Nutritional Disorders & The Nervous System

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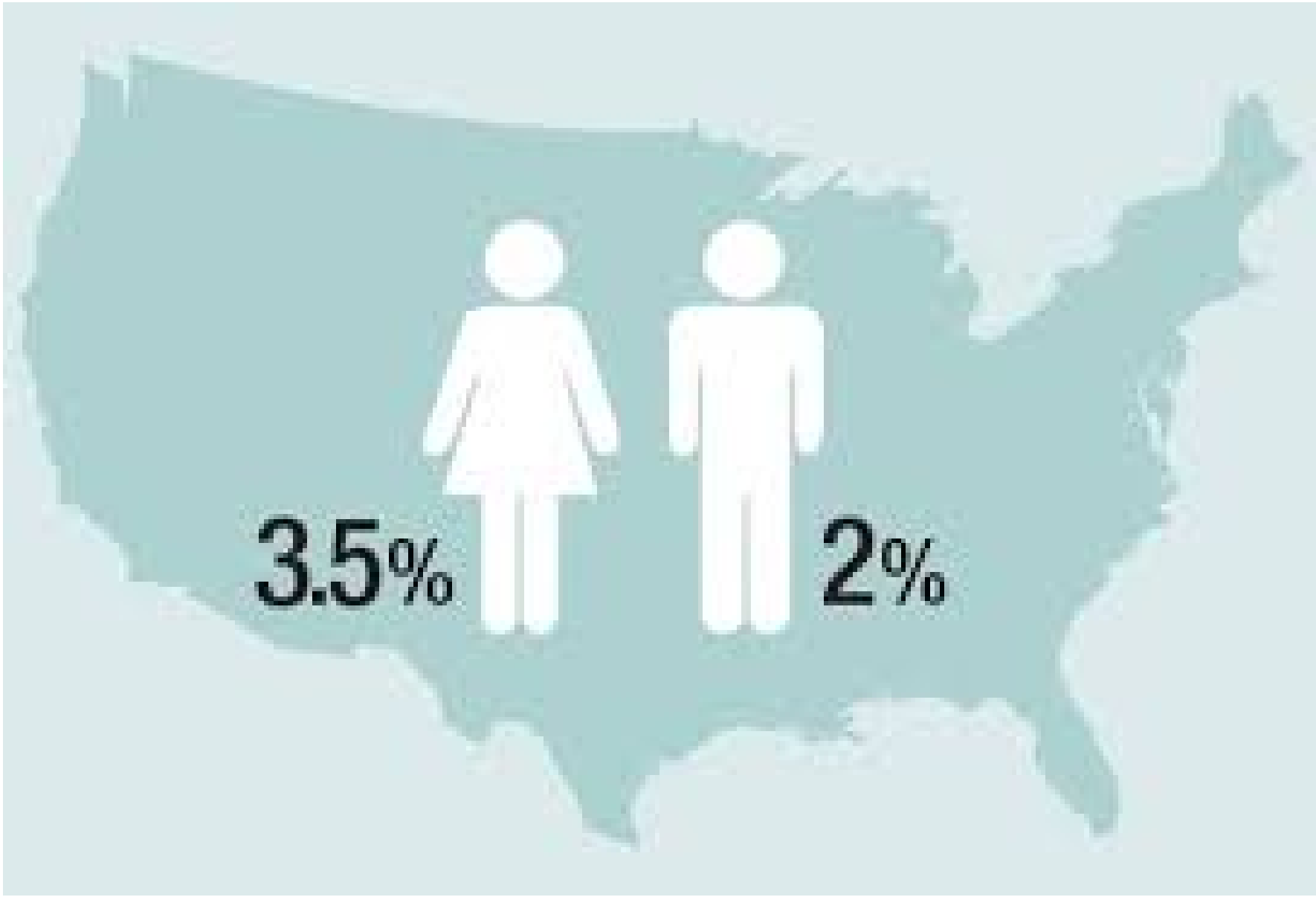
Nutritional disorders


3.5%
2%

"Food for thought
is no substitute for
the real thing."
~ *Walt Kelly*


WARNING:
Reflections in this mirror may be distorted by socially constructed ideas of 'beauty'

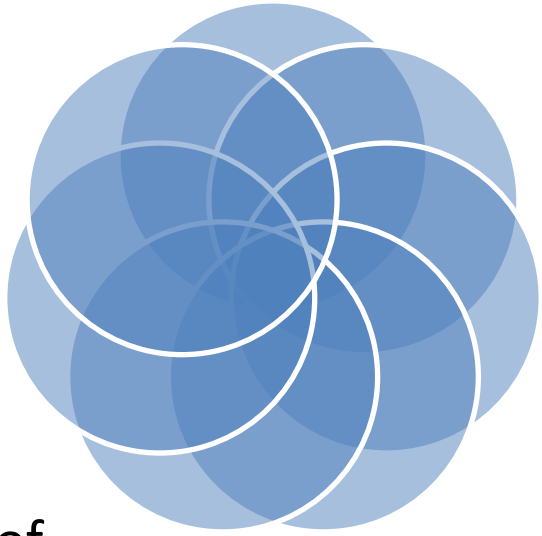
Perfect body?

OTHER PSYCHIATRIC CONDITIONS AFFECTING FOOD INTAKE

- Mood Disorders
- Schizophrenia
- Substance Use Disorders
- Attention Deficit Hyperactivity Disorder
- Psychotropic Medications ⇩ Food Intake

Mood Disorders

Accompanied by;



disturbance in appetite

changes in sleep patterns

thoughts of death or suicide

difficulty in concentrating

feelings of worthlessness or guilt

lack of energy

FOOD and MOOD

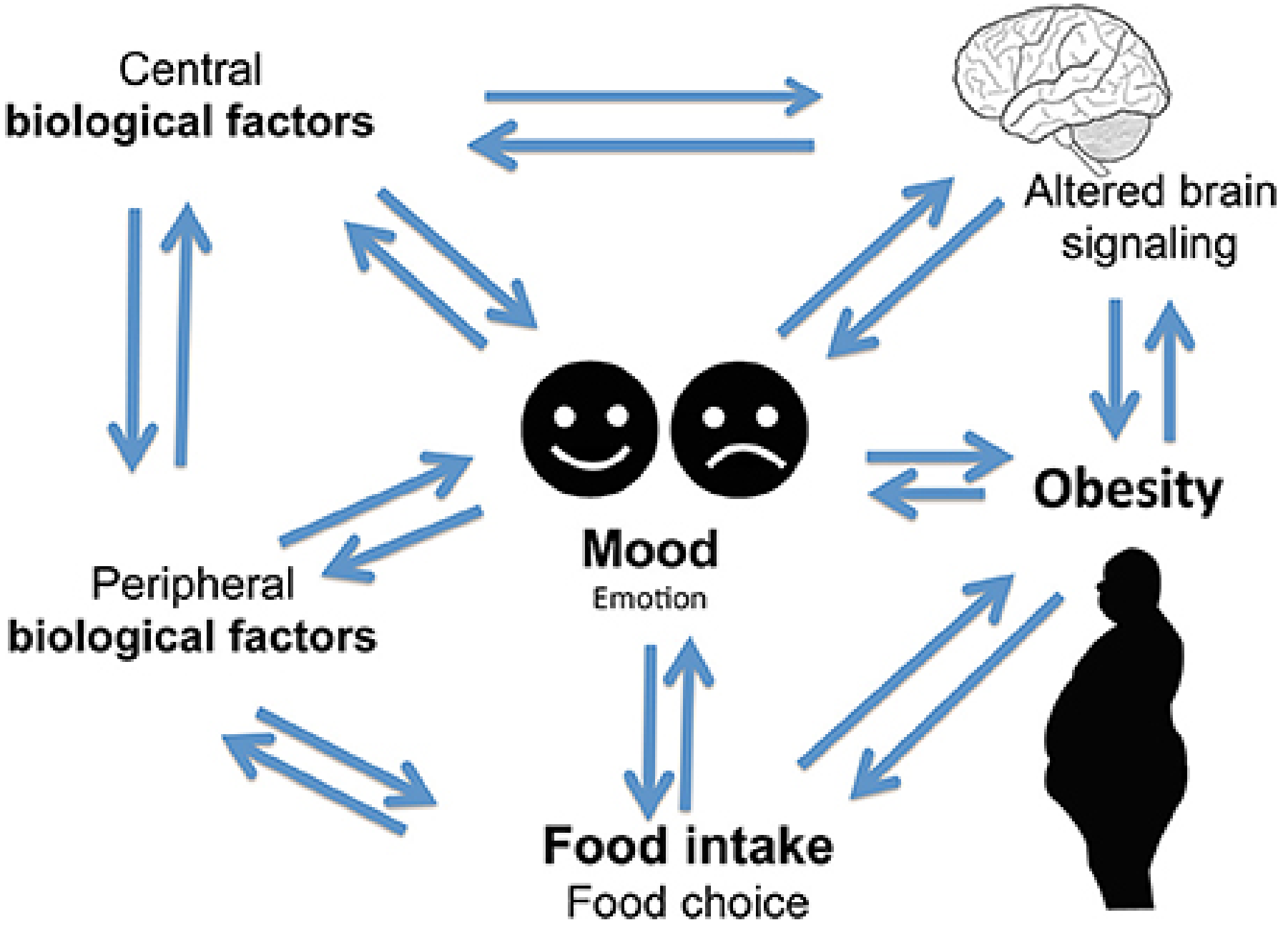
Mood Disorders

Besides depression

adjustment disorders in response to acute stressors and grief reactions

transient anorexia or loss of appetite

weight loss


Central
biological factors
Altered brain
signaling
Mood
Emotion
Obesity
Peripheral
biological factors
Food intake
Food choice

