



The Mind-Body Connection: How metabolic health contributes to brain health



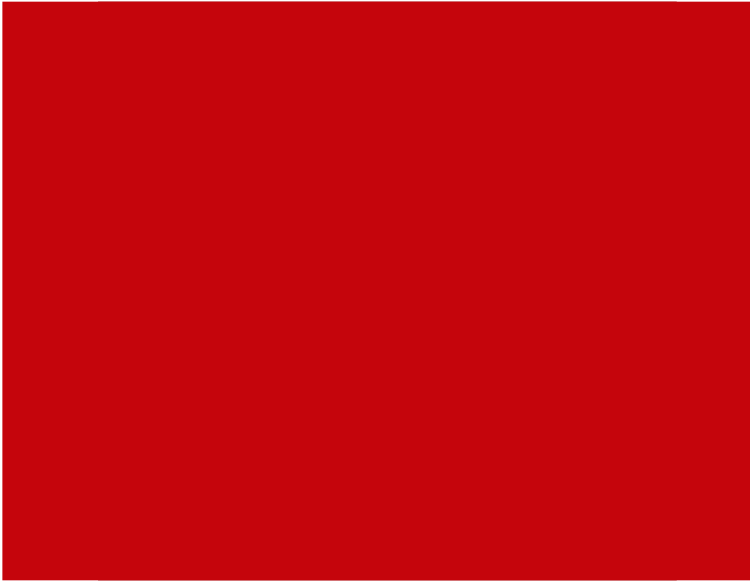
Taryn T. James, PhD

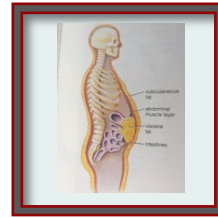
ttjames@medicine.wisc.edu

UW-Madison Alzheimer's Disease Center

June 12, 2024







DEMENTIA

Umbrella term for loss of memory and other thinking abilities severe enough to interfere with daily life.

Alzheimer's: 60-80%
Lewy Body Dementia: 5-10%
Vascular Dementia: 5-10%
Frontotemporal Dementia: 5-10%
Others: Parkinson's, Huntington's

Mixed dementia: Dementia from more than one cause

<https://www.alz.org/alzheimers-dementia/what-is-dementia>

- **Cognition:**
 - Memory
 - Language
 - Problem-Solving
 - Thinking

- **Dementia:**
 - Umbrella term used to describe a syndrome that have many different causes
 - **Describes difficulties with Cognition:**
Thinking that affects daily activities

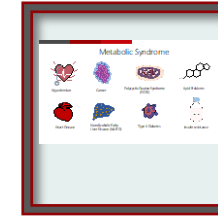
Normal memory loss as we age	Signs of Alzheimer's
Occasionally making the wrong decision	Frequently showing poor judgment and decision-making
Forgetting to pay a bill	Not being able to manage money and household finances
Not remembering what day it is, but remembering later	Not knowing the day, year or season
Trouble remembering the correct word to use sometimes	Not being able to hold a conversation intelligently
Losing car keys or other things every now and then	Losing things and not being able to retrace your steps to find them

By Michael A. Janz, M.D. Director, Alzheimer's Disease Research Center

Brain: Carries out three major functions i.e. memory, movement, and mood

Cognition: Language, attention, perception, remembered skills (driving), thought, memory, executive function (the ability to plan and carry out tasks), judgement, and the ability to live a purposeful life

Dementia: thinking that affects daily activities



Cognition:

- Memory
- Language
- Problem-Solving
- Thinking

Dementia:

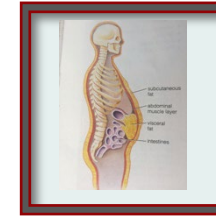
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The Book of Alzheimer's Disease for African American Populations

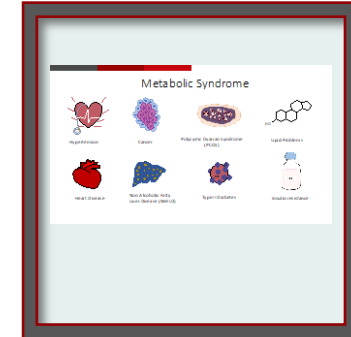
www.alz.co.uk

Alzheimer's Disease: The number one cause of dementia. Alzheimer's is not normal aging.



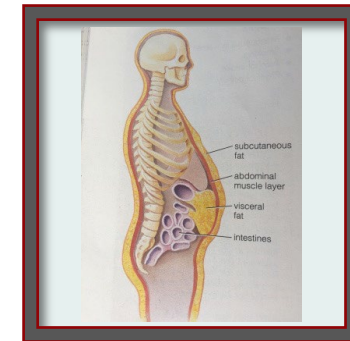
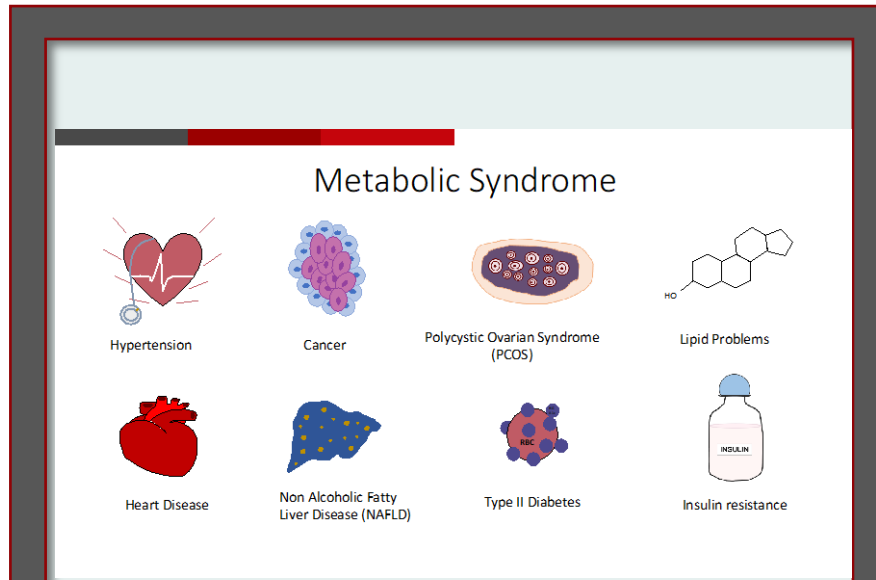
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The World of Alzheimer's Disease is a trademark of Alzheimer's Association.



