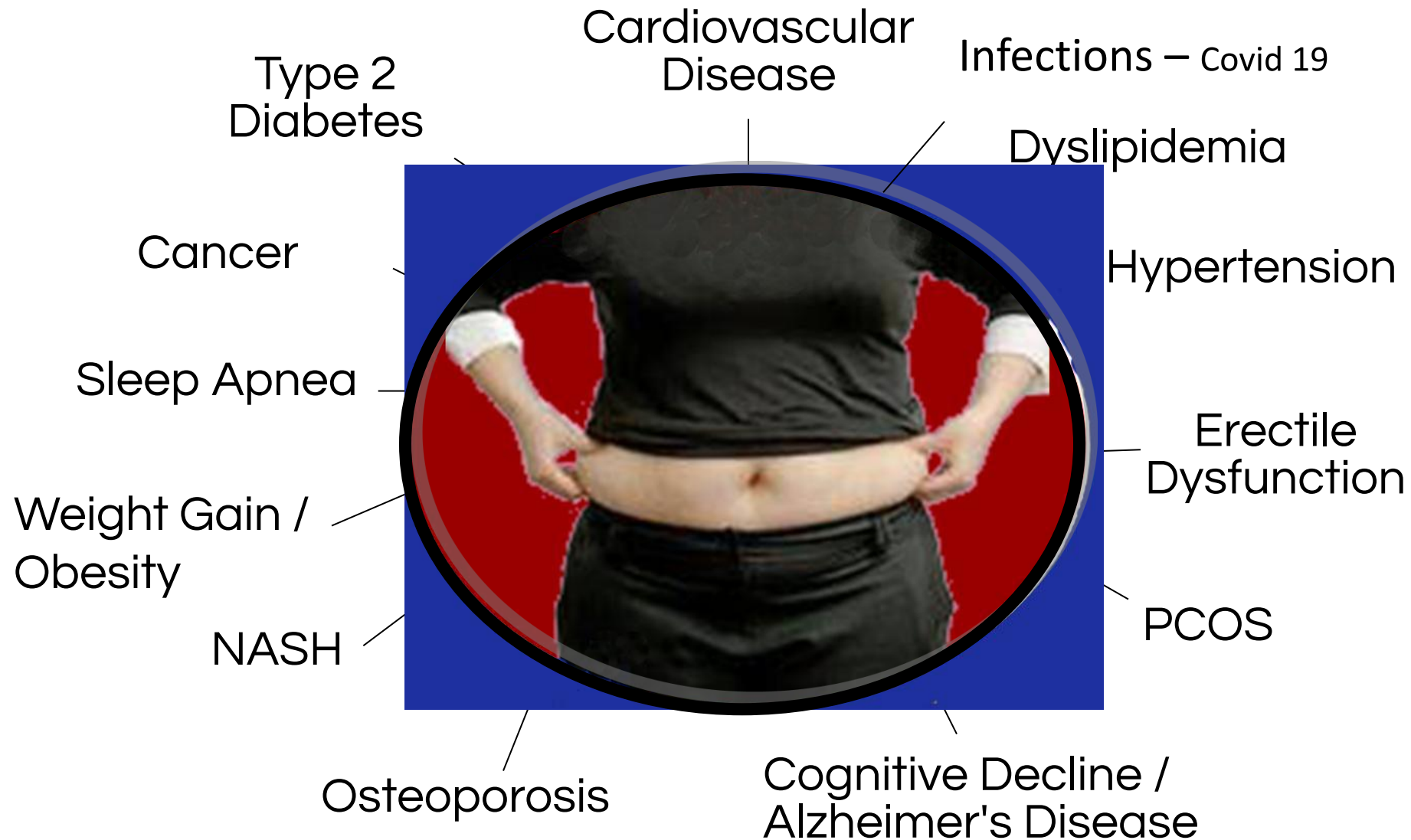
Epidemic

- 5% of children
- 34% of adults over age 20
- > 50% of people over age 60

NHANES 2007-2012

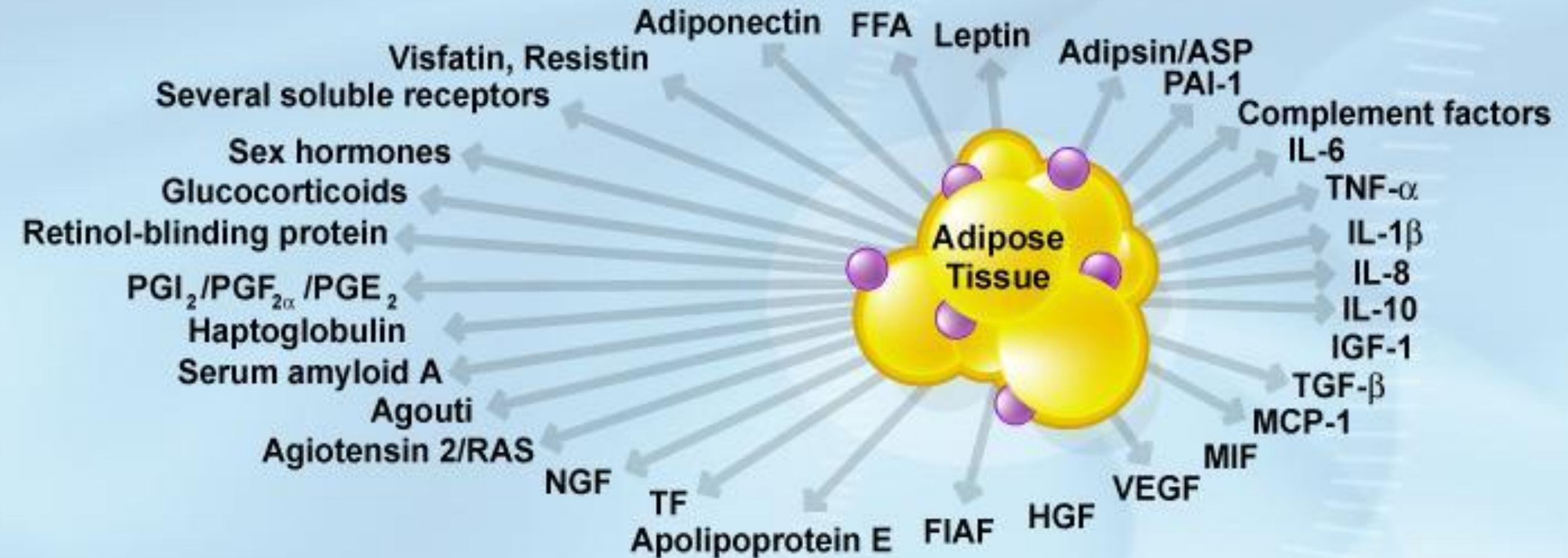


Potential Consequences of Insulin Resistance

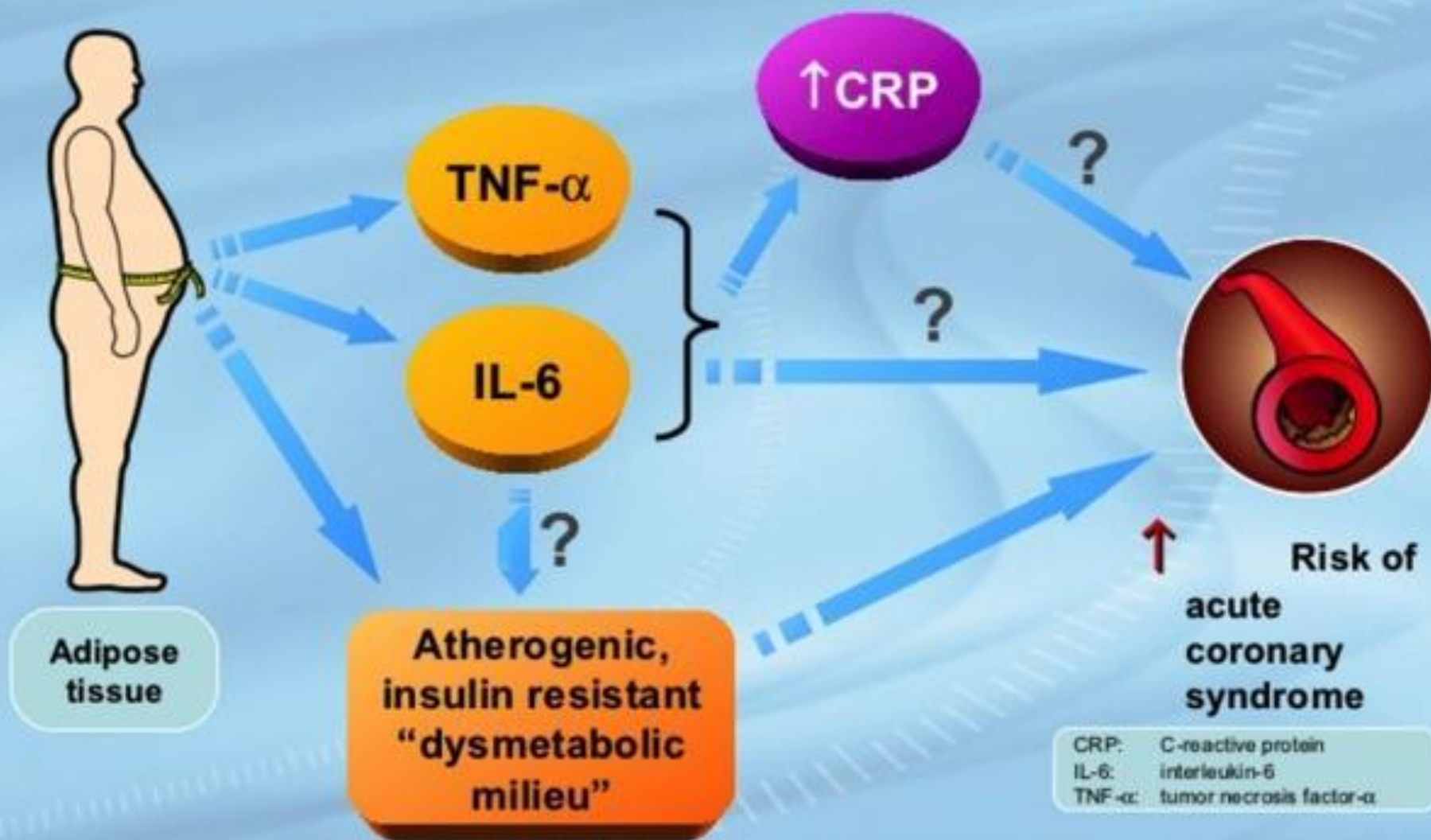