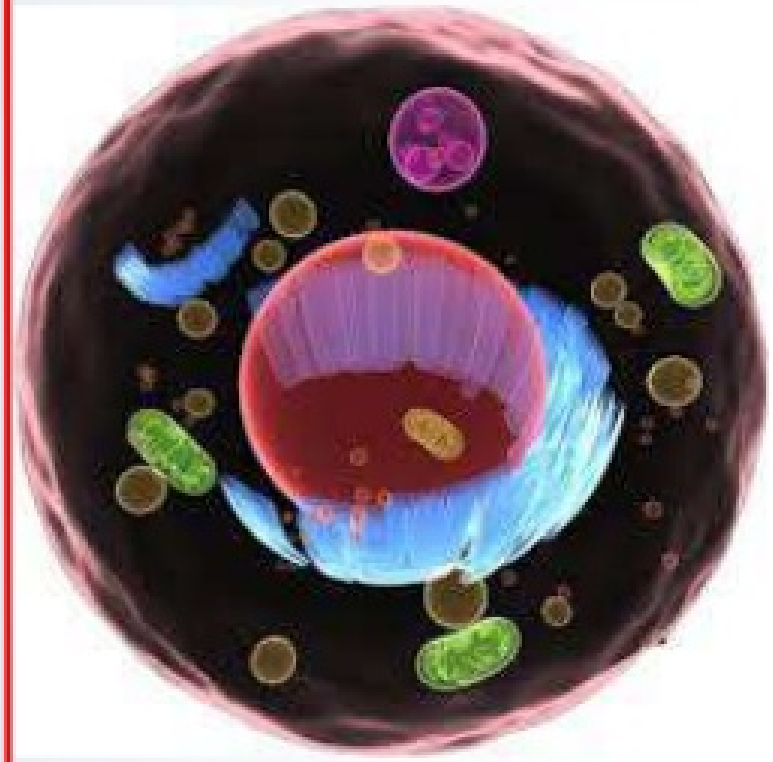
DavidAWiss@NutritionInRecovery.com

FOOD & MOOD – Fat

- Low plasma cholesterol associated with depression[1] and anxiety[2]
  - Part of every cell membrane
  - Building block for hormones
  - Statins???

CONCLUSION:

- Fat supports mental health!



1. Leyse-Wallace, R. (2008). *Linking nutrition to mental health*. Lincoln, NE: iUniverse.
2. Carson, R, E. (2012). *The brain fix.* Deerfield, FL: Health Communication, Inc.

Serotonin-rich foods


walnuts


hickory nuts


pineapple


bananas


kiwis


plums

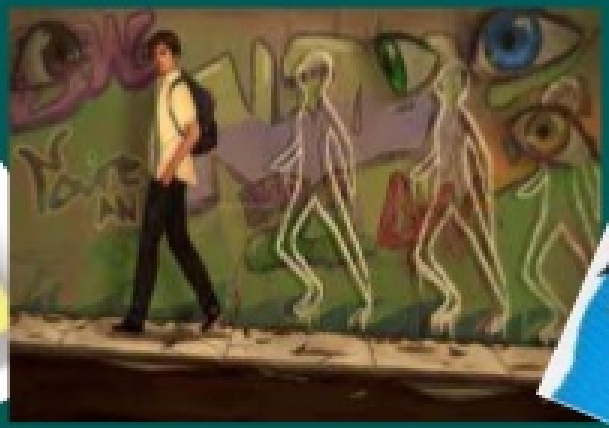

tomatoes

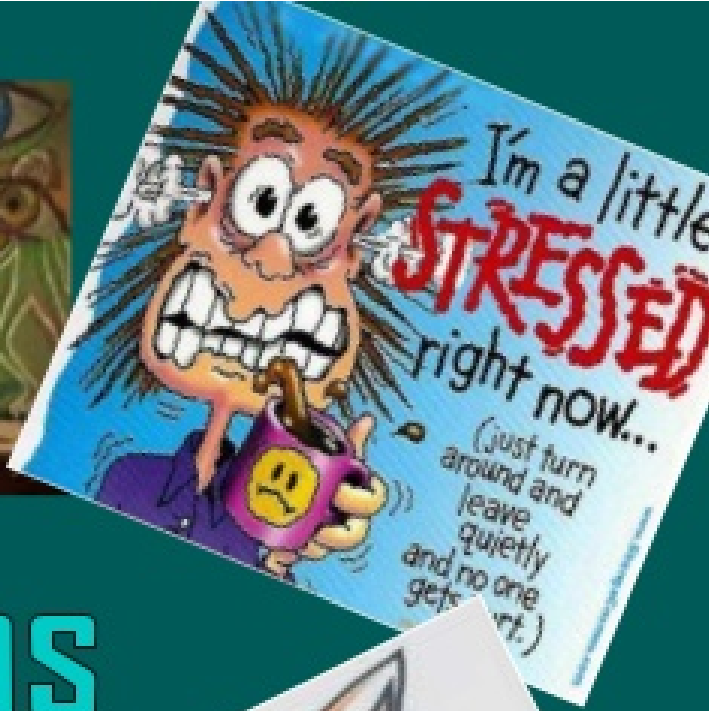
FOOD and MOOD


Where are those voices coming from?
The Radio Told Me To Free All The Zoo Animals
I Saw Elephants Under My Bed
Aliens are contacting me
Maybe I Am Jesus
They're Following Me!
SCHIZOPHRENIA

Symptoms


I'M A SCHIZOPHRENIC!
AND SO AM I!
SCHIZOPHRENIA




I'm a little
STRESSED
right now...
(just turn around and leave quietly and no one gets hurt.)


Benztropine (Cogentin)
"Controlling The Uncontrollable"
Anticholinergic Antiparkinson Drug
Tremors
Rigidity


The voices in my head are telling me to KILL yo


LUCKILY THE DAYS ARE LONG GONE WHEN WE JUST LABELLED PEOPLE AS "MAD"
PARANOID
PSCHITZOPHRENIC
CARTOONSTOCK .com
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SUPPORT

Substance use disorder

- Marijuana ↑ food intake
- Cannabis withdrawal ↓ food intake
- Alcoholism → Wernicke-Korsakoff
- Cocaine ↓ food intake

Attention Deficit hyperactivity disorder (ADHD)

- 2% to 18% prevalence
- Cause - genes and environment (diet)
- 1922– high-sugar diets worsen ADHD
- 1970s – food additives deteriorate ADHD
- Azo dyes – urticaria-histamine release- ADHD
- Tartrazine - urinary zinc excretion - zinc deficiency

Attention Deficit hyperactivity disorder (ADHD)

- Imaging studies - reduced blood flow to the frontal lobes in children with ADHD

Omega-3 deficiencies in children with ADHD

Optimal blood flow to the brain depends on

- Omega-3 fatty acids
- Thiamin
- Pyridoxine and
- Folic acid

Psychotropic Medications

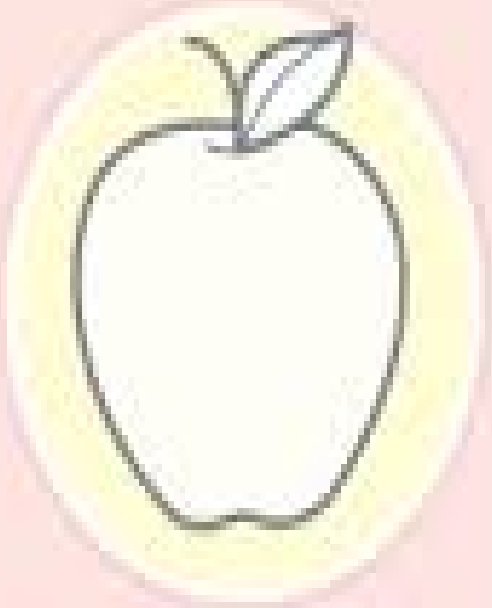
Several antidepressants, mood stabilizers, and antipsychotics are associated with weight gain

Stimulant drugs used in the treatment of ADHD tend to reduce appetite and may result in weight loss

An Eating Disorder Requires Treatment From:

A Doctor

A Therapist

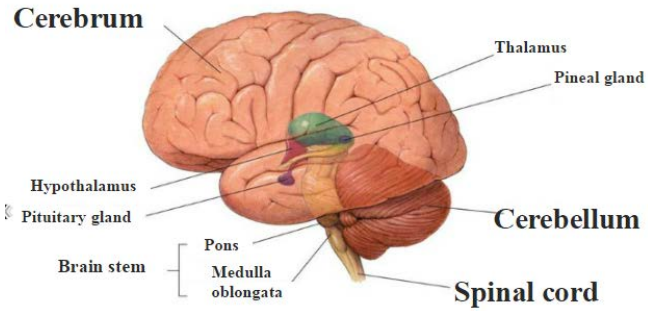


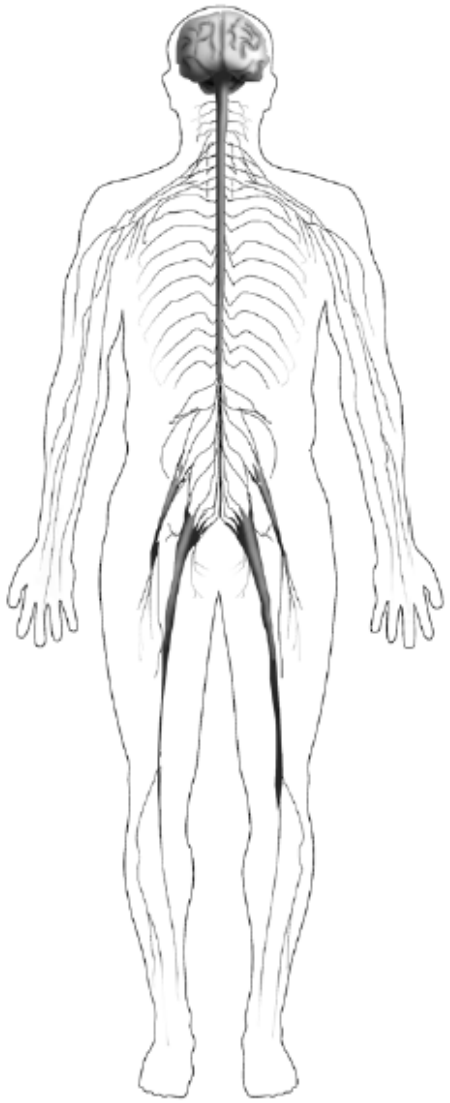
A Nutritionist

"Fuel Your Brain, Feel Your Best"