Dementia Risk Factors: Include age, genetic factors, environmental factors (air pollution, pesticides such as organophosphates, metals, arsenic, phthalates), lifestyle factors (sleep, exercise, educational history), diseases ([metabolic syndrome diseases: heart disease, diabetes, insulin resistance, obesity] periodontal disease, microbiome issues, and compounding risk factors.

Normal memory loss as we age	Signs of Alzheimer's
Occasionally making the wrong decision	Disrupts normal day-to-day activities
Forgetting a name or two	Disrupts normal day-to-day activities
Forgetting a date or two	Disrupts normal day-to-day activities
Not remembering what day of the week it is	Disrupts normal day-to-day activities
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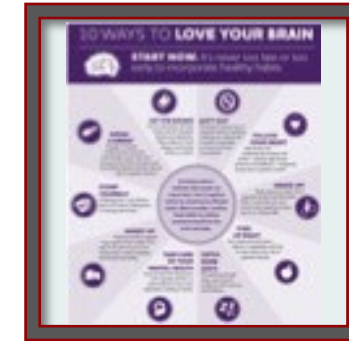
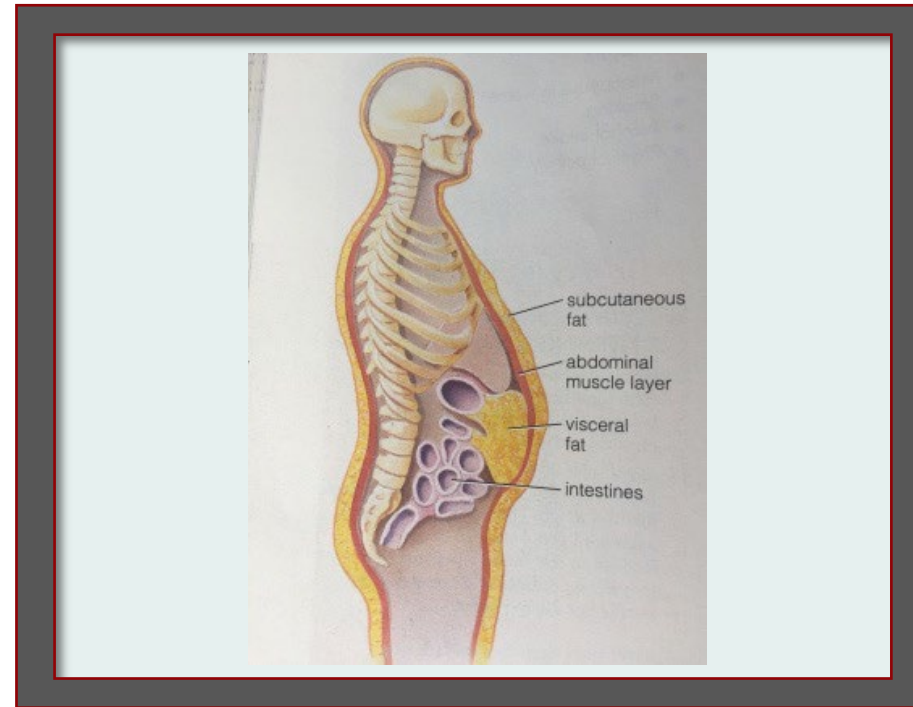
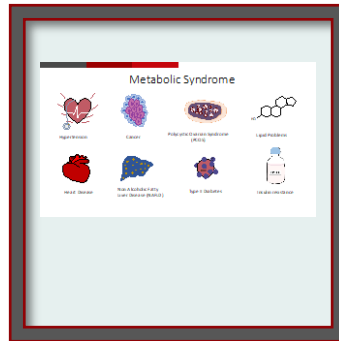
Metabolism: “the chemical reactions in the body’s cells that change food into energy”

Metabolic health: the ability of the body to regulate the use of nutrients and bodily functions (i.e. blood sugar, cholesterol, blood pressure, body weight)

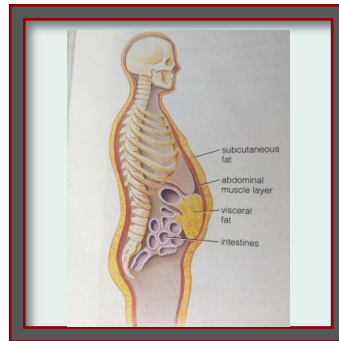
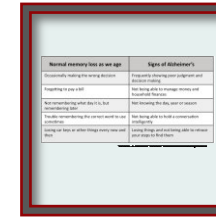
Metabolic Syndrome (MtS): MtS diseases include high blood pressure, insulin resistance, diabetes, cholesterol problems, etc). Having three or more of the diseases depicted here constitute having metabolic syndrome. MtS results from metabolic dysfunction (a dysregulation of nutrient signaling).



Prevention Strategy	Type of Evidence
Physical activity	Observational
Weight management	Observational
Healthy diet	Observational
Alcohol consumption	Observational
Smoking	Observational
Stress management	Observational
Social engagement	Observational
Cognitive training	Experimental
Medication	Experimental
Genetic testing	Observational
Environmental factors	Observational



Belly Fat: Belly fat is fat that surrounds the organs. It is also called visceral fat. Increased belly fat has been linked to metabolic syndrome diseases and poorer cognitive performance.



10 WAYS TO LOVE YOUR BRAIN

START NOW. It's never too late or too early to incorporate healthy habits.

BREAK A SWEAT
Engage in regular cardiovascular exercise that elevates heart rate and increases blood flow. Studies have found that physical activity reduces risk of cognitive decline.

HIT THE BOOKS
Formal education will help reduce risk of cognitive decline and dementia. Take a class at a local college, community center or online.

BUTT OUT
Smoking increases risk of cognitive decline. Quitting smoking can reduce risk to levels comparable to those who have not smoked.

FOLLOW YOUR HEART
Risk factors for cardiovascular disease and stroke – obesity, high blood pressure and diabetes – negatively impact your cognitive health.