Adipose Tissue is an very active endocrine organ.

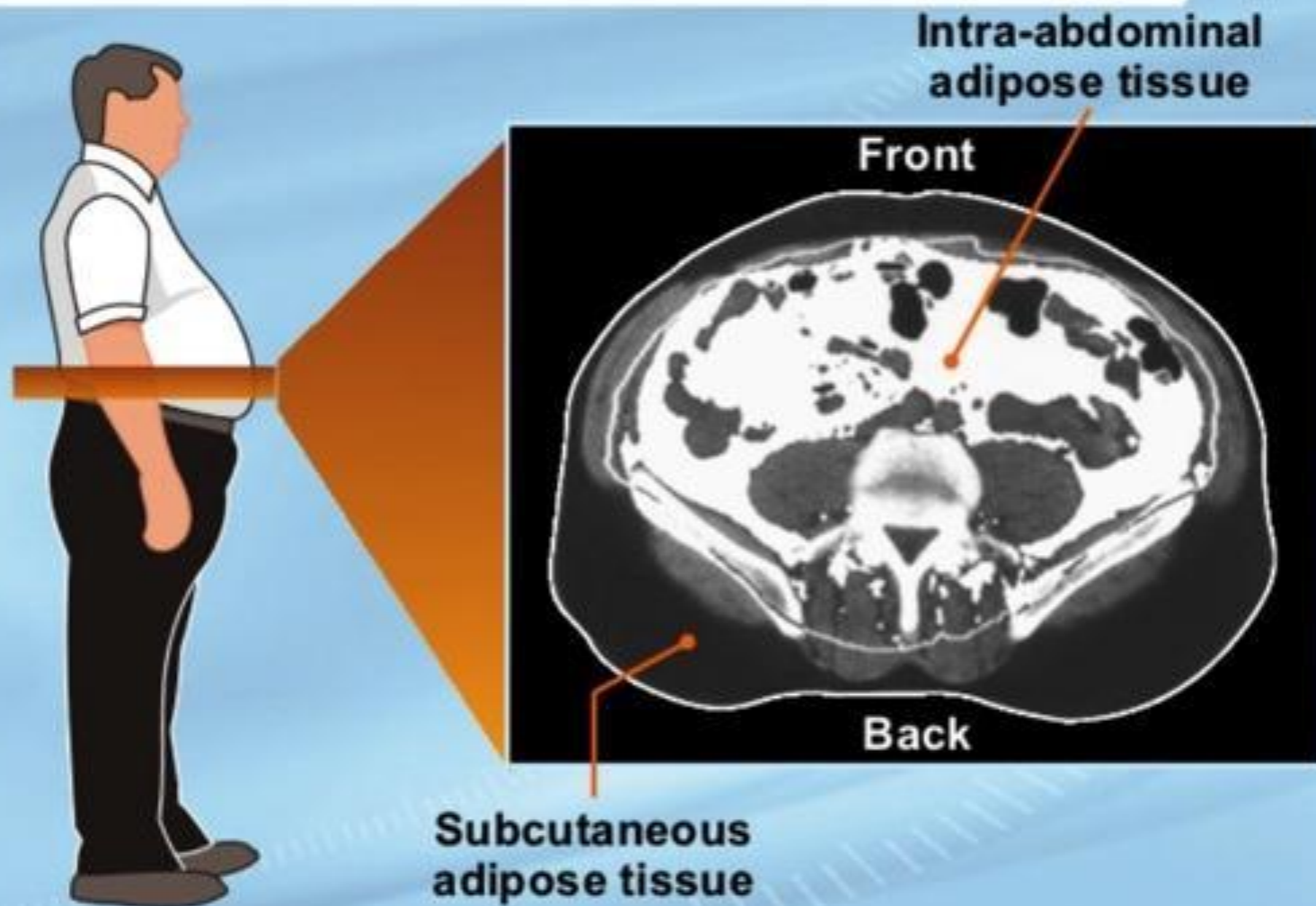
Bray, G, J. Nutr. 2002; 132: 3451S–3455S.



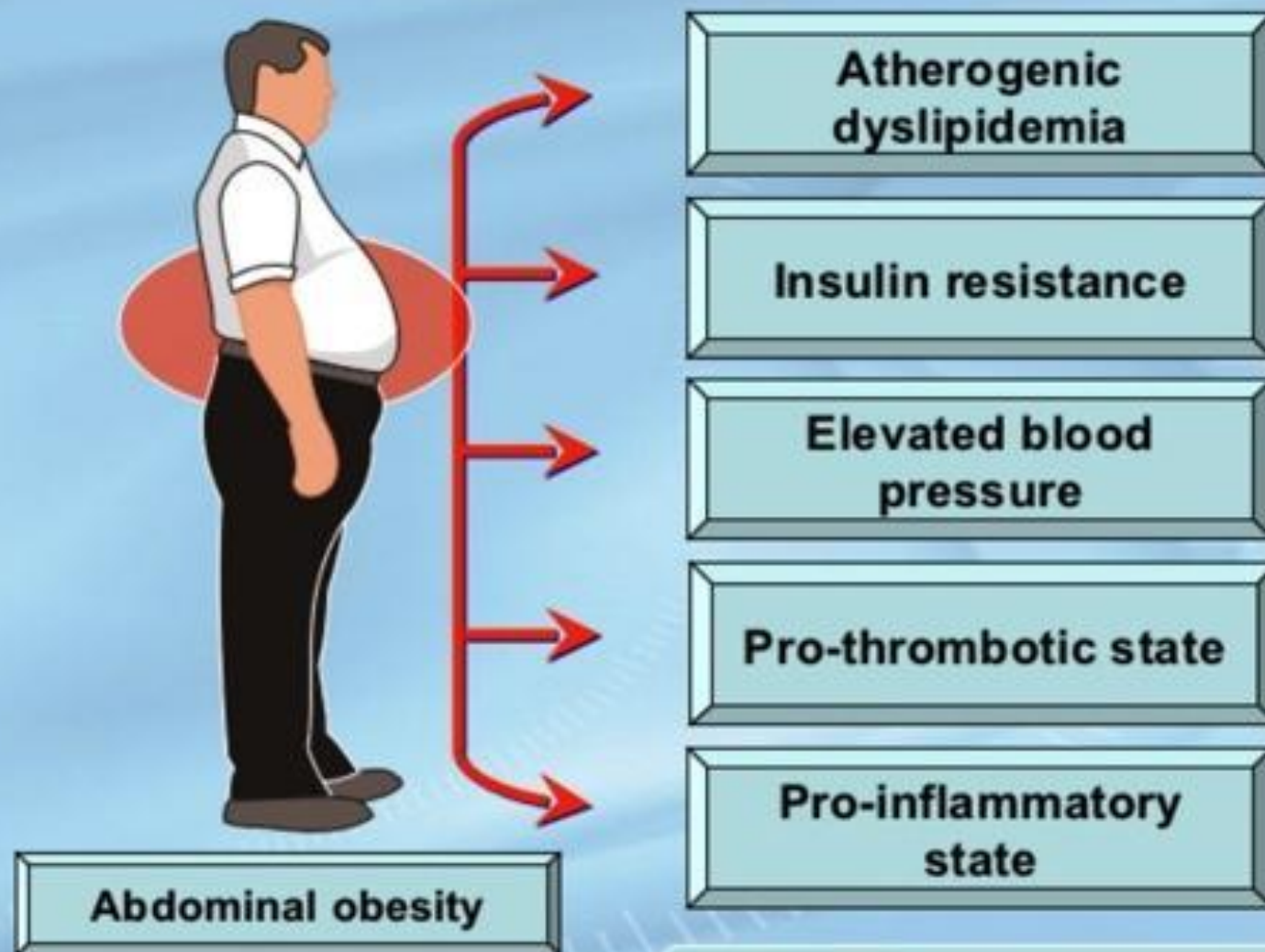
Inflammation and Cardiovascular Disease: Is Abdominal Obesity the Missing Link?