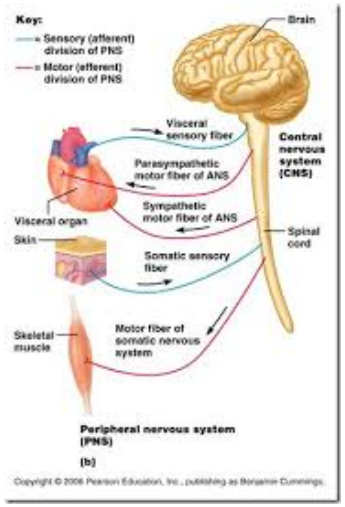
Nervous System

- Central Nervous System
  - Brain
  - Spinal Cord

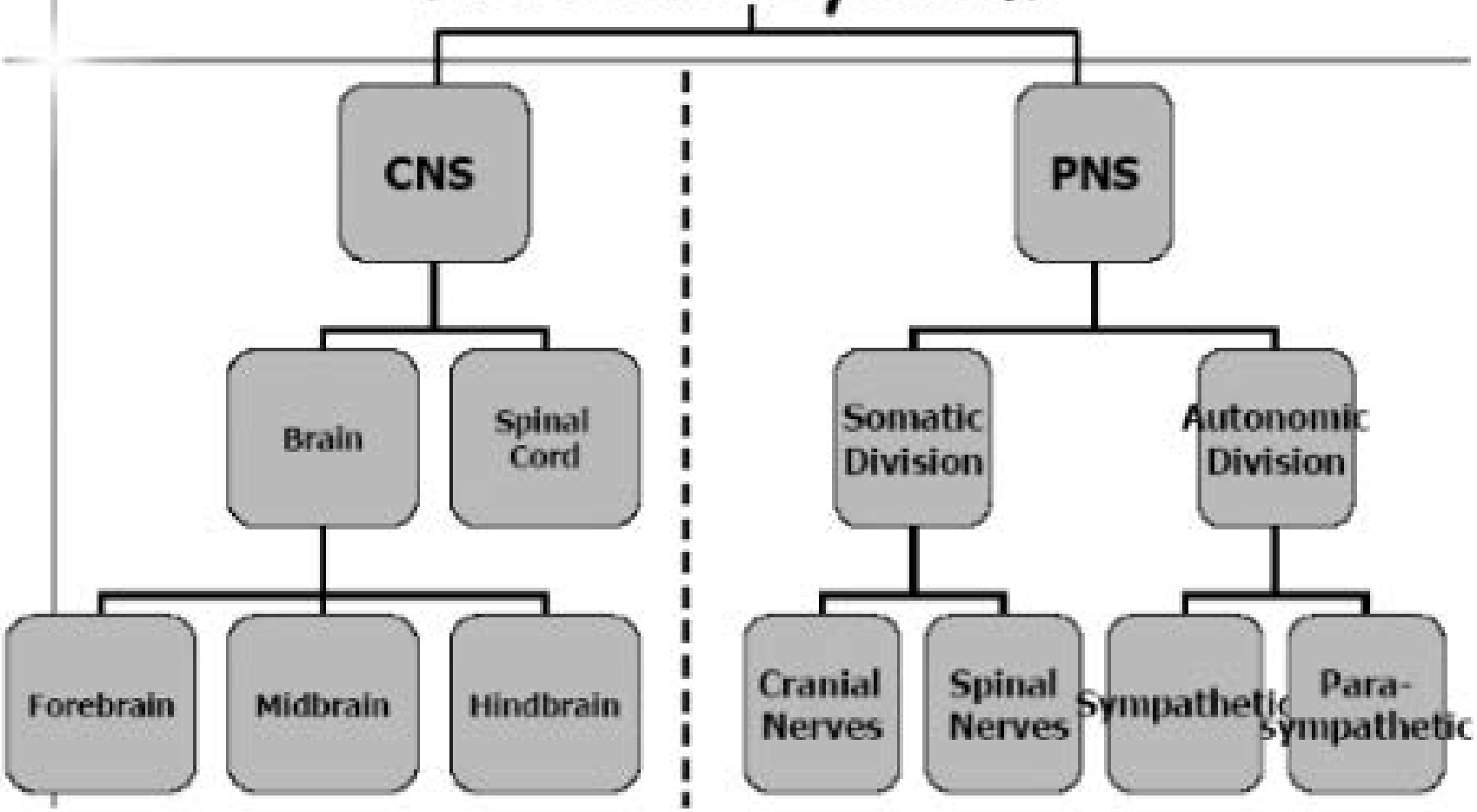




- Peripheral Nervous System



Basic Divisions of the Nervous System



Factors Important to Understanding Nervous System Pathology

1. The nervous system consists of highly specialized functional units called neurons. Damage to neurons is irreversible because neurons cannot regenerate. Injury to certain areas of the brain result in loss of function to that particular area. A loss of vision center in the occipital lobe causes blindness. Lesions of the respiratory centers in the medulla oblongata causes death.

2. The central nervous system (CNS) is protected from mechanical injury by the bones of the skull and vertebrae. If the vertebrae were detached from one another or dislocated, the spinal cord may be severed.

Factors Important to Understanding Nervous System Pathology

3. The CNS is separated from the remainder of the body by meninges and by a bloodbrain barrier. The brain is protected from harmful substances in that the blood or cerebral spinal fluid (CSF) acts as filters.

Examples:

- Bilirubin does not enter the CNS compartment, even in the most severe forms of jaundice.
- Glucose concentration in the CSF is at a level that is one-half that of the blood concentration.

Factors Important to Understanding Nervous System Pathology

4. The brain and the spinal cord are surrounded by CSF.

- CSF separates the brain from the meninges and serves as a mechanical buffer (cushion) between the brain and bones of the skull

- CSF serves as a venue to remove metabolites and waste products from the brain
- CSF remains constant under normal circumstances in regards to rate of production, flow and reabsorption

Overview of Major Diseases

The nervous system is affected by many diseases such as

- Developmental and genetic diseases
- Diseases caused by trauma
- Circulatory disorders
- Infectious diseases
- Autoimmune disorders
- Metabolic and nutritional diseases
- Neurodegenerative diseases of unknown etiology
- Brain tumors

Overview of Major Diseases

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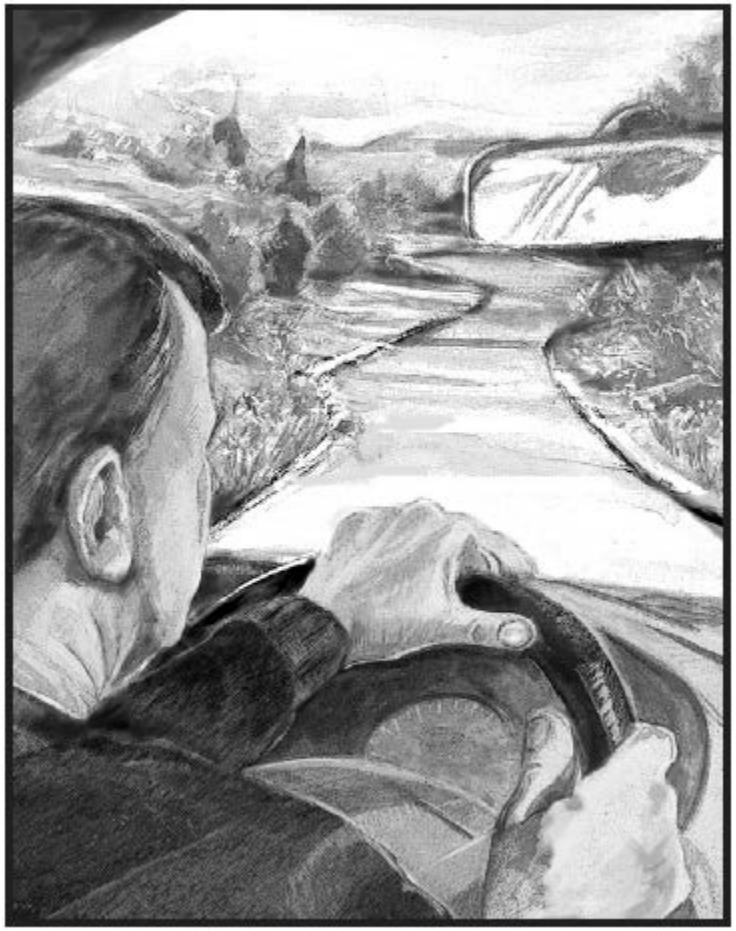
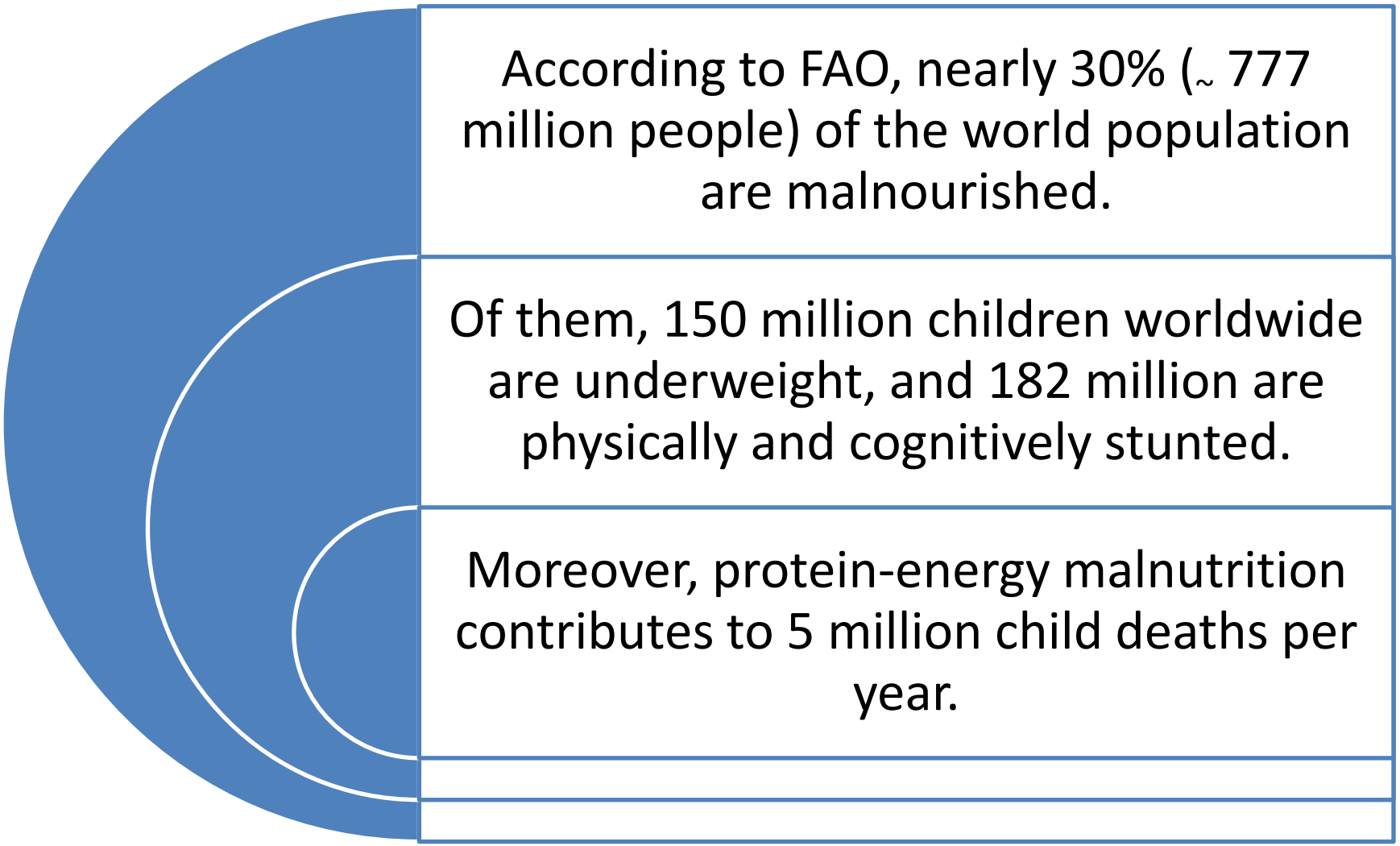