STUMP YOURSELF
Challenge your mind. Build a piece of furniture. Play games of strategy, like bridge.

HEADS UP!
Brain injury can raise risk of cognitive decline and dementia. Wear a seat belt and use a helmet when playing contact sports or riding a bike.

BUDDY UP
Staying socially engaged may support brain health. Find ways to be part of your local community or share activities with friends and family.

TAKE CARE OF YOUR MENTAL HEALTH
Some studies link depression with cognitive decline, so seek treatment if you have depression, anxiety or stress.

CATCH SOME ZZZ'S
Not getting enough sleep may result in problems with memory and thinking.

FUEL UP RIGHT
Eat a balanced diet that is higher in vegetables and fruit to help reduce the risk of cognitive decline.

Growing evidence indicates that people can reduce their risk of cognitive decline by adopting key lifestyle habits. When possible, combine these habits to achieve maximum benefit for the brain and body.

DEMENTIA

Umbrella term for loss of memory and other thinking abilities severe enough to interfere with daily life.

- Cognition:**
 - Memory
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- Dementia:**
 - Umbrella term used to describe a syndrome that has many different causes
 - Describes difficulties with Cognition: Thinking that affects daily activities

Methods To Reduce risk: diet (foods that reduce inflammation), regular exercise reduces risk for dementia, mental stimulation (i.e. challenge the brain by learning new skills, by doing puzzles etc), sleep (helps with memory and the removal of brain toxins), stress reduction, socializing etc