Intra-abdominal (Visceral) Fat: The Dangerous Inner Fat



The Prevalent Form of the Metabolic Syndrome as Defined by NCEP-ATP III and IDF



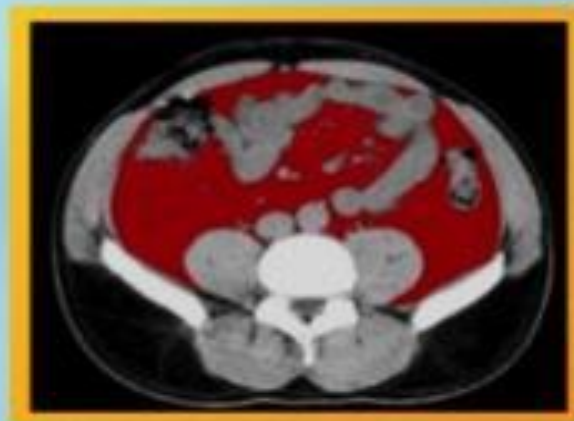
Source: International Chair on Cardiometabolic Risk
www.cardiometabolic-risk.org

NCEP-ATP III: National Cholesterol Education Program
– Adult Treatment Panel III
IDF: International Diabetes Federation

Intra-abdominal (Visceral) Fat is an Independent Predictor of All-cause Mortality in Men

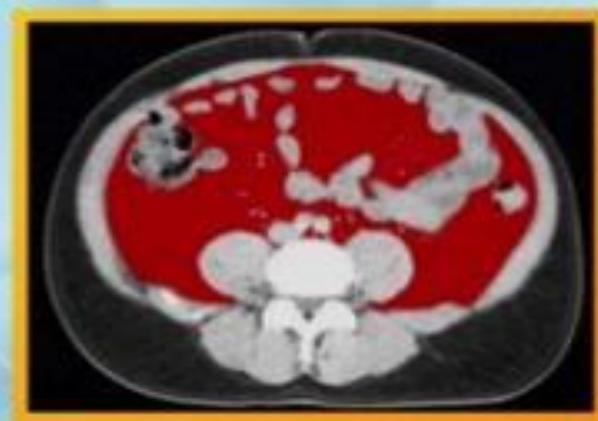


Subject B
is at a 2-fold
higher risk
for mortality



Subject A

**Intra-abdominal
fat is shown in red**



Subject B

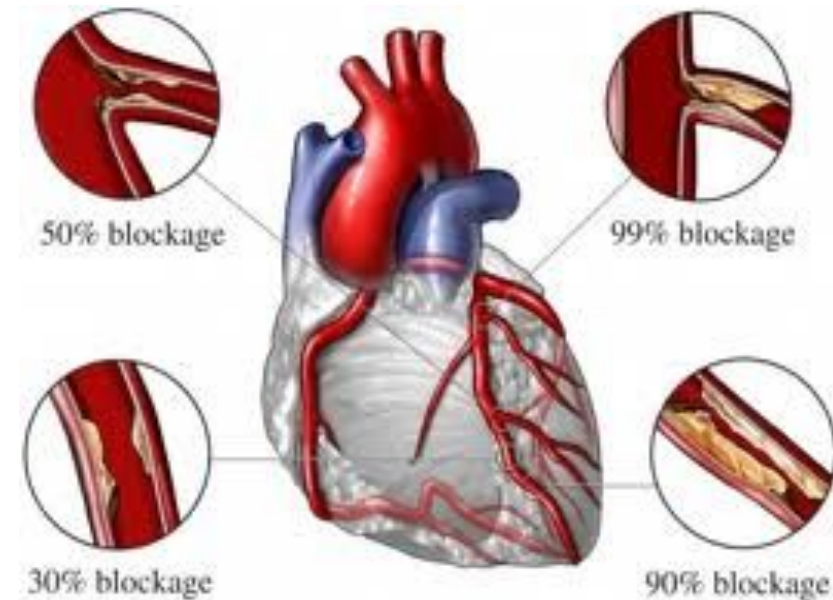
Insulin Resistance

- Overtake cigarette smoking as the number one cause of heart disease

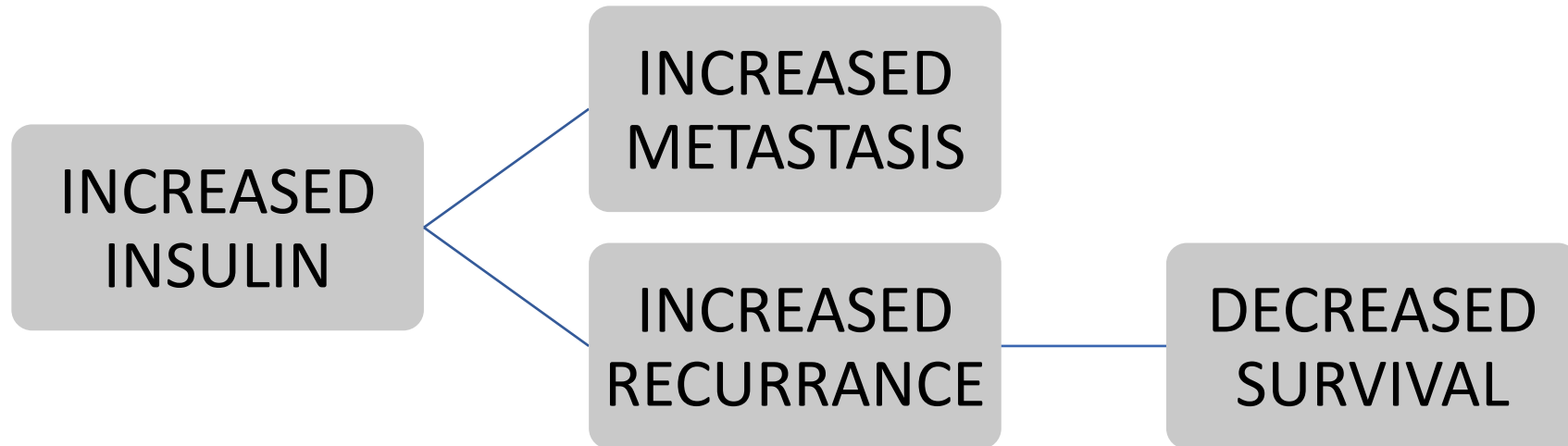
- Also causes

- Weight Gain
- Dementia
- Alzheimer's Disease
- Stroke
- Diabetes
- Cancer - breast, prostate, colon, lung

- Diabetes and the Brain. Contemporary Diabetes. 2009, Part 5, 433-457
- JACC,2010;55, Issue 10A
- Cancer Science. 2010;101:1073–1079