- Brain function is unavoidably dependent on a constant dietary supply of appropriate nutrients


According to FAO, nearly 30% (~ 777 million people) of the world population are malnourished.
Of them, 150 million children worldwide are underweight, and 182 million are physically and cognitively stunted.
Moreover, protein-energy malnutrition contributes to 5 million child deaths per year.

The effects of malnutrition on the nervous system

- isolated involvement of the peripheral nervous system that produces blindness, deafness, paralysis, or
- sensory deficits to complex lesions of the spinal cord and CNS that lead to mental retardation, cognitive dysfunction, and gait limitations

POPULATIONS AT RISK

the poor

the homeless

people addicted to alcohol and substance abusers

some patients with chronic psychiatric conditions

demented elderly persons

Under nutrition

obesity

“the double burden of malnutrition”

NUTRITION AND COGNITIVE FUNCTION

glucose, amino acids, fatty acids, vitamins, and minerals-required for normal brain function

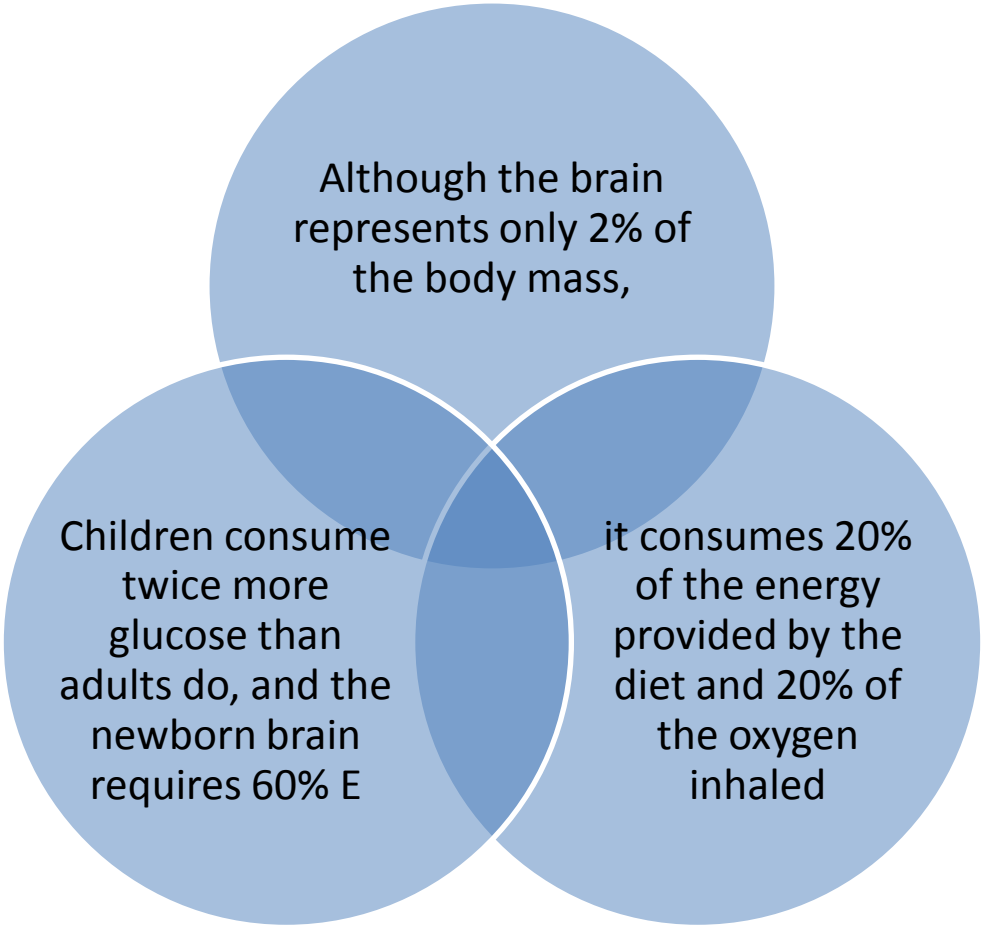
NUTRITION AND COGNITIVE FUNCTION

Food is also needed to;

maintain the integrity of cellular membranes in the brain and

the production of neurotransmitters

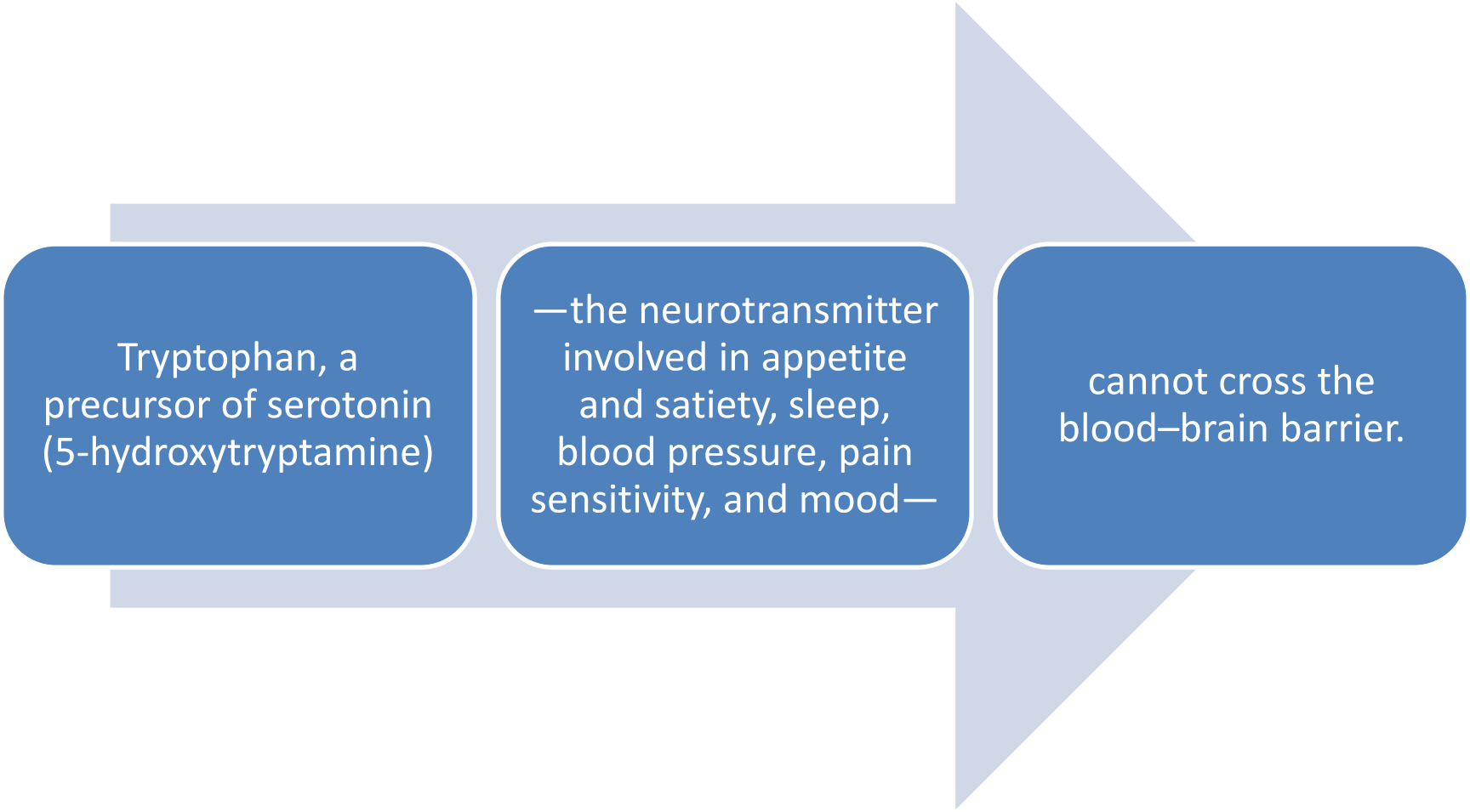
NUTRITION AND COGNITIVE FUNCTION



NUTRITION AND COGNITIVE FUNCTION

dietary supply of amino acids is needed to synthesize proteins and neurotransmitters in the nervous system