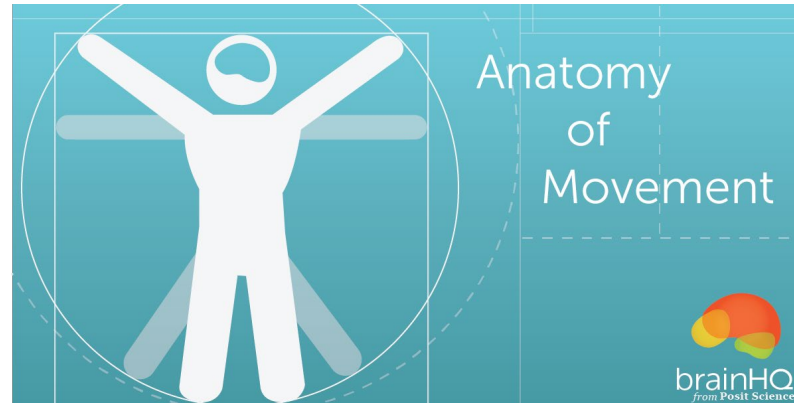


The Brain: Three Major Brain Functions

- Mood



- Movement

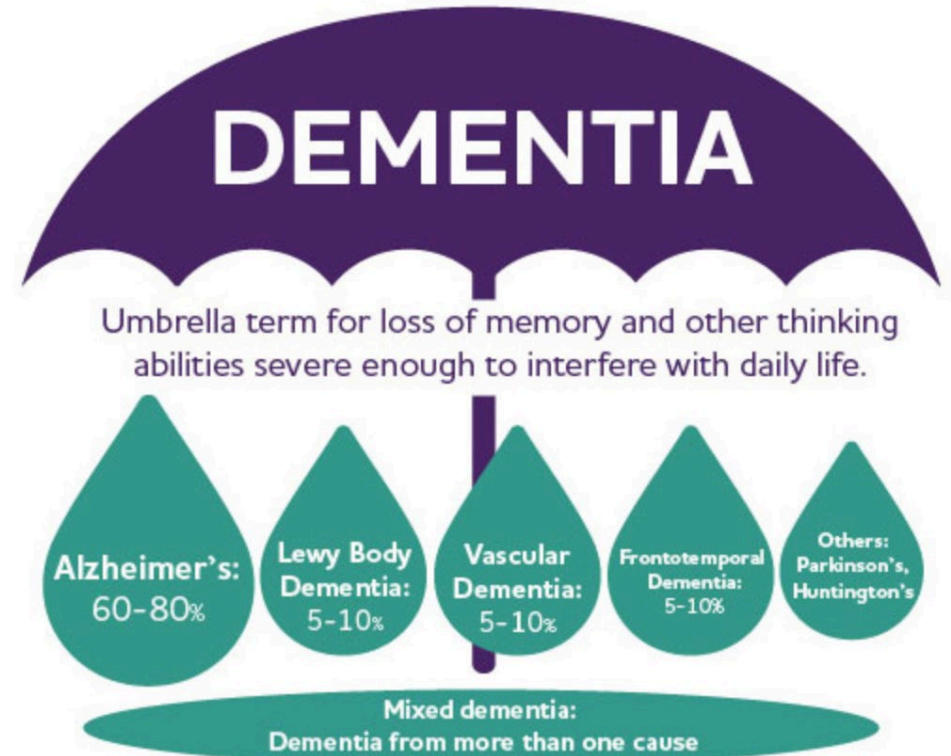


- Memory



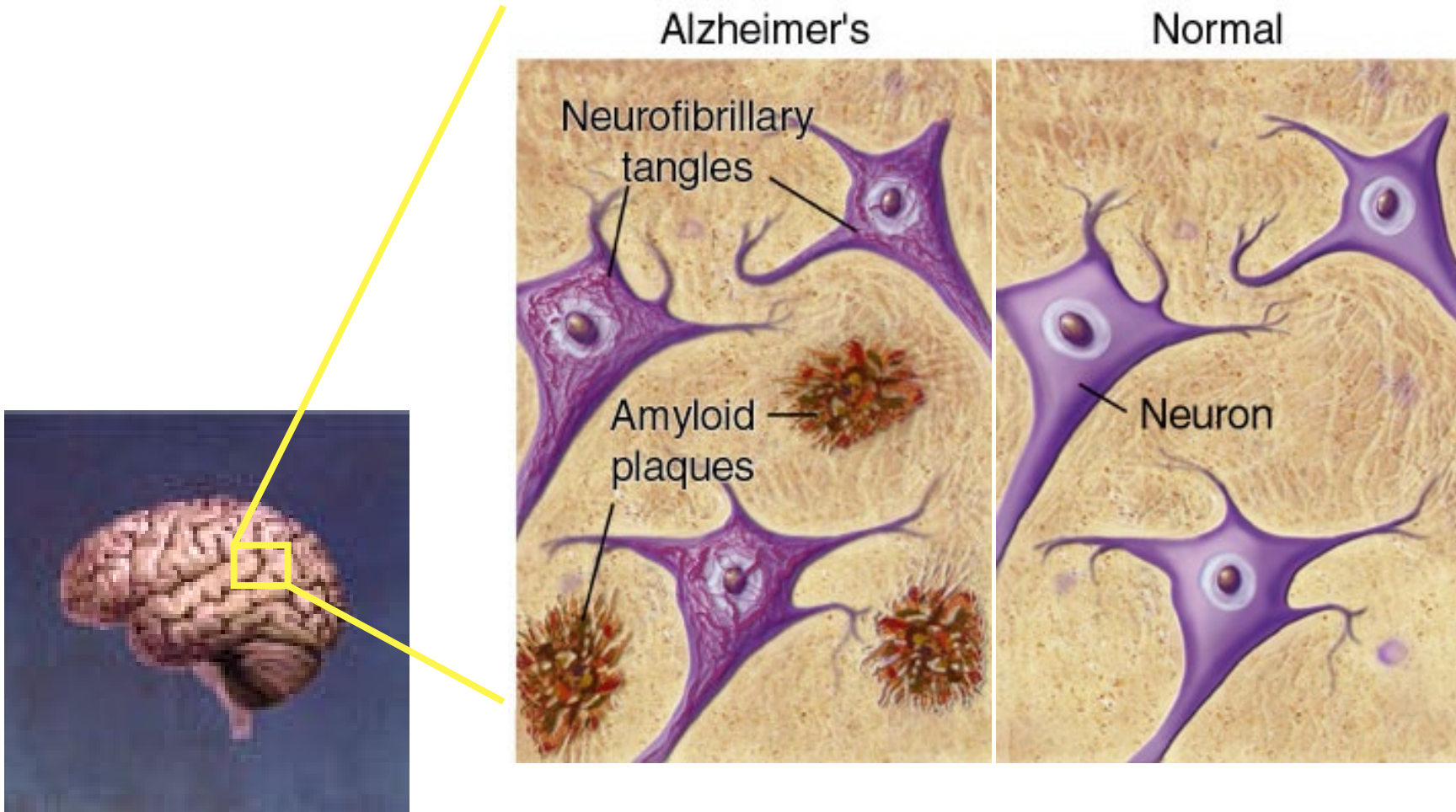
What is Cognition and Dementia?

- **Cognition:**
 - Memory
 - Language
 - Problem-Solving
 - Thinking
- **Dementia:** Umbrella term used to describe a syndrome that have many different causes
- Difficulties with:
 - Memory
 - Language
 - Problem-Solving
 - Thinking that affects daily activities



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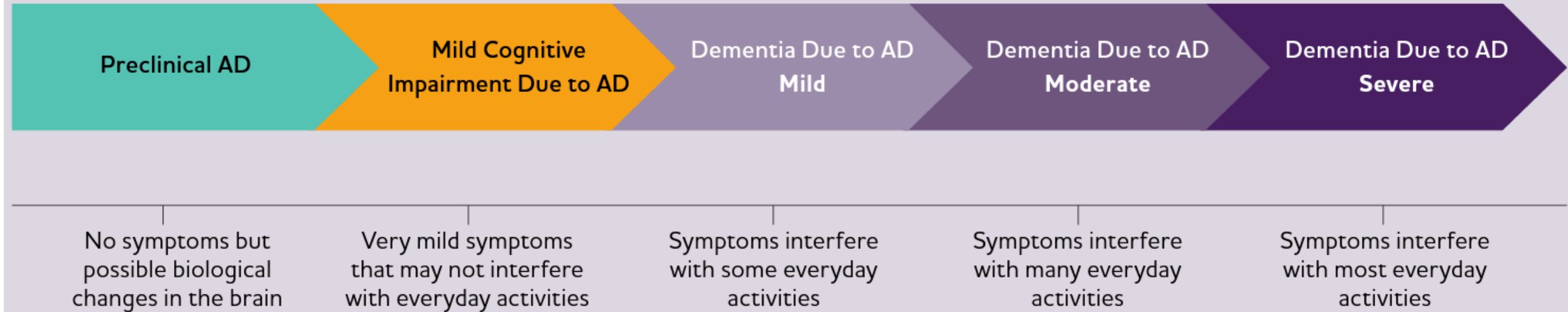
Alzheimer's and how it affects the brain





Alzheimer's Disease Progression

Alzheimer's Disease (AD) Continuum*



*Although these arrows are of equal size, the components of the AD continuum are not equal in duration.

Alzheimer's Association. 2022 Alzheimer's Disease Facts and Figures. *Alzheimers Dement* 2022;18



Normal Aging vs Alzheimers Disease (AD)

Normal memory loss as we age	Signs of Alzheimer's
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NonModifiable Risk Factors For Dementia

- Irreversible (Nonmodifiable) Causes:
 - Age
 - Genetics
 - Family History

Modifiable Risk Factors For Dementia



Source: Livingston et al. A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission

www.alzint.org



Metabolism and Metabolic Health

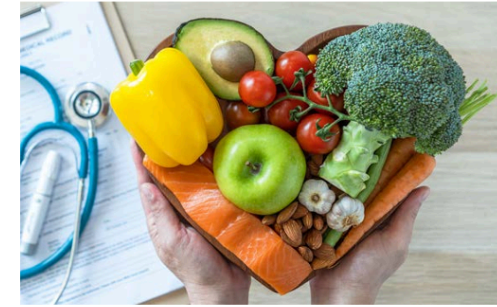
Metabolism: “the chemical reactions in the body’s cells that change food into energy”

Metabolic health: the ability of the body to regulate the use of nutrients and bodily functions (i.e. blood sugar, cholesterol, blood pressure, body weight)

Metabolic Syndrome (MtS): Having three or more of the diseases constitute having metabolic syndrome. MtS results from metabolic dysfunction (a dysregulation of nutrient signaling). MtS diseases include high blood pressure, insulin resistance, diabetes, cholesterol problems, etc)

Metabolism of Lipids

- Lipids: fats, waxes, oils, hormones, triglycerides, and components of membranes
- Functions of lipids: energy storage, chemical messengers, vitamin absorption, making hormones
- Cholesterol: a waxy type of lipid
- Lipids are water insoluble. Therefore to travel through blood they have to be bound to a protein to become a lipoprotein: examples are high density lipoprotein (HDL) and low-density lipoprotein (LDL)
- The liver makes cholesterol



WHAT IS CHOLESTEROL?