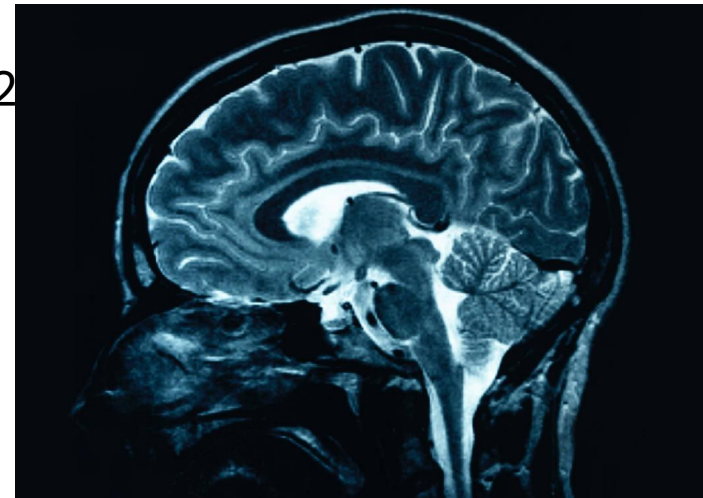
Insulin Resistance and Cancer



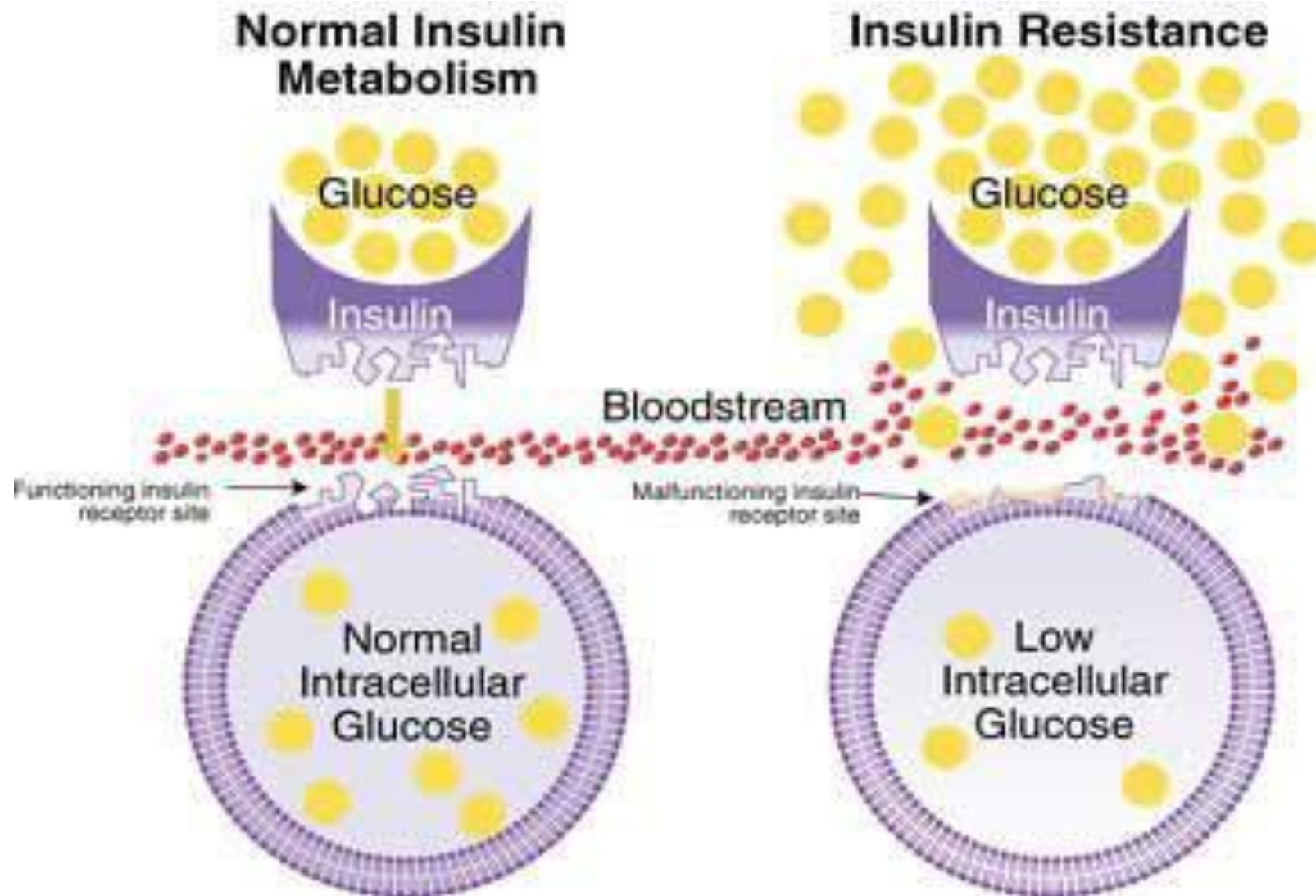
ALZHEIMER'S DISEASE IS A NEUROENDOCRINE DISORDER RESEMBLING A FORM OF DIABETES.

Individuals with Type 2 diabetes have a higher risk of learning and memory problems and cognitive decline.