NUTRITION AND COGNITIVE FUNCTION



NUTRITION AND COGNITIVE FUNCTION

Metabolically active brain sites such as hippocampus, basal ganglia, and hypothalamus are particularly sensitive to

The effects of malnutrition, loss of energy, and amino acid supply

NUTRITION AND COGNITIVE FUNCTION

Neurons and glia are formed and begin migration by 22 weeks of gestation;

and by late pregnancy, marked axonal and neural proliferation result in substantial brain growth.

NUTRITION AND COGNITIVE FUNCTION

Early malnutrition also affects processes involved in brain maturation such as neurogenesis, neuronal and glial migration, number of synapses, and degree of myelination.

NUTRITION AND COGNITIVE FUNCTION

Lower IQ and more severe learning difficulties result in

worse school performance

higher school desertion

lower enrollment in higher education institutions

NUTRITION AND COGNITIVE FUNCTION

- Maternal milk contains lipids that promote brain maturation
- The brain is 60% structural lipid and depends on dietary lipids
- Lack of both linoleic acid and –linolenic acid (ALA) is incompatible with life
- Arachidonic acid and docosahexaenoic acid (DHA) are large contributors to non-myelin membranes and must be provided by the diet

Micronutrient deficiencies

vitamins, fat-soluble as well as water-soluble, and trace elements (minerals)

Essentially used as cofactors for enzymes engaged in various biochemical reactions

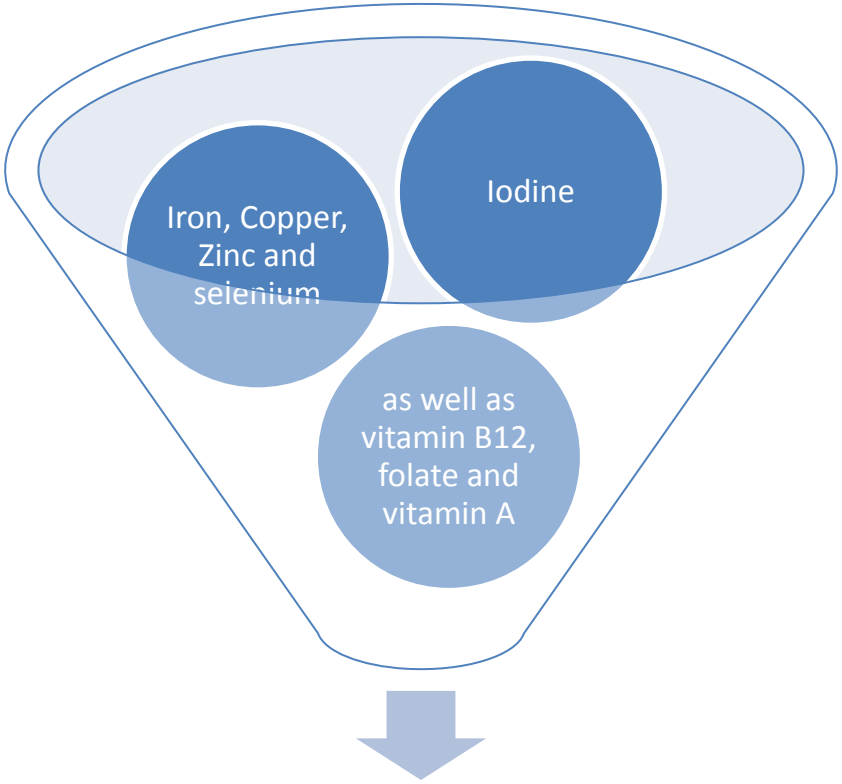
Iron, vitamin A, zinc and iodine
vitamin C and the vitamin B complex

Micronutrient deficiencies

From the public health viewpoint, iodine is the most important micronutrient for the prevention of brain disorders

causing lower intellectual functioning, psychomotor delay, and mental retardation

Micronutrient deficiencies



Nutritional disorders of nervous system

Iodine Deficiency Disorders

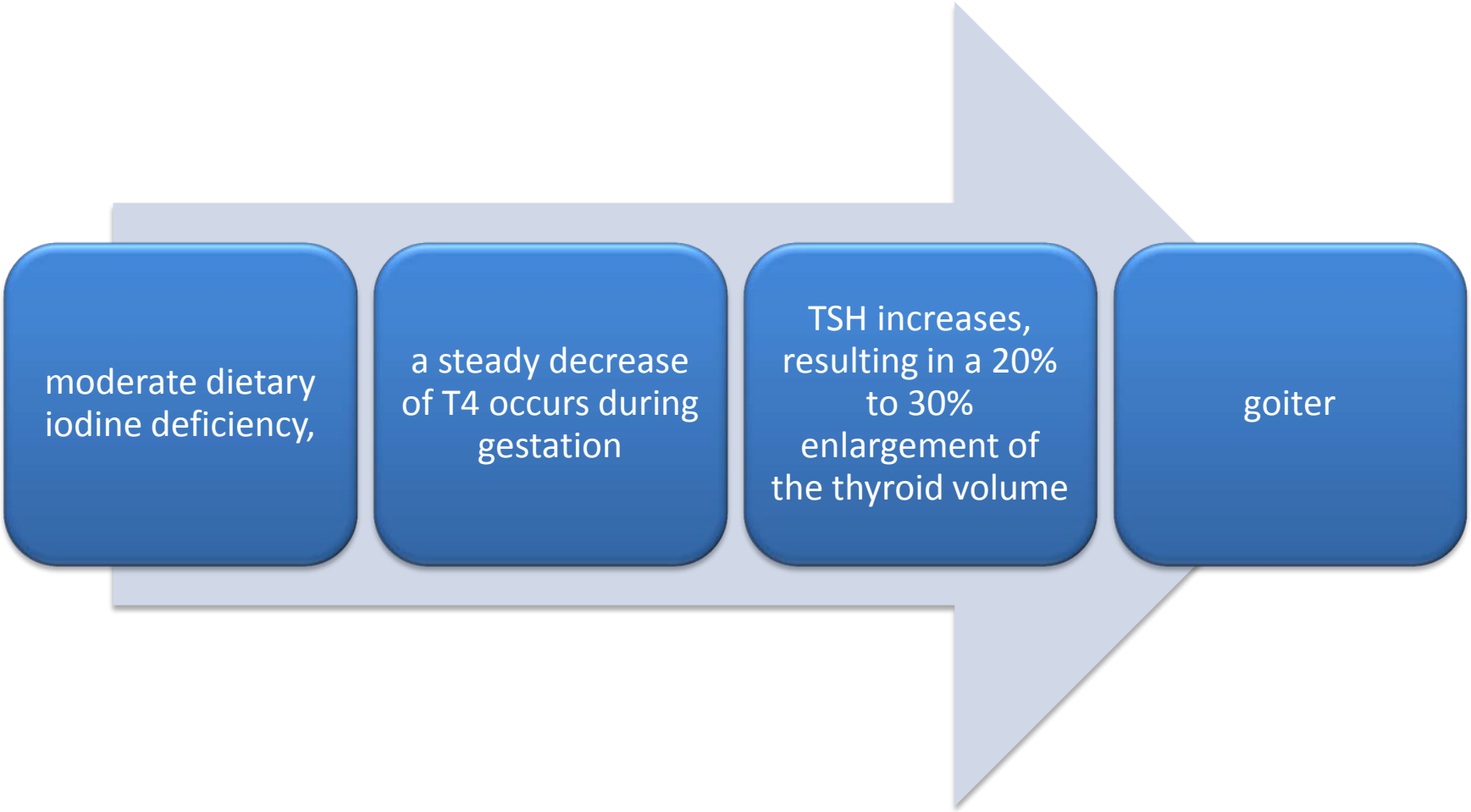
endemic cretinism

goiter

short stature

deafness

Iodine Deficiency Disorders



In areas with moderate iodine deficiency (iodine ingestion 20 to 49 g/day), people have definite abnormalities of

Psychomotor and intellectual development including

- lower IQ,
- slower visual-motor performance,
- loss of fine-motor skill,
- Deficits in perceptual and neuromotor abilities,
- apathy,
- and low developmental quotients

Endemic Cretinism and Other Forms of Iodine Deficiency Disorders

Endemic cretinism is different from congenital hypothyroidism, which occurs in 1 in 3500 newborns

Congenital hypothyroidism results from deficient thyroid function in the fetus and the newborn, resulting from endocrine factors unrelated to dietary iodine deficiency