Cholesterol is a waxy, fatlike substance in your blood. Cholesterol is essential for good health. But too much of the bad kind of cholesterol can put you at a higher risk of heart disease or stroke.



Where does cholesterol come from? Cholesterol comes from **two different places.**

1 **Blood cholesterol** comes from your liver and it helps your body build cells and make vitamins and certain hormones. Your body produces all of the cholesterol it needs through this process.

2 **Dietary cholesterol** comes from foods you eat, primarily animal products like meat, eggs, cheese and milk. Dietary cholesterol can lead to health problems if it gets too high.

The bad kind of cholesterol

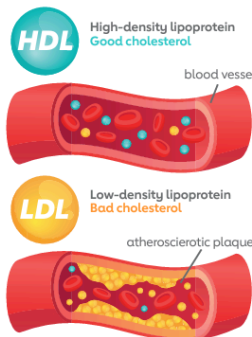
Low-density lipoprotein (LDL) cholesterol is known as the bad kind of cholesterol. High levels of LDL cholesterol can lead to heart disease and stroke. The AHA recommends "lower is better" for LDL. Studies suggest an ideal LDL level at or below 100 mg/dL. Adults who maintain this level have lower rates of heart disease and stroke.

The good kind of cholesterol

High-density lipoprotein (HDL) is the good kind of cholesterol. High levels of HDL cholesterol can reduce your risk of heart disease and stroke.

Triglycerides contribute to high cholesterol

Triglycerides are a type of fat in your body. A high level of triglycerides can contribute to problematic cholesterol buildup in your body.



Check your cholesterol to avoid a heart attack or stroke

If too much bad cholesterol is circulating in your blood, it can build up inside the arteries that feed your heart and brain. If the cholesterol buildup gets too thick, it can trap blood clots in your arteries and lead to a heart attack or stroke.

It's important to check your cholesterol to make sure you're at a healthy level — and healthy lifestyle habits like eating a healthy and balanced diet, moving your body, and eliminating tobacco use can all help you better manage your cholesterol levels. Remember to speak with your health care professional about the best treatment plan for you.

Learn more at [heart.org/cholesterol](https://www.heart.org/cholesterol)

Metabolism of Sugar

- Carbohydrates are broken down into simple sugars such as glucose
- Glucose in the blood signals insulin release from the pancreas. Insulin is a hormone that signals to cells to take up the glucose



HOW TO MANAGE BLOOD SUGAR

✓ UNDERSTAND BLOOD GLUCOSE

The first step to managing your blood sugar is to understand what makes blood sugar levels rise

GLUCOSE INSULIN

The carbohydrates and sugars in what you eat and drink turns into glucose (sugar) in the stomach and digestive system. Glucose can then enter the bloodstream.

Insulin is a hormone made in the pancreas that helps the body's cells take up glucose from blood and lower blood sugar levels.

In Type 2 diabetes, glucose builds up in the blood instead of going into cells because:

The body develops "insulin resistance" and can't use the insulin it makes efficiently.



The pancreas gradually loses its ability to produce insulin.



The result can be a high blood glucose level.



✓ TRACK LEVELS

Health care professionals can take blood glucose readings and provide recommendations. If you're diagnosed with Type 2 diabetes, you will need to monitor your blood sugar level regularly.

Visit [KnowDiabetesbyHeart.org](https://www.knowdiabetesbyheart.org) to learn how to manage your risk for heart disease and stroke if you have diabetes.

Fasting Blood Glucose	Diagnosis	What It Means
Lower than 100 mg/dl	Normal	Healthy range
100 to 125 mg/dl	Prediabetes (impaired fasting glucose)	At increased risk of developing diabetes.
126 mg/dl or higher	Diabetes Mellitus (Type 2 diabetes)	At increased risk of heart disease or stroke.



TIPS FOR SUCCESS



EAT SMART

Eat a healthy diet of vegetables, fruits, whole grains, beans, legumes, nuts, plant-based proteins, lean animal proteins like fish and seafood. Limit sugary foods and drinks, red or processed meats, salty foods, refined carbohydrates and highly processed foods.



MOVE MORE

Being physically active can lower your risk of developing diabetes and help you manage the disease if you already have it.



MANAGE WEIGHT

Stay at a healthy weight to help prevent, delay or manage diabetes



NO NICOTINE

Smoking, vaping, exposure to secondhand smoke or using tobacco can increase your risk of heart disease, stroke, many cancers and other chronic diseases. It may also make prediabetes and diabetes harder to manage.

Learn more at [heart.org/lifes8](https://www.heart.org/lifes8)



Microbiome: and Human Health

- **Microbiome:** "the collection of all microbes, such as bacteria, fungi, viruses, and their genes, that naturally live on our bodies and inside us"-NIEHS
- The microbiome is diverse
- The microbiome is formed in the first years of life
- The microbiome is affected by diet, medications and environmental exposures
- Disruption in the microbiome can affect health such as increase risk for developing diabetes, obesity, cardiovascular and neurological diseases, allergies and inflammatory bowel disease



Gut Microbiome: Affect Heart and Brain Health

- **Gut Microbiome:** microbes that live in your intestine
- Some gut bacteria help to reduce cholesterol
- Some gut microbes can produce chemicals that contribute to heart disease
- The gut is connected to the brain through millions of nerves
- Probiotics can improve depression