Starr, V. *Curr Opin Pharmacol*, 2007;7: 638-42



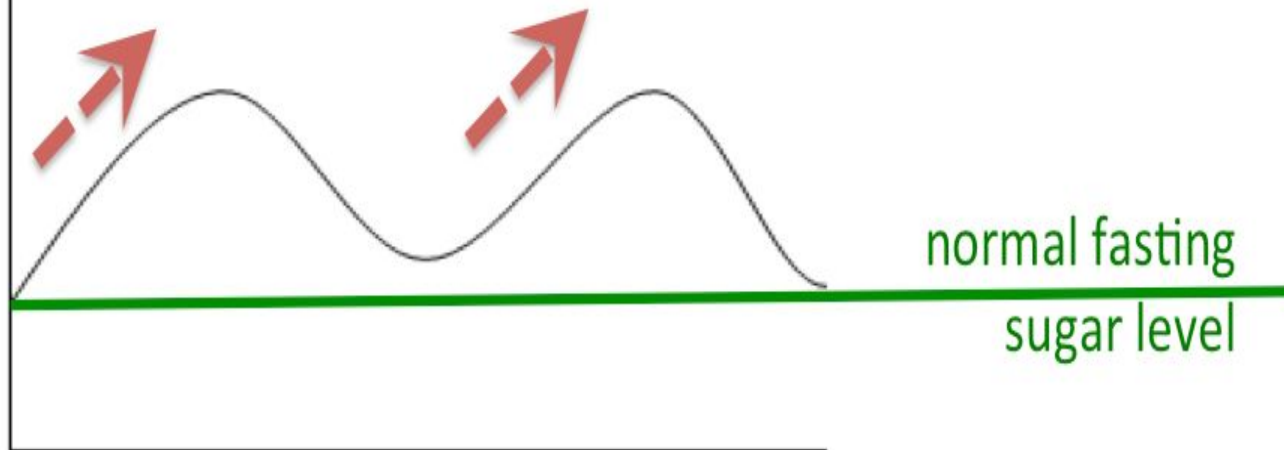
Insulin Resistance



Blood Sugar Cycle and Insulin Levels

Insulin
increases

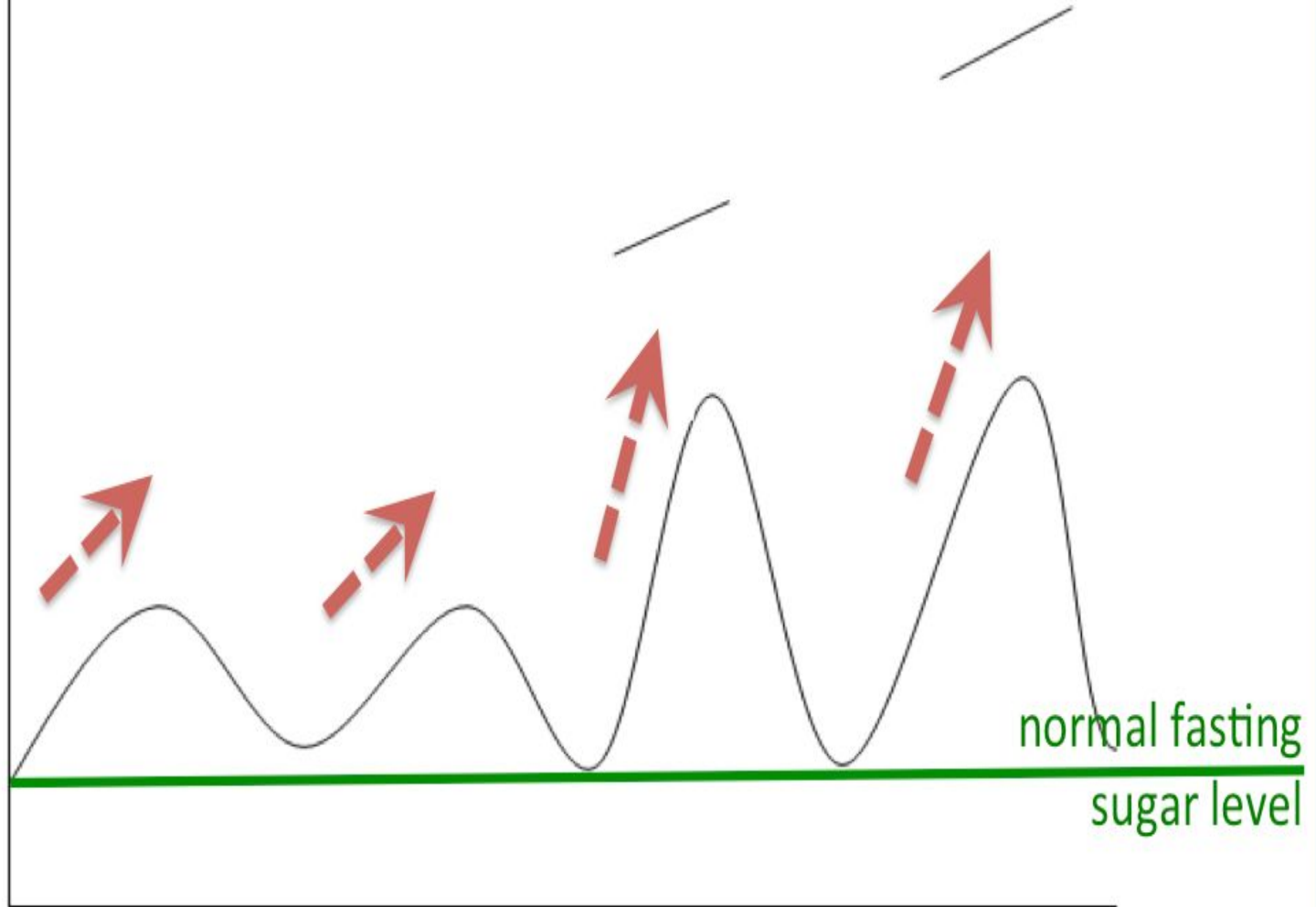
As blood sugar
increases



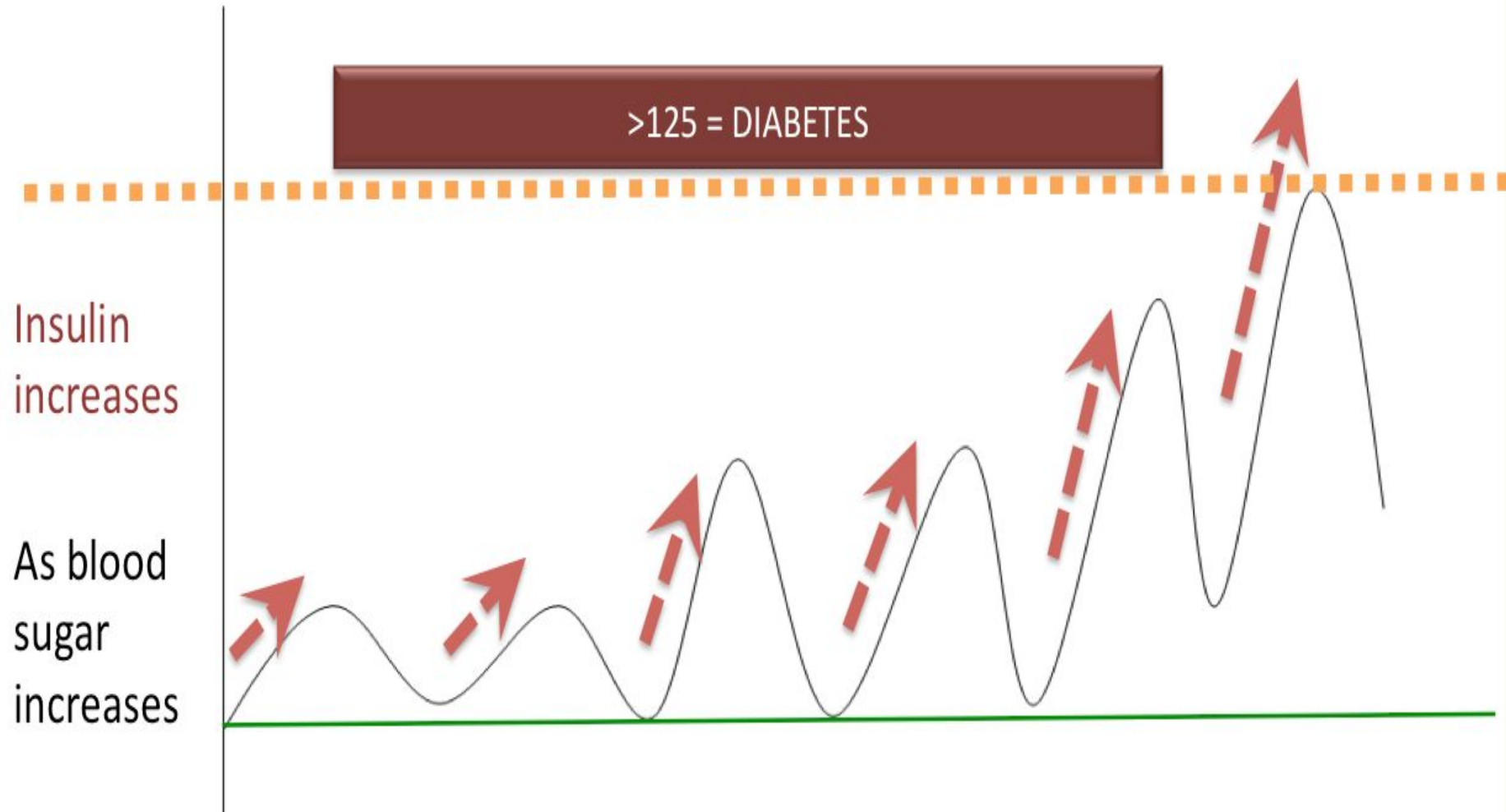
Insulin Resistance

Insulin
increases

As blood sugar
increases



Insulin Resistance



Wellness Continuum



Pattern Recognition – Insulin Resistance

- Weight gain = Apple
- Fatigue / Feeling tired after a meal
- Harder time losing weight
- Cravings for foods
- Hot flashes
- Energy swings
- Low blood sugar - signs of hypoglycemia
- Elevated fasting blood sugar > 100
- Memory Changes
- Lower libido
- Irregular cycle / Infertility
- Acne – chin area
- Hair loss / changes – male pattern hair loss, hirsutism, hair loss on legs, skin tags, hair growth on belly of women



Causes of Insulin Resistance

- Weight gain – overnutrition
- Poor diet- low in nutrient density, high in simple sugars, low in fiber
- Lack of exercise / movement
- Poor Sleep – not enough sleep, sleep apnea
- Stress –high cortisol
- Toxin exposure – BPA / POPs
- Shifts in the microbiome – Dysbiosis / leaky gut
- Genetic predisposition
- Maternal Health -
 - Maternal Malnutrition and Gestational DM increases risk for offspring
- Born small or large for gestational age or premature increases risk for obesity and IR

METABOLIC SYNDROME

3 out of 5

METABOLIC SYNDROME

3 out of 5

- **1. Impaired glucose tolerance**
 - **Fasting blood sugar >100**
 - **High fasting insulin > 12**
 - **Glucose tolerance test**

METABOLIC SYNDROME

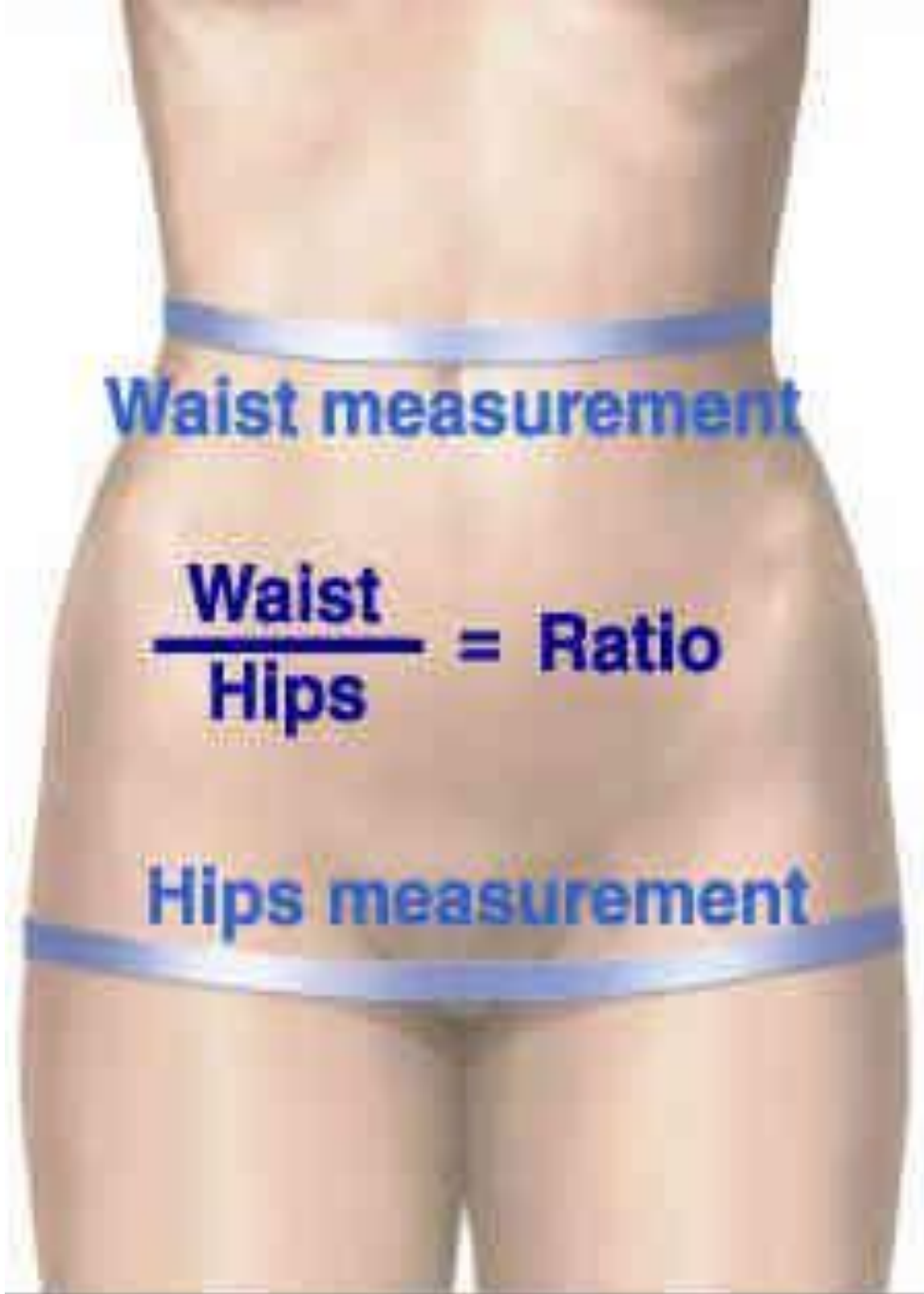
3 out of the 5

- 1. Impaired glucose tolerance - fasting blood sugar > 100 or high insulin
- **2. Elevated blood pressure >130/85 or on medication**