Endemic Cretinism and Other Forms of Iodine Deficiency Disorders

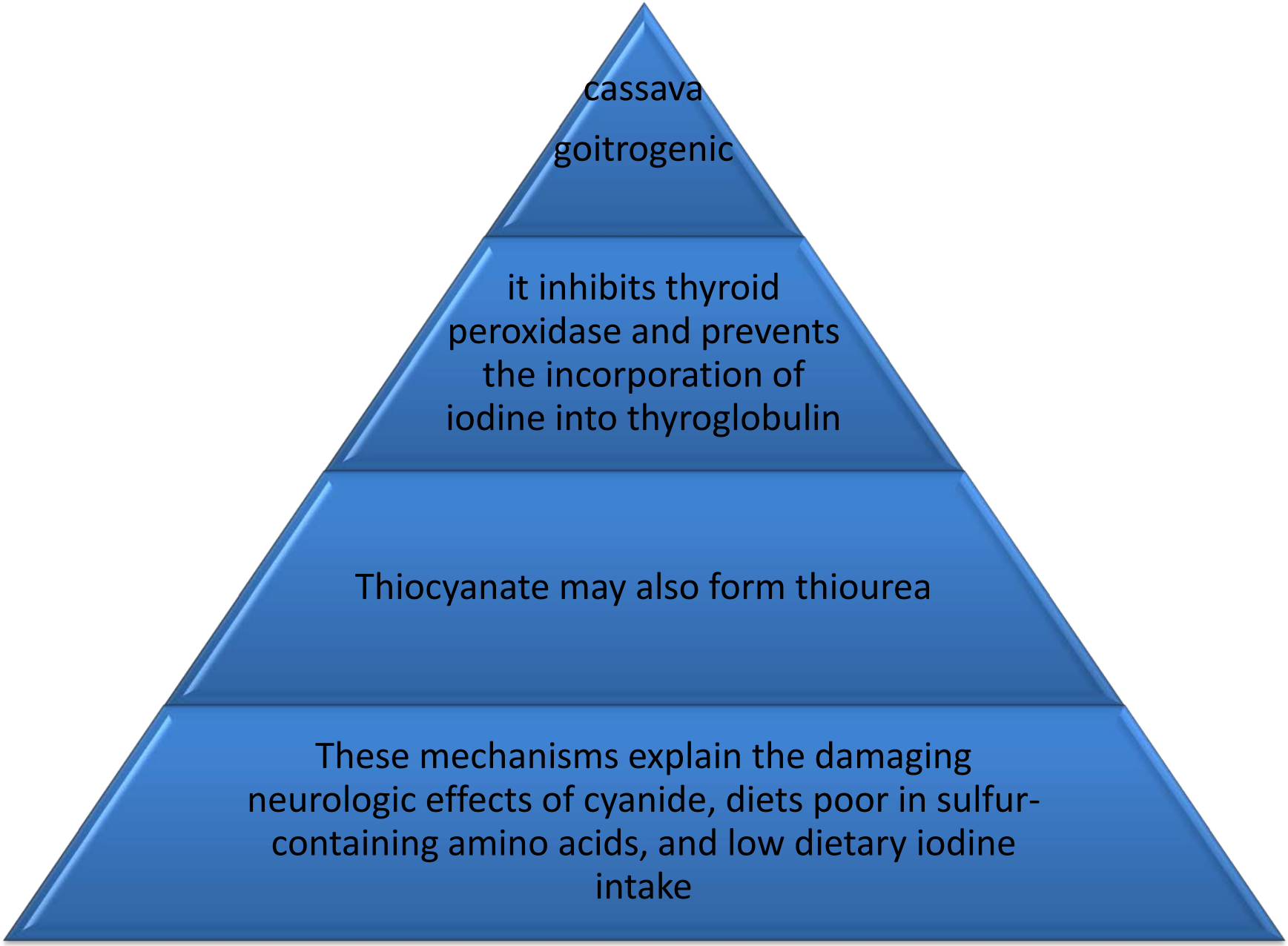
Both forms of endemic cretinism (neurologic and myxedematous) represent the most severe degree of brain damage from in utero maternal and fetal hypothyroidism

Thiocyanate toxicity from cassava consumption plays a role in myxedematous endemic cretinism.

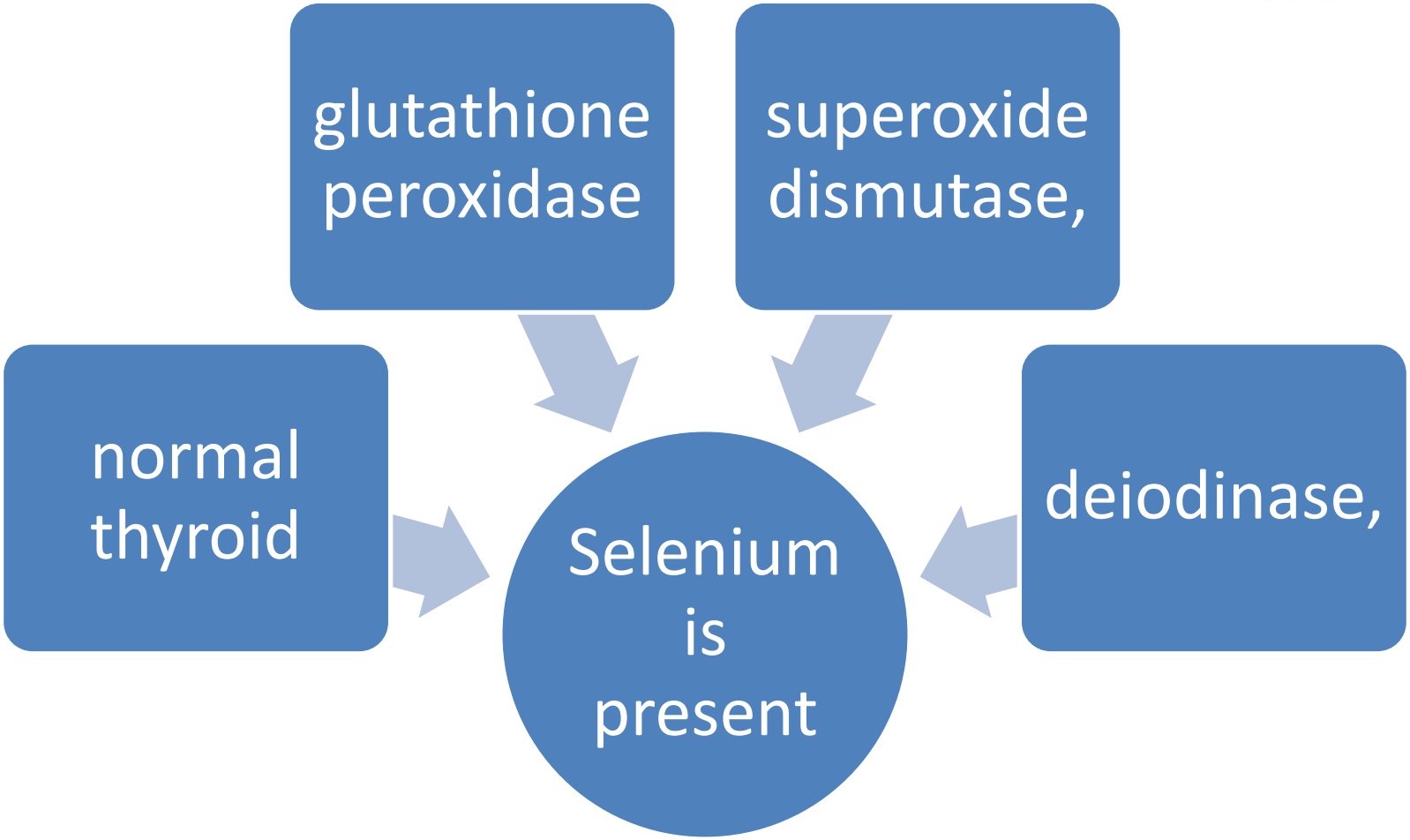
Thiocyanate Toxicity

- cassava, Spanish, *yam, sweet potato, corn, millet, bamboo shoots, and beans*
- *Tobacco smoke*

Foods containing large amounts of cyanogenic glycosides include


cassava
goitrogenic
it inhibits thyroid peroxidase and prevents the incorporation of iodine into thyroglobulin
Thiocyanate may also form thiourea
These mechanisms explain the damaging neurologic effects of cyanide, diets poor in sulfur-containing amino acids, and low dietary iodine intake

Selenium


glutathione peroxidase
superoxide dismutase,
normal thyroid
Selenium is present
deiodinase,

Pathogenesis of Brain Lesions Induced by Iodine Deficiency

Thyroid hormones affect

neuronal differentiation,	migration,	neural networking, and	synaptogenesis

Through binding of T3 to nuclear receptors regulating gene expression in different brain regions