Modifiable Risk Factors For Dementia

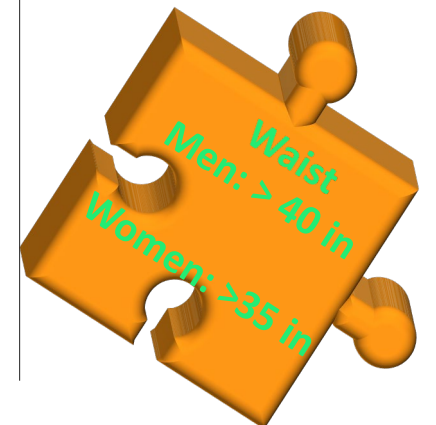


12 dementia risk factors

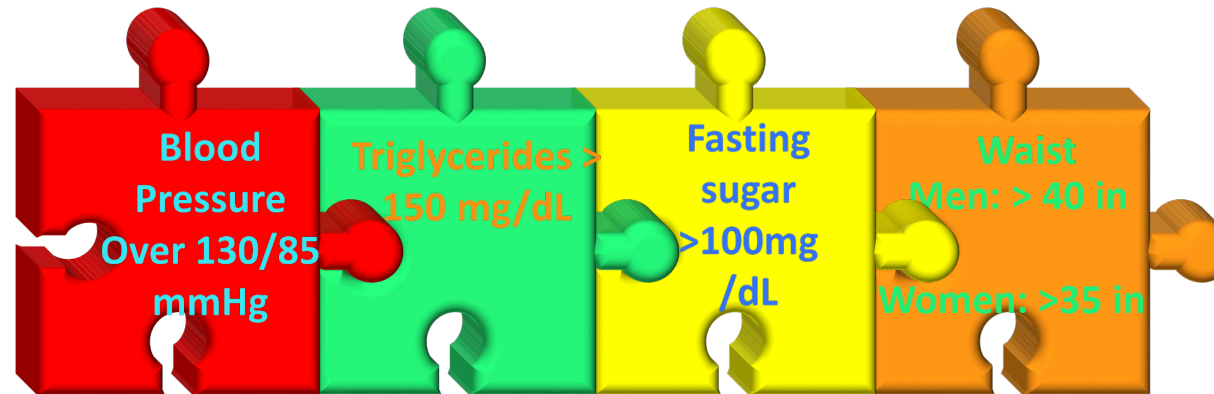
- 1 Physical inactivity
- 2 Smoking
- 3 Excessive alcohol consumption
- 4 Air pollution
- 5 Head injury
- 6 Infrequent social contact
- 7 Less education
- 8 Obesity
- 9 Hypertension
- 10 Diabetes
- 11 Depression
- 12 Hearing impairment

Source: Livingston et al. A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission

www.alzint.org

The logo for Alzheimer's Disease International, featuring a stylized 'A7' and the text "Alzheimer's Disease International The global voice on dementia".

Insulin Resistance

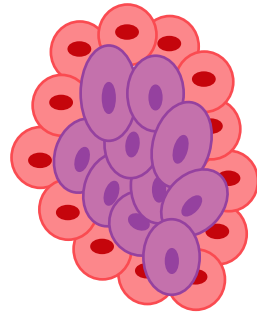


- **Insulin resistance:** an early stage of type 2 diabetes that increases your risk of chronic diseases
- Insulin is a hormone involved in the regulation of fats, carbohydrates, and protein metabolism
- Insulin resistance occurs when the body can no longer use insulin efficiently
- Insulin resistance signals a state of metabolic dysregulation where there are an excess of nutrients (ex. sugar) in the blood

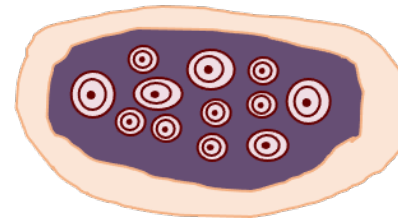
Metabolic Syndrome



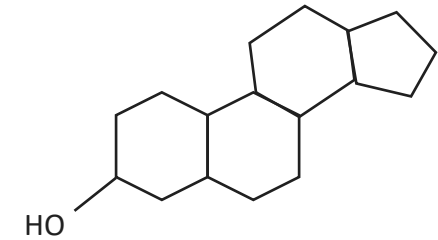
Hypertension



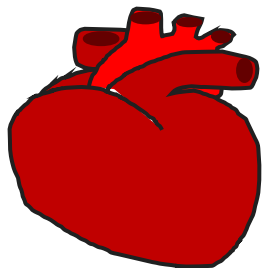
Cancer



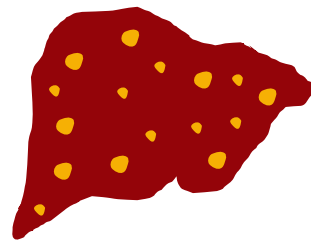
Polycystic Ovarian Syndrome (PCOS)



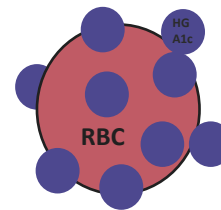
Lipid Problems



Heart Disease



Non Alcoholic Fatty Liver Disease (NAFLD)