METABOLIC SYNDROME

3 out of the 5

- 1. Impaired glucose tolerance - fasting blood sugar > 100 or high insulin
- 2. Elevated blood pressure >130/85 or on medication
- **3. Central Obesity = Apple shape**
 - **Waist circumference > 35" women > 40" men**
 - **Waist / Hip ratio > .80 women > 0.9 men**



Waist =

Midway between lowest rib and iliac crest

Hip =

Over the greater trochanter or widest area

Goal < 0.8 women and < 0.9 men on average

METABOLIC SYNDROME

3 out of the 5

- 1. Impaired glucose tolerance - fasting blood sugar > 100 or high insulin
- 2. Elevated blood pressure $>130/85$ or on medication
- 3. Central Obesity = Apple shape
 - Waist circumference $>35''$ women $> 40''$ men
 - Waist / Hip ratio $> .85$ women >0.9 men
- **4. Elevated Triglycerides > 150**

METABOLIC SYNDROME

3 out of the 5

- 1. Impaired glucose tolerance - fasting blood sugar > 100 or high insulin
- 2. Elevated blood pressure $>130/85$ or on medication
- 3. Central Obesity = Apple shape
 - Waist circumference $>35''$ women $> 40''$ men
 - Waist / Hip ratio $> .85$ women >0.9 men
- 4. Elevated Triglycerides > 150
- **5. Low HDL < 50 women
 < 40 men**

Think Insulin Resistance

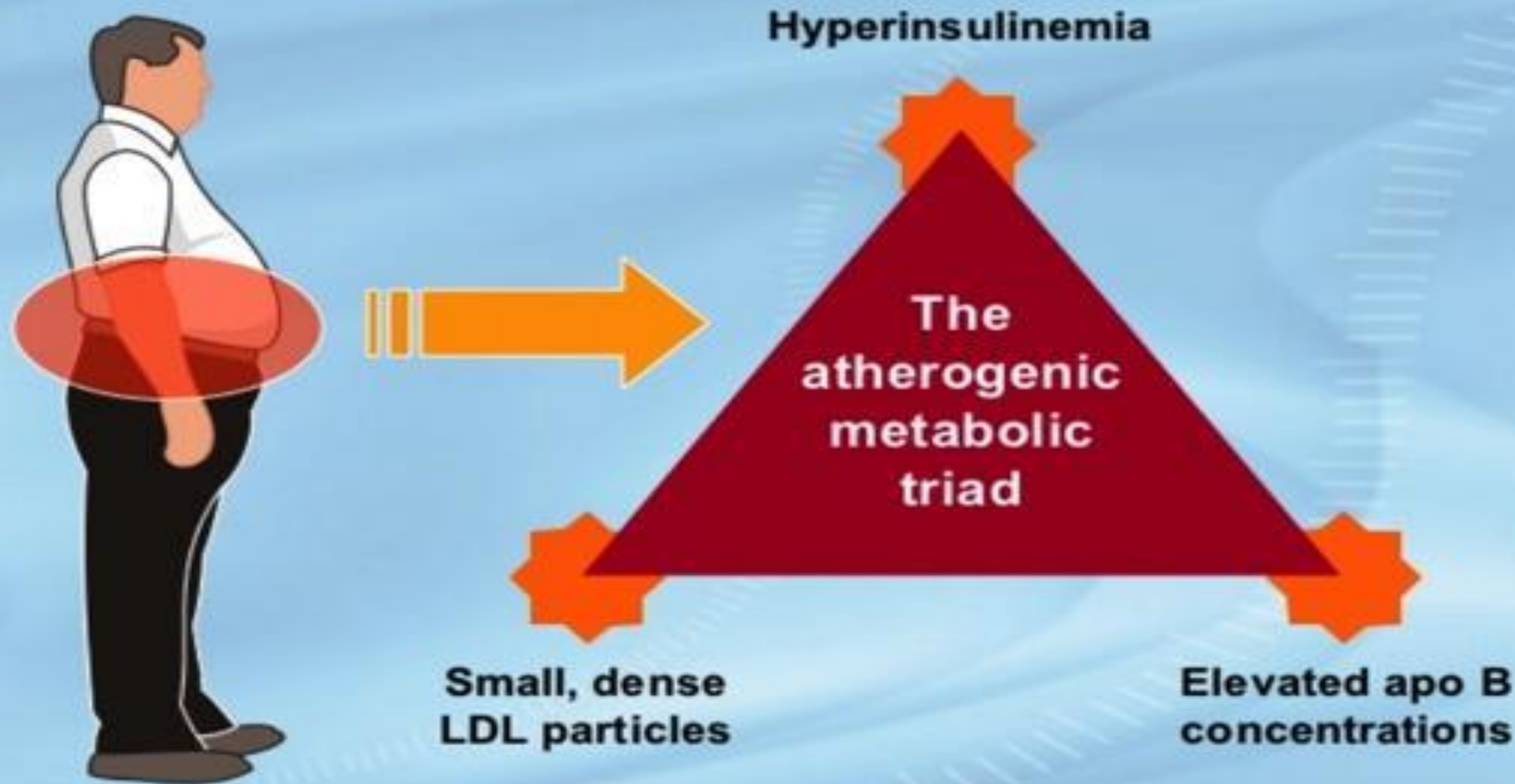
- Small dense LDL
- Elevated triglycerides > 150
- Low HDL <50 for women and <40 for men
- Elevated blood pressure > 130/85 or on medication
- Increased inflammation - elevated hs-CRP
- Weight gain around belly
- Increased uric acid – Gout
- PCOS
- Depression
- Erectile dysfunction
- NASH - fatty liver