Treatment and Prevention

iodized oil

iodized salt

Cognitive Effects of Iron Deficiency

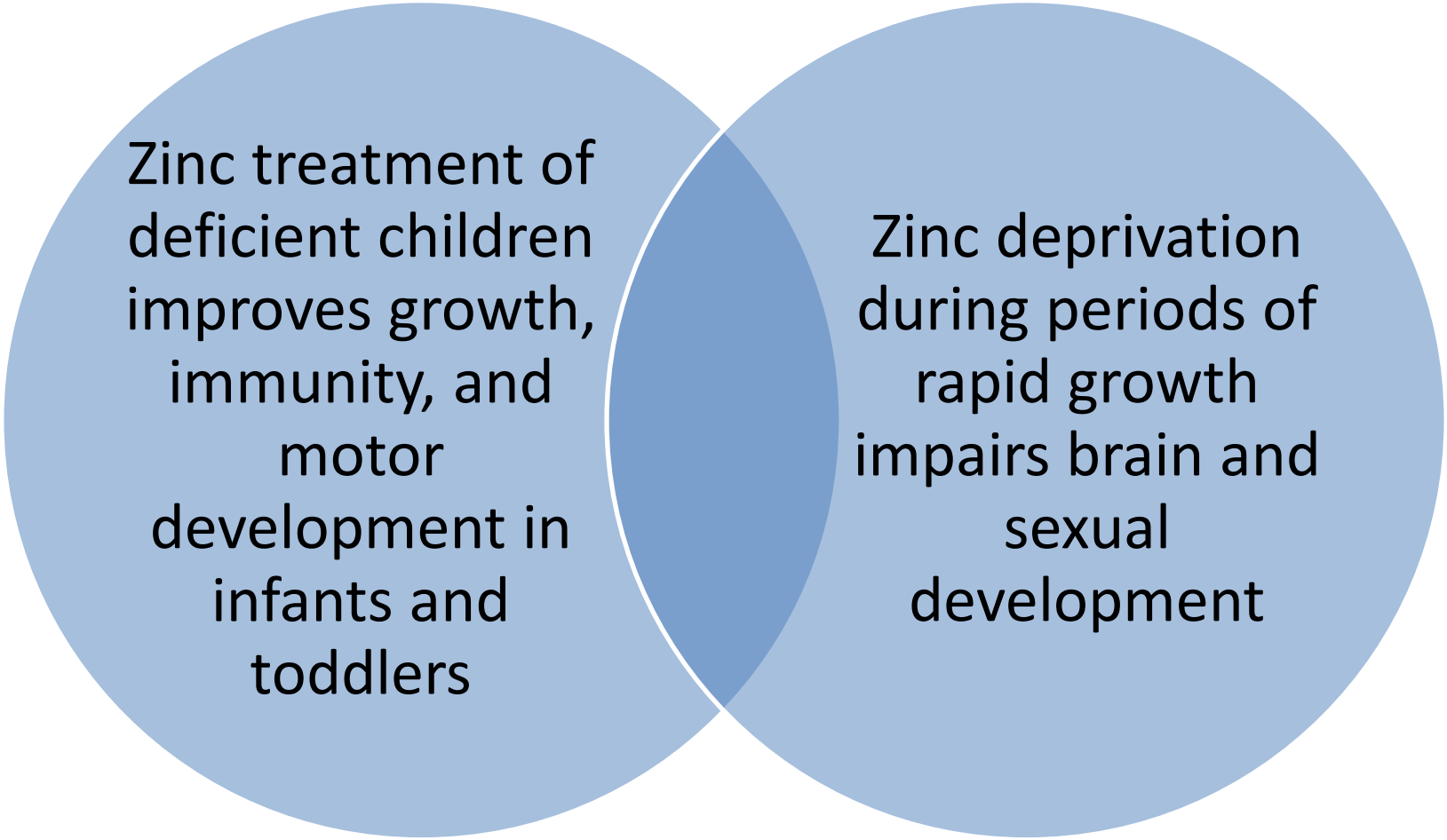
Both iron deficiency anemia and excessive iron accumulation in the brain are associated with neurologic disturbances

Cognitive Effects of Iron Deficiency

anemic children usually have poor cognition and lower school achievement than non-anemic Children

With aging, there is accumulation of iron-containing molecules in the brain, particularly in Alzheimer and Parkinson diseases, perhaps caused by enhanced generation of reactive oxygen species (ROS) and higher neuronal vulnerability

Cognitive Effects of Zinc Deficiency



Neurologic Effects of Copper Deficiency

Copper is an essential cofactor for numerous enzymes

- copper-zinc superoxide dismutase,
- Ceruloplasmin ferroxidase,
- cytochrome oxidase.

Neurologic Effects of Copper

Menkes disease

MNK

- *ATP7A*
- *Low Cu*

Wilson disease

WND

- *ATP7B*
- *High Cu*

NUTRITIONAL NEUROPATHIES AND MYELONEUROPATHIES

Alcohol play a secondary neurotoxic role, but it also displaces food in the diet, increases the metabolic demands for B-group vitamins, and decreases absorption of thiamin, folic acid, and liposoluble vitamins because of impaired pancreatic function

Cuban Epidemic Neuropathy

caused by nutritional deficiencies produced by

- poor diets resulting from political and economic problems
- Deficit of B vitamins (B12) + lack of essential sulfur containing amino acids and carotenoids such as lycopene in the diet
- Cigar smoking and alcohol

TABLE 95.1 CLINICAL SYNDROMES OBSERVED DURING THE EPIDEMIC OF NUTRITIONAL NEUROPATHY IN CUBA AND POSSIBLE CAUSES

CLINICAL MANIFESTATIONS	POSSIBLE CAUSE
Optic neuropathy	
Decreased visual acuity	Folate-vitamin B_{12} deficiency and methanol
Cecocentral scotoma	Cyanide
Dyschromatopsia	
Dorsolateral myelopathy	
Proprioceptive loss	Vitamin B_{12} deficiency
Pyramidal tract weakness	
Sensorineural deafness	
High-frequency (4–8 kHz) loss	Folate-vitamin B_{12} deficiency
Peripheral neuropathy	
Stocking-and-glove sensory loss	Thiamin deficiency
Areflexia	
Burning feet	Deficiencies of niacin, pantothenic acid, thiamin, and pyridoxine
Myeloneuropathy	Multivitamin deficiency including vitamin E

NEUROLOGIC DISORDERS ASSOCIATED WITH SPECIFIC VITAMINS

- Vitamin A
- Vitamin B1
- Vitamin B2
- Vitamin B3
- Vitamin B6
- Vitamin B12
- Folic Acid

Vitamin A Deficiency

night blindness

conjunctival xerosis

Bitot spots

corneal xerosis that may lead to corneal ulceration and keratomalacia

Vitamin A Intoxication

cleft palate,

harelip,

macroglossia,

eye abnormalities,

hydrocephalus.

Vitamin B1 (Thiamin)

The main manifestations of thiamin deficiency are a sensorimotor axonal peripheral neuropathy (dry beriberi)

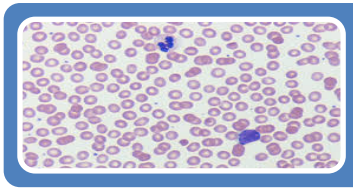
and a cardiac form (Shoshin beriberi) also called wet beriberi because of edema secondary to congestive heart failure

Vitamin B2 (Riboflavin)

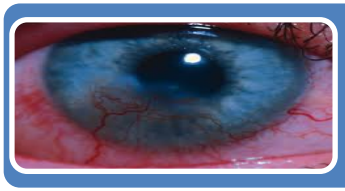
angular cheilosis

glossitis (beefy-red tongue)

scaling dermatitis



normochromic normocytic anemia



superficial interstitial keratitis

Niacin Deficiency

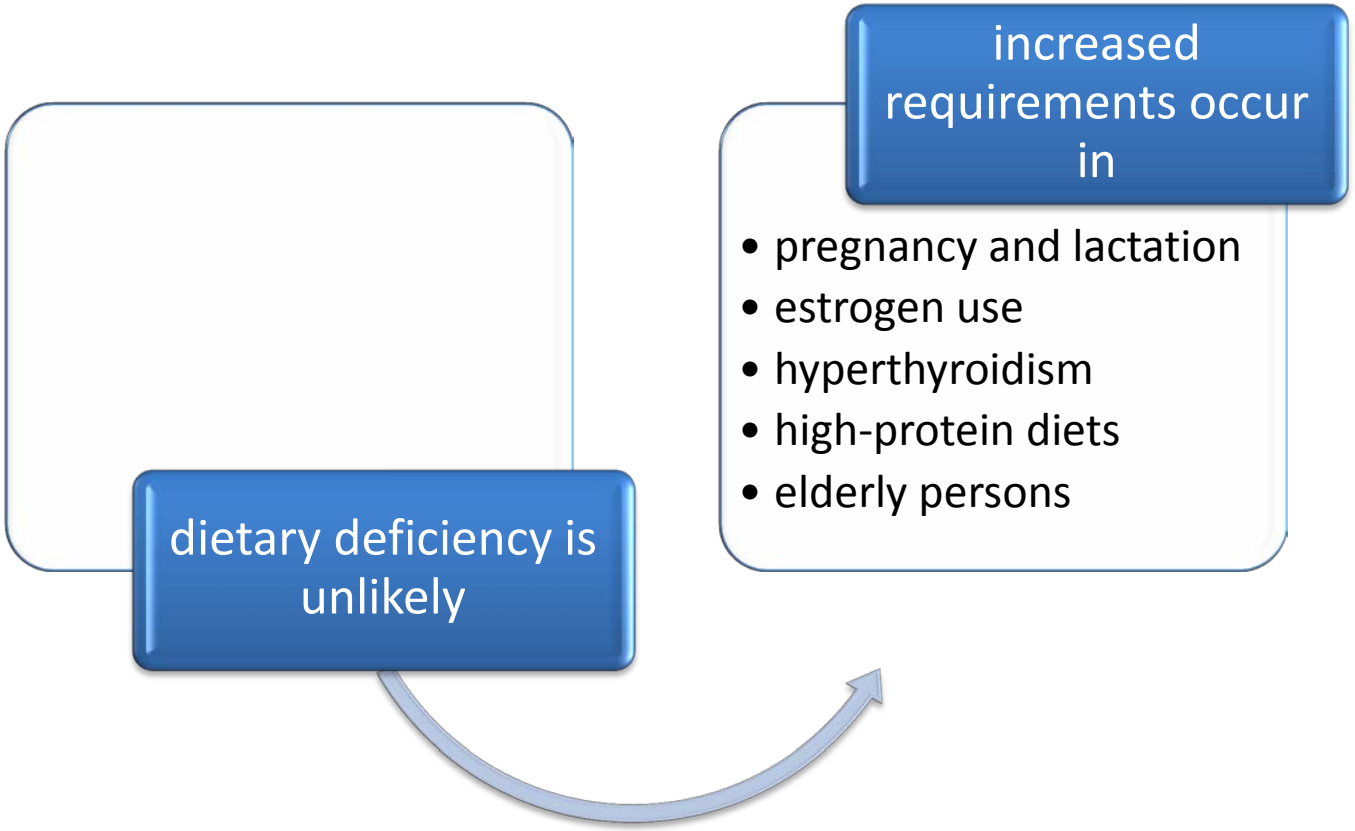
- Alcoholism
- malabsorption syndromes
- chronic diseases