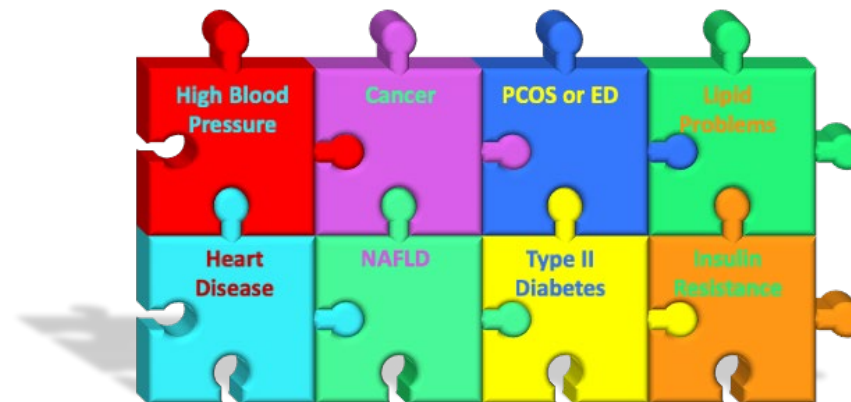
Type II Diabetes



Insulin resistance

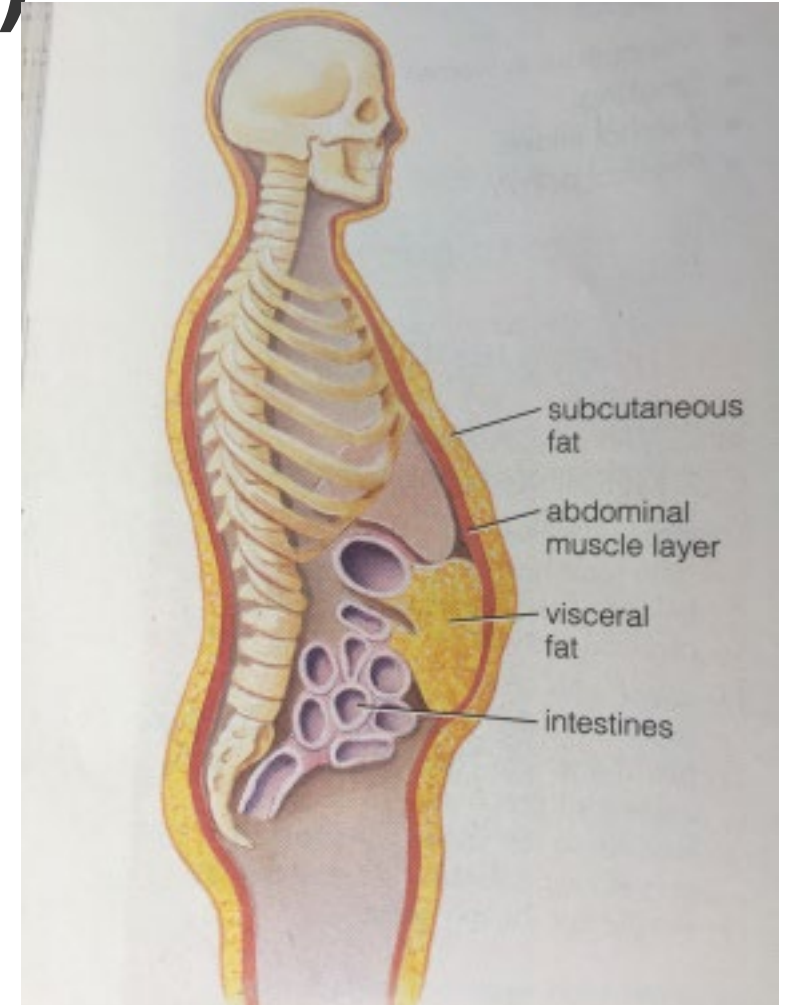
Metabolic Syndrome: Summary

- Characterized by excess glucose and fats
- Central adiposity (belly fat) can contribute to diseases of the metabolic syndrome



Central Adiposity (Belly Fat)

- Visceral fat
- Secretes hormones
- Main source of estrogen after menopause
- Functions like an organ



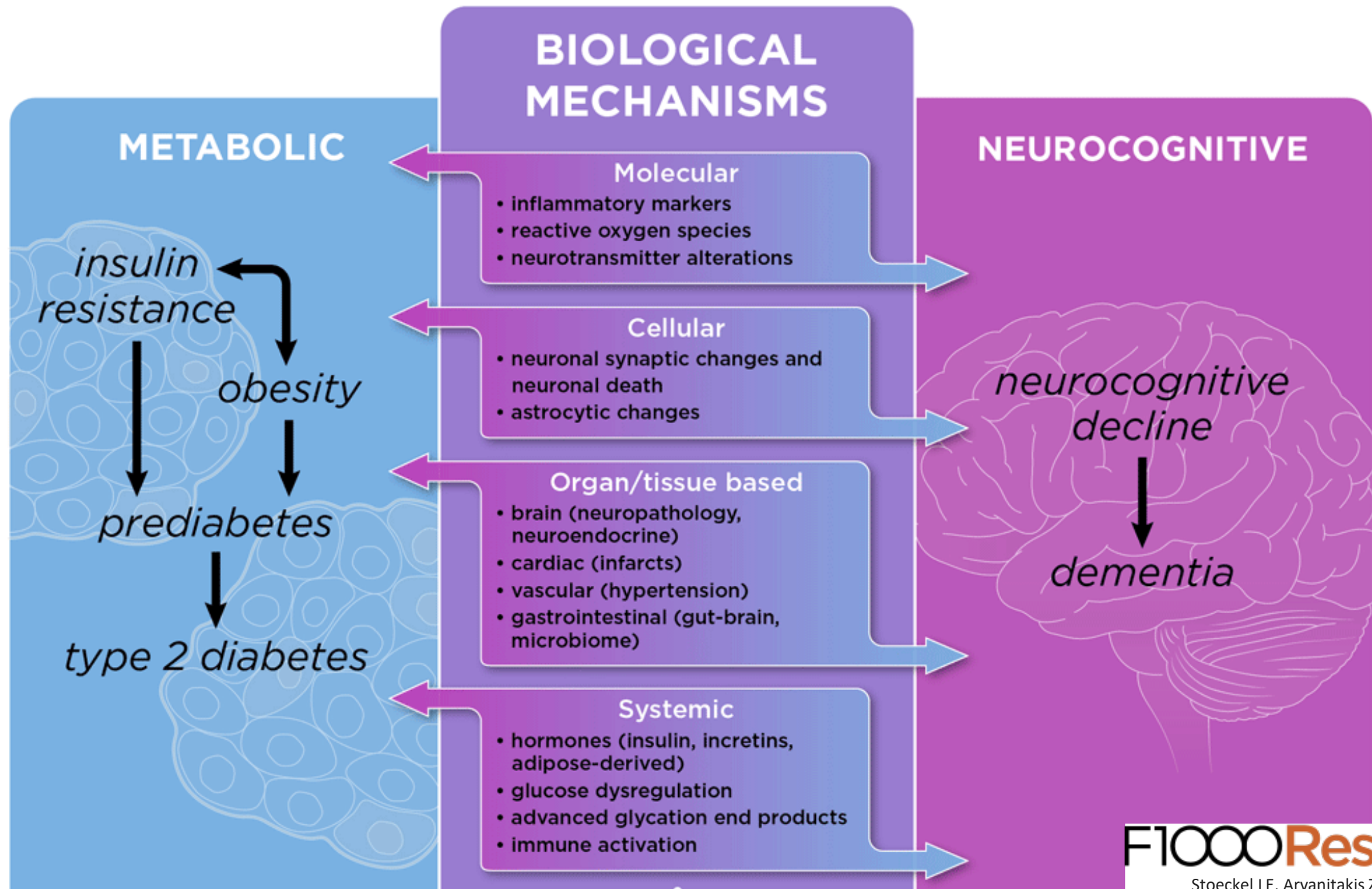
<https://bridgecitywellness.wordpress.com/2018/06/01/excess-visceral-fat/>