Testing

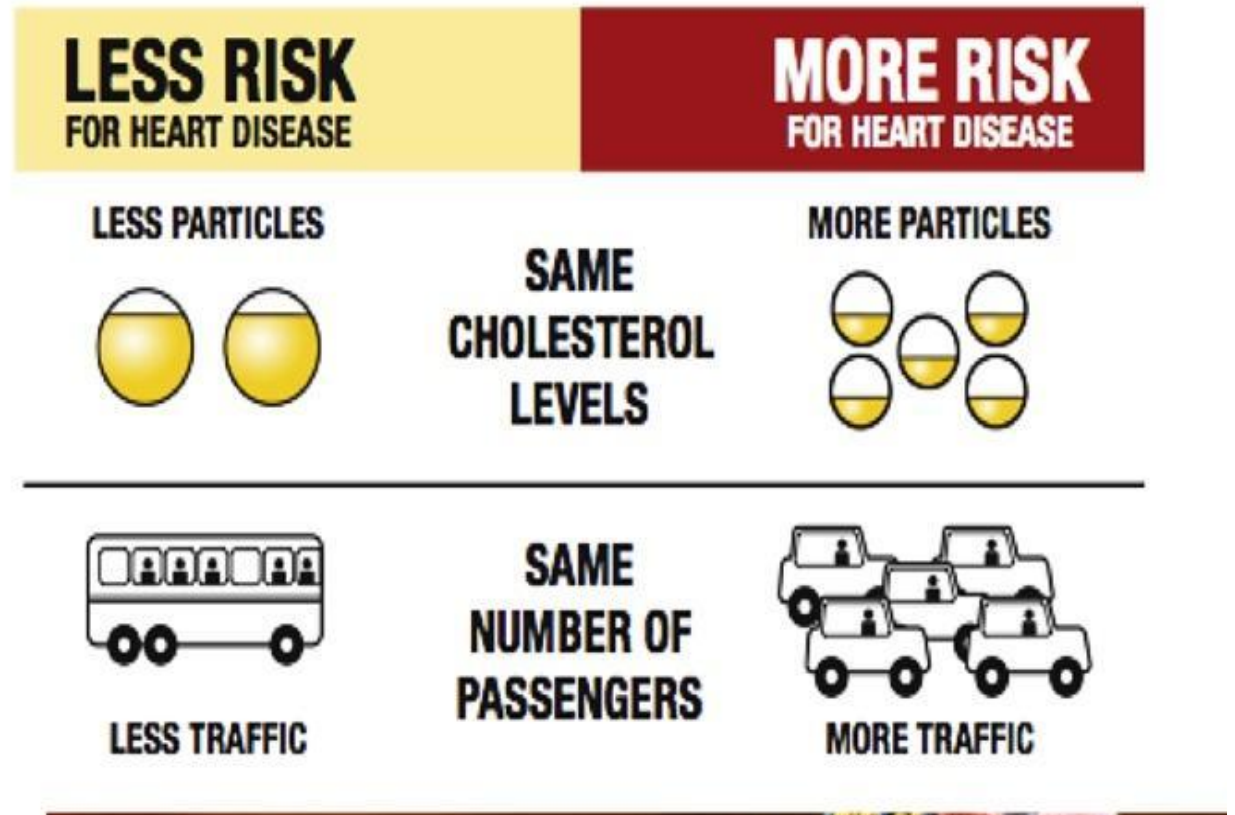
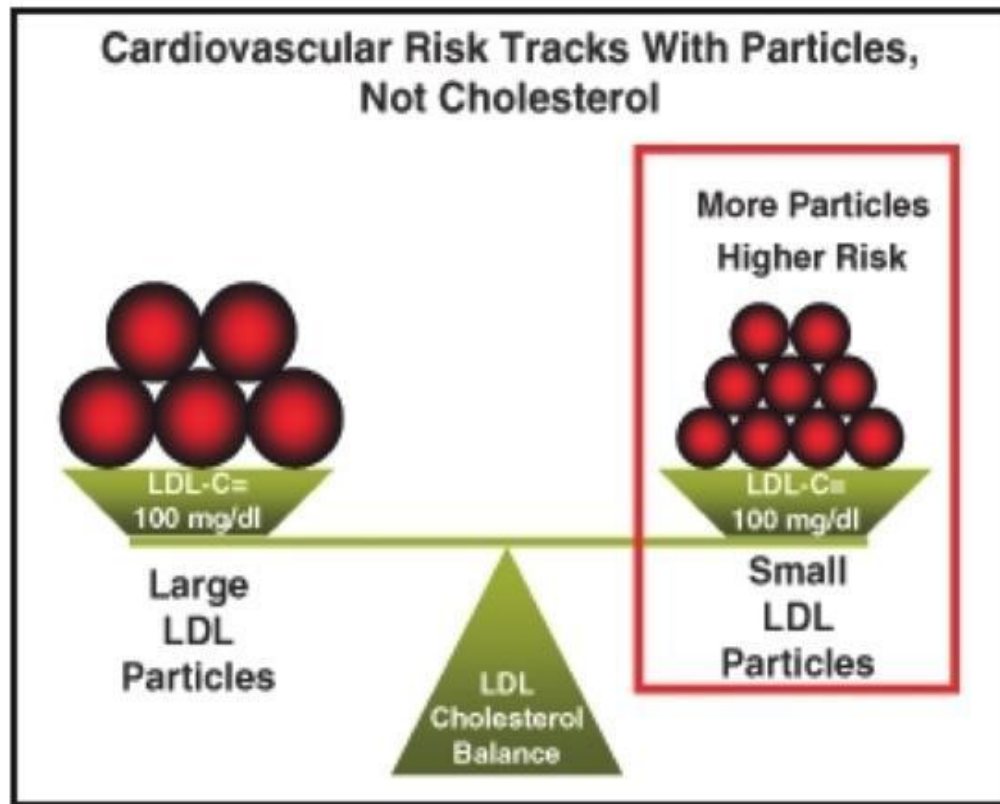
- Waist circumference and Waist / Hip Ratio
- Fasting Glucose and Insulin
- Glucose tolerance test with Insulin levels
- HgA1C
- Lipid Panel
- Particle Size Cholesterol Panel – NMR LipoProfile / Cardio IQ
- Apo B
- hsCRP
- GGT
- Oxidative Stress Markers – organic acid testing, 8OHdG, oxidized LDL

The Atherogenic Metabolic Triad of Intra-abdominal (Visceral) Obesity



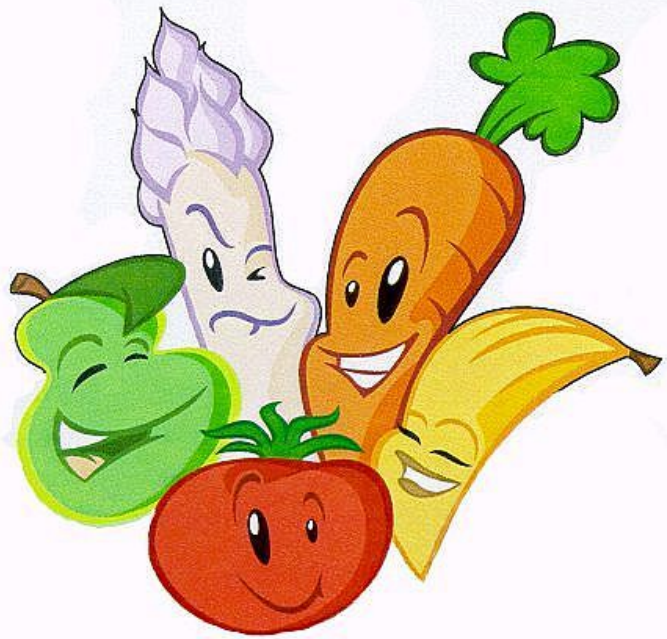
Beyond LDL cholesterol, blood pressure, type 2 diabetes...

Particle Size Testing of Cholesterol



How Can I Improve Insulin Sensitivity?

- Increase **fiber** - 35 grams daily



Dietary fiber and nutrient density are inversely associated with the metabolic syndrome in US adolescents

- 2100 boys and girls age 12-19
- Lowest fiber intake had 3X risk of metabolic syndrome
- As fiber intake increased, MS risk decreased
- Saturated fat and cholesterol intake did not influence risk of MS

It is more important to emphasize a paradigm that promotes the inclusion of fiber-rich, nutrient-dense, plant-based foods vs what foods to restrict or exclude as is commonly done when the focus is on total fat, cholesterol, or saturated fat intake.

How Can I Improve Insulin Sensitivity?

- Increase **fiber** - 35 grams daily
- Protein - at each meal
- Increase omega 3 fats
- Eliminate highly processed foods and added sugar
- Nutrient dense foods
- 40 minutes of **exercise** daily
- Get 7-9 hours of **sleep** per night
- Manage stress
- Microbiome
- Toxins