Vitamin B6

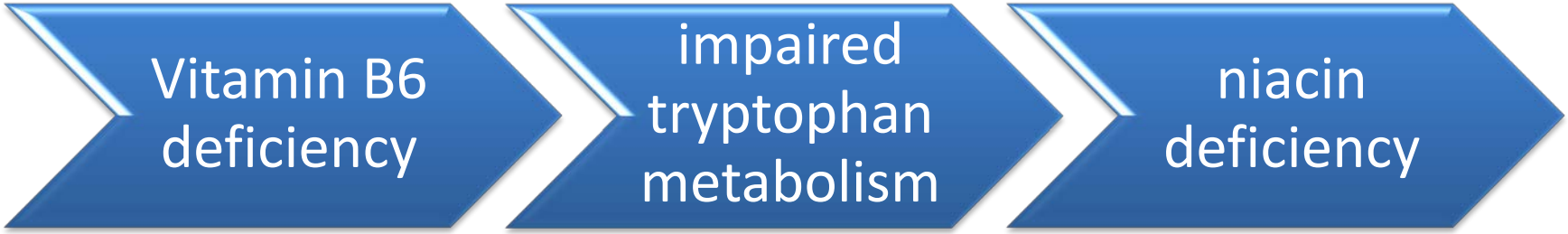
Vitamin B6 - three natural forms

- pyridoxol
- Pyridoxal
- pyridoxamine

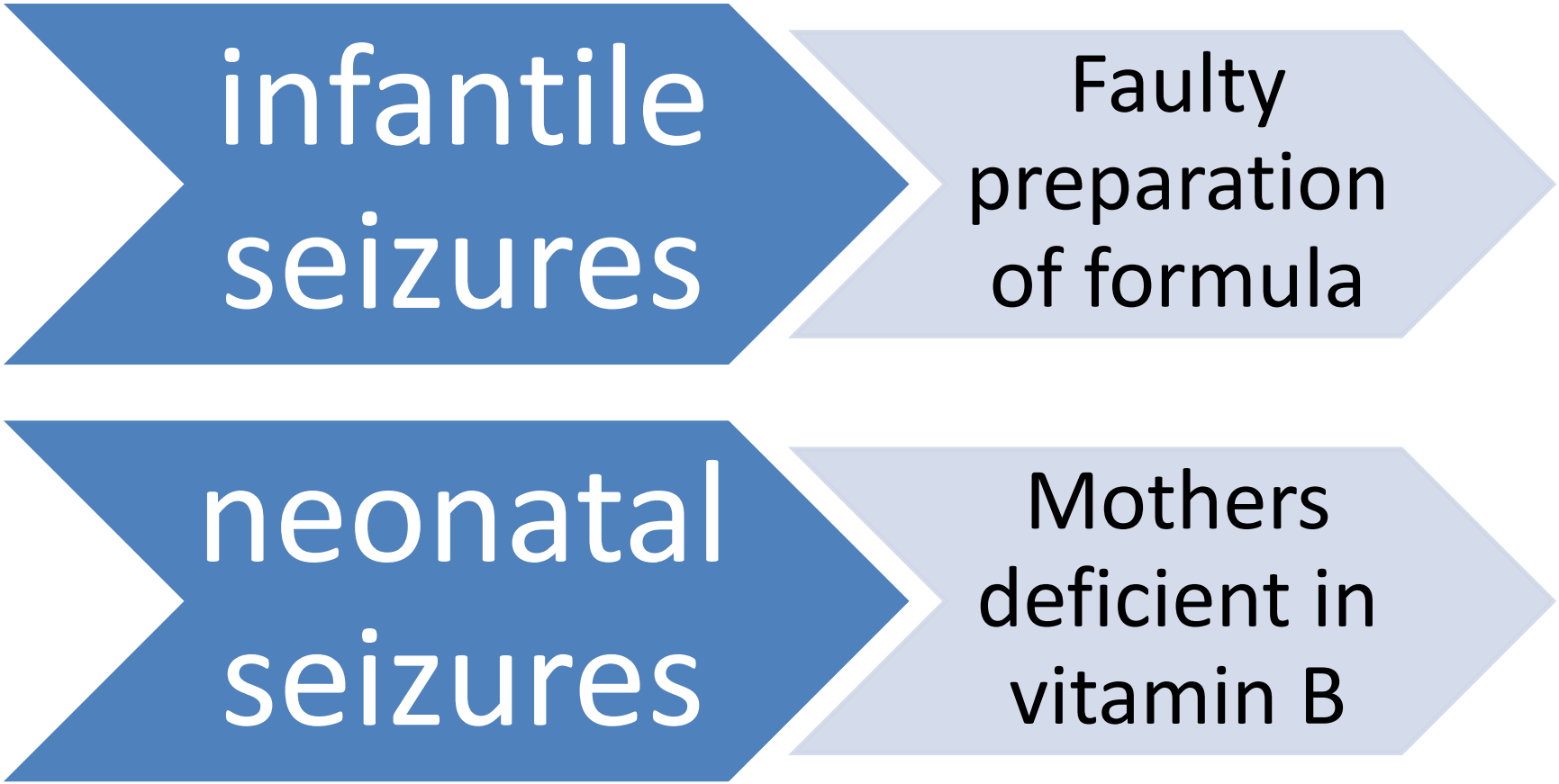
Vitamin B6 Deficiency



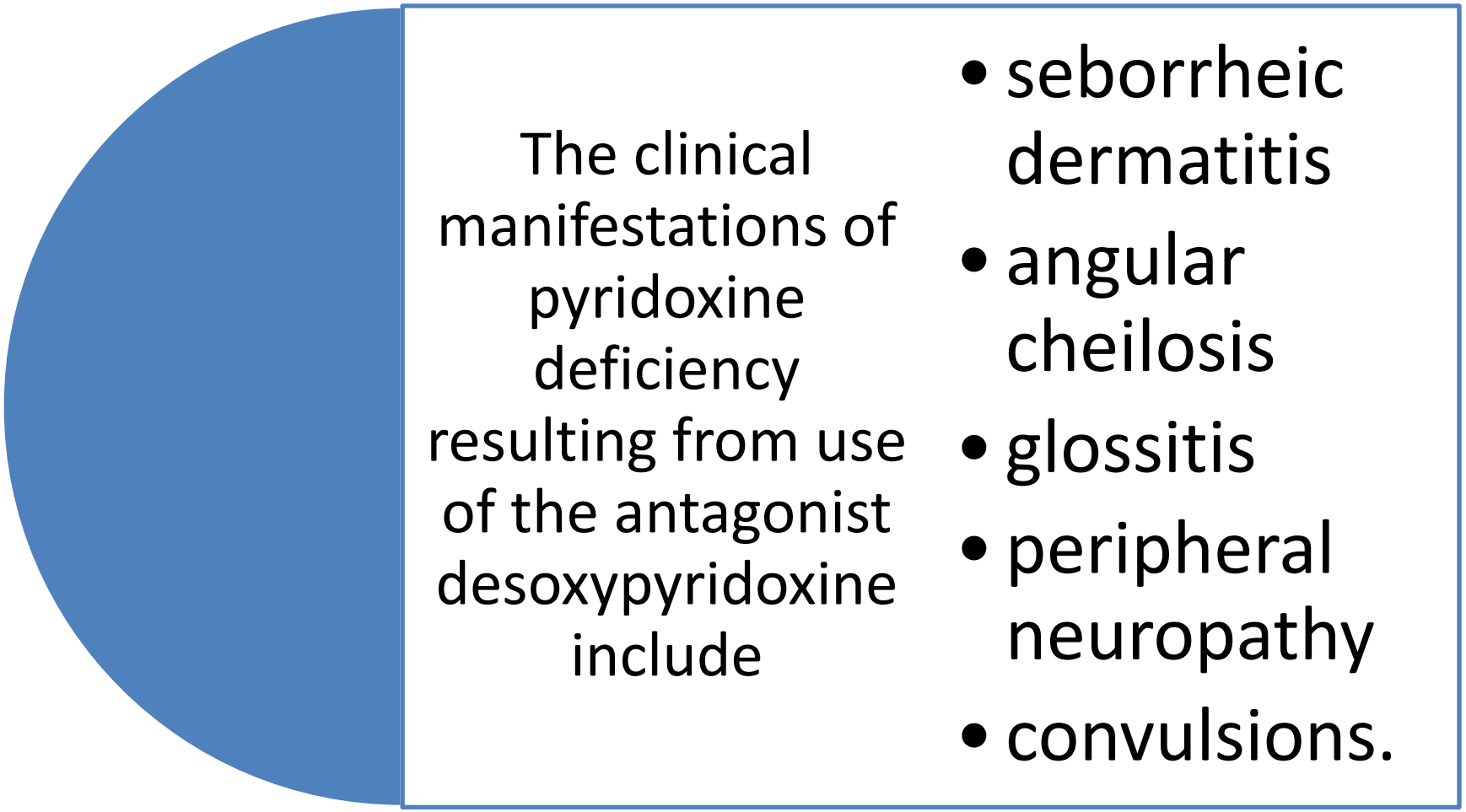
Vitamin B6 Deficiency



Vitamin B6 Deficiency

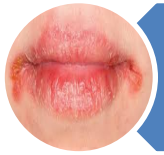


Vitamin B6 Deficiency

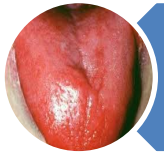


Vitamin B6 Deficiency

seborrheic dermatitis



angular cheilosis