Body Shape and Health Risk



HEALTH RISK	BODY SHAPE
Low	Pear
Moderate	Avocado
High	Apple

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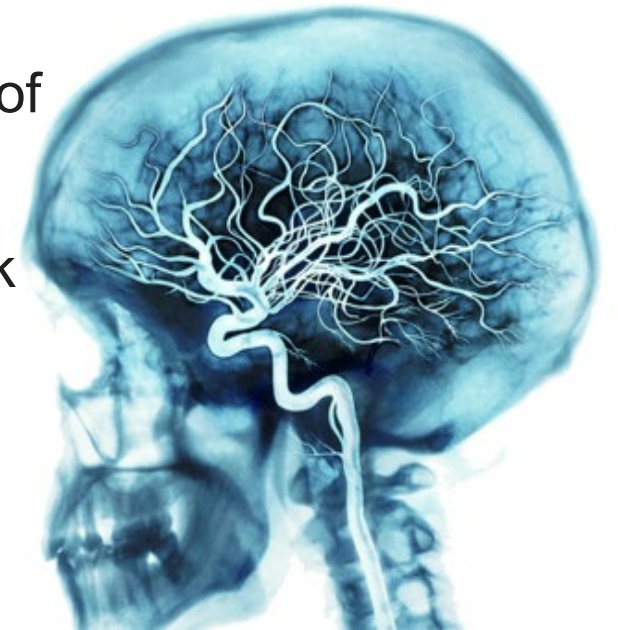
Why are diabetes and brain changes linked?

- Blood vessels may be damaged
- Similar factors may contribute to both diabetes and Alzheimer's
- Brain insulin resistance
- Insulin degrading enzyme
- Abnormal levels of insulin or sugar in the brain
- Directly cause cell death and inflammation
- Diabetes may lower the reserve
- Causes numerous other "hits" to the brain



Metabolic Syndrome and Cognition

- Increased belly fat is related to poorer cognitive performance
- Other hormones are implicated such as estrogen
 - A reduction of estrogen (ex. menopause) is related to insulin resistance and accumulation of belly fat as estrogen is a regulator of metabolism.
 - Estrogen has normal physiological roles for brain function. Therefore, a reduction in estrogen is implicated in an increased risk for dementia in women after menopause.
 - Estrogen as hormone therapy (HT) given around menopause i.e. menopausal HT (mHT) has been explored in clinical trials for cognitive benefit.
- African American individuals have a higher prevalence of dementia, which may be related to higher prevalence of metabolic syndrome diseases.





Methods For Risk Reduction

START NOW. It's never too late or too early to incorporate healthy habits.



BREAK A SWEAT
Engage in regular cardiovascular exercise that elevates heart rate and increases blood flow. Studies have found that physical activity reduces risk of cognitive decline.

HIT THE BOOKS
Formal education will help reduce risk of cognitive decline and dementia. Take a class at a local college, community center or online.

BUTT OUT
Smoking increases risk of cognitive decline. Quitting smoking can reduce risk to levels comparable to those who have not smoked.

FOLLOW YOUR HEART
Risk factors for cardiovascular disease and stroke – obesity, high blood pressure and diabetes – negatively impact your cognitive health.

HEADS UP!
Brain injury can raise risk of cognitive decline and dementia. Wear a seat belt and use a helmet when playing contact sports or riding a bike.

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CATCH SOME ZZZ'S
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Staying socially engaged may support brain health. Find ways to be part of your local community or share activities with friends and family.

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Challenge your mind. Build a piece of furniture. Play games of strategy, like bridge.

Growing evidence indicates that people can reduce their risk of cognitive decline by adopting key lifestyle habits. When possible, combine these habits to achieve maximum benefit for the brain and body.

Visit alz.org/10ways to learn more.

alzheimer's association®

Can we reduce the risk?



- 1 Look after your heart
- 2 Be physically active
- 3 Follow a healthy diet
- 4 Challenge your brain
- 5 Enjoy social activity



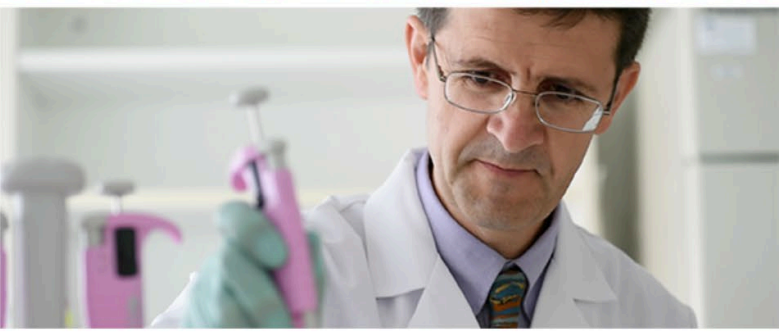
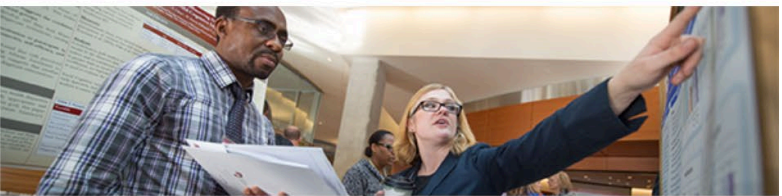
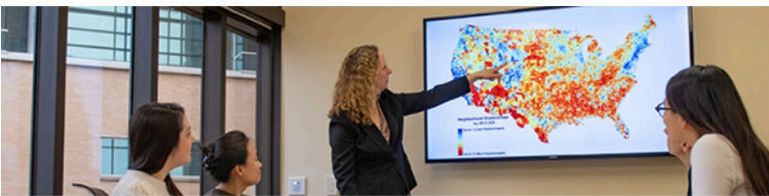
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