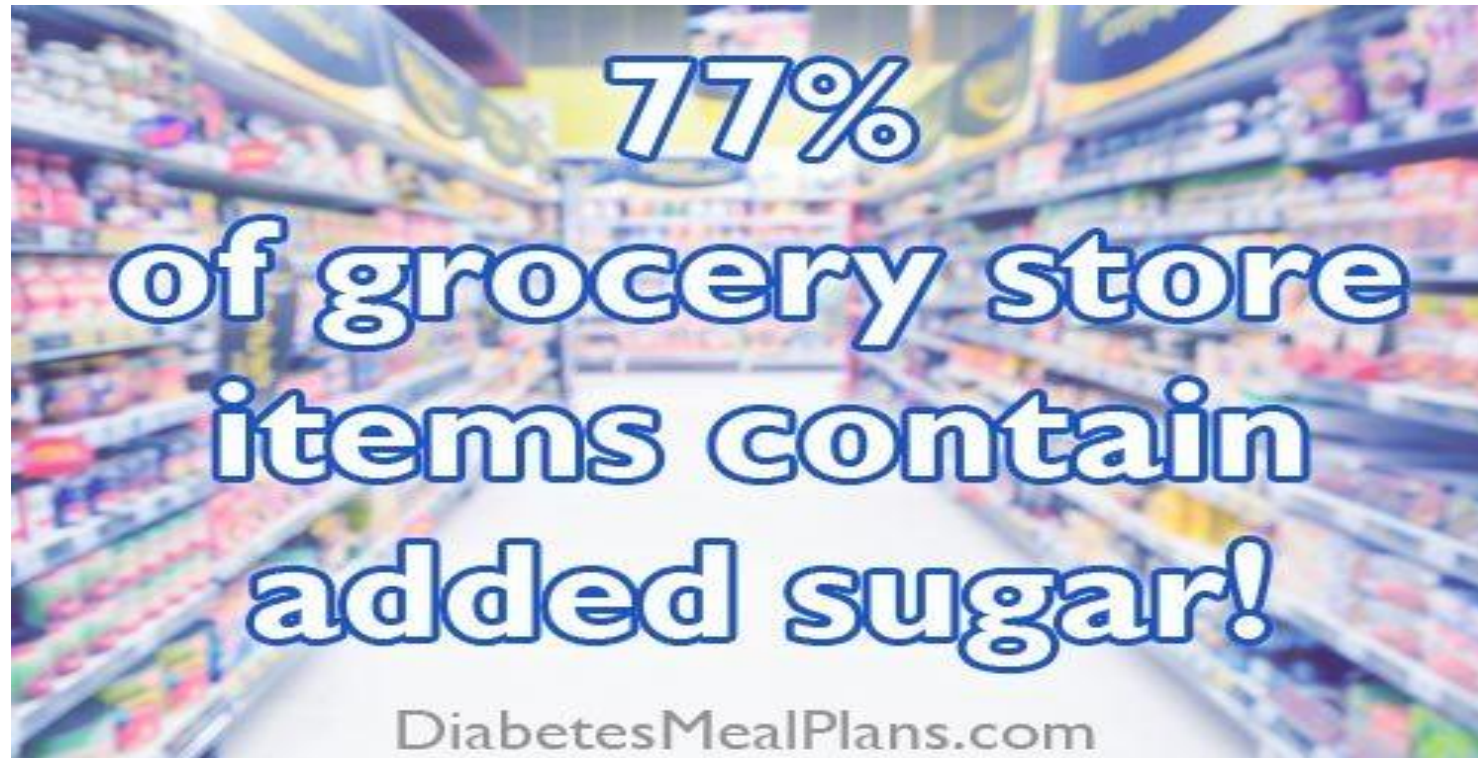
Dr Boham's Food Rules

- 1. Don't drink your calories



Dr Boham's Food Rules

- 1. Don't drink your calories
- 2. Avoid added sugar



Dr Boham's Food Rules

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- 3. Eat the rainbow



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- 4. Embrace fiber



Dr Boham's Food Rules

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- 5. Balance your blood sugar – fat, protein, fiber

Dr Boham's Food Rules

- 1. Don't drink your calories
- 2. Avoid added sugar
- 3. Eat the rainbow
- 4. Embrace fiber
- 5. Balance your blood sugar



Food As Medicine – Green Tea

- 4 cups per day of green tea for 8 weeks significantly decreased body weight and BMI
- Lowered oxidative stress and improved markers of metabolic syndrome





Food As Medicine - Tree Nuts

- Nuts can lower triglycerides, Apo B, inflammation and LDL oxidation, as well as improve endothelial function and vascular reactivity.
- 1 ounce 5 times per week
- Keep in fridge / freezer for freshness
- 1 oz = 24 almonds, 14 walnut halves, 12 hazelnuts, 15 pecan halves

Food As Medicine - Kimchi

- Both fresh and fermented kimchi shown to decrease body weight and waist circumference
- Consumption of fermented kimchi (fermented 10 days) improved insulin sensitivity, lowered blood pressure, and improved glucose tolerance even more than just fresh kimchi (fermented 1 day)
- Dose: about 3 ounces (3/4s of a cup) of kimchi, three times daily

Food As Medicine – Omega 3 Fats

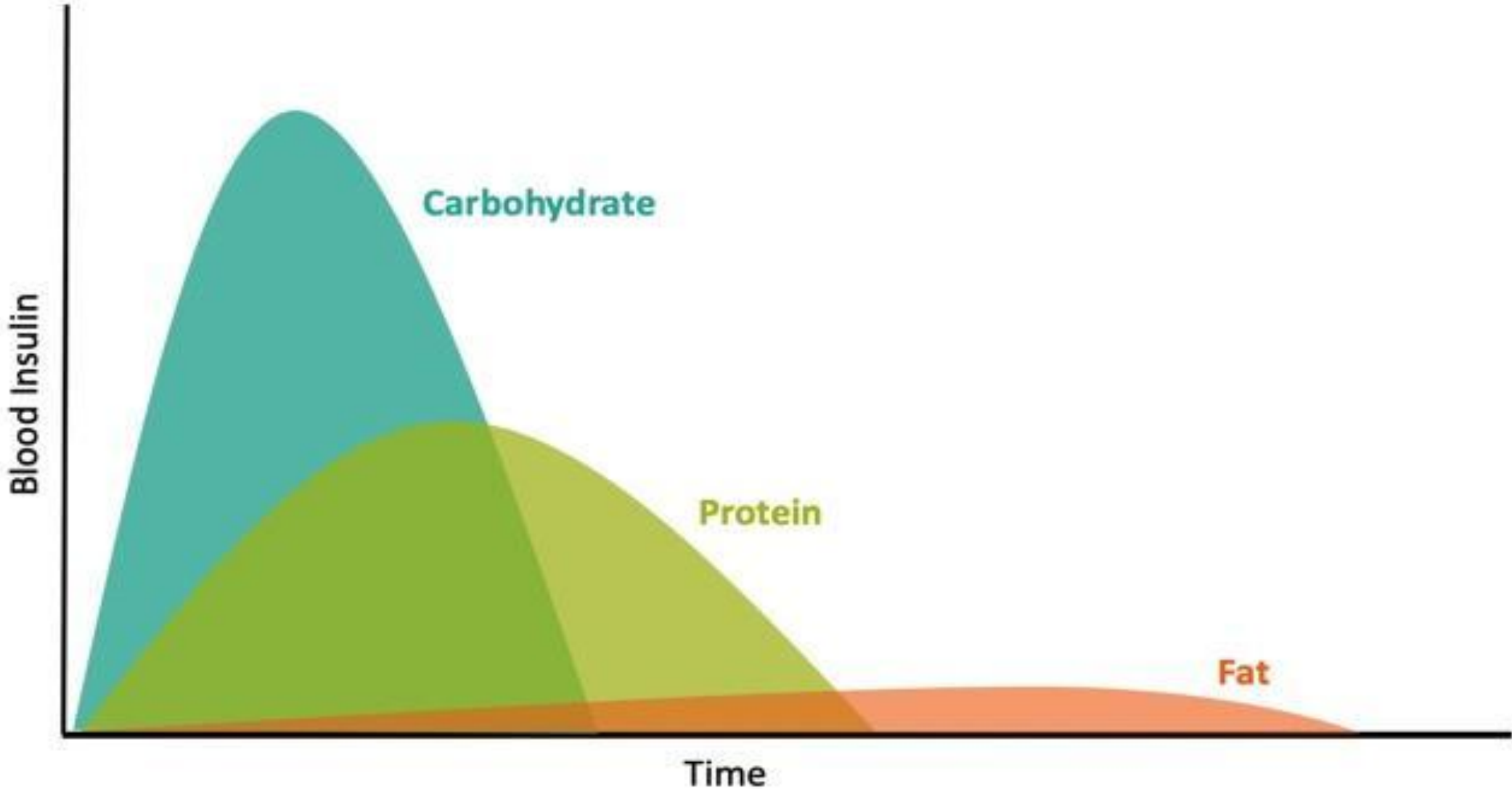
- Recommendation of 2-4 grams omega 3 fats to lower triglycerides and increases HDL
- Lowering triglycerides is as important as lowering LDL

- VITAL trial – for people eating < 1.5 servings of fish / week or African Americans getting 1 gm of fish oil per day can decrease risk of MI
- If eating 2 or more servings of fish per day fish oil may not be helpful

Beyond the Basics

- Stricter Diet
- Microbiome
- Toxins
- Maternal Health

Insulin Response to Macronutrients



Next Steps with Diet

- Intermittent Fasting / Time Restricted Eating
 - Calorie Restriction – Restrict by 25-40% per day
 - Intermittent Fasting –
 - Fasting for 14-16 hrs, then eating normally
 - Fast for 24 hours 1-2 days/week – 6 pm – 6 pm
 - Periodic multiday fasts / fasting mimicking – ie Prolon
 - Alternate Day Fasting (ADF) – alternate zero-calorie fast days with days of “normal” eating.
- Elimination Diet
- Lower Carbohydrate Diet
- Ketogenic Diet

Obesity

Is the microbiome a cause of obesity, or an effect? The answer is...probably both.

There is no universal "fat microbiome" or "thin microbiome." Everyone is different. Yet in some populations, leaner people tend to have very different microbiomes than their heavier neighbors. So microbes may be a factor in body weight, along with diet and exercise.

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Further Testing

- Continuous Glucose Monitoring
- Intestinal permeability
 - Elevated Lipopolysaccharides – LPS
 - Food sensitivities
- Evaluate the microbiome
 - Stool
 - Oral microbiome
- Toxin testing
 - BPA / POPs / pesticides
 - medications
- Genetic Testing

Supplements

- Optimize Vitamin D
- Omega 3 fats
- Inositol - myo-inositol, D-chiro inositol
- L-carnitine
- Alpha lipoic acid
- Konjac Root – PGX
- Magnesium
- EGCG – green tea
- Berberine
- Cinnamon
- Fenugreek
- Probiotics



Thank you!

Elizabeth Boham, MD, MS, RD

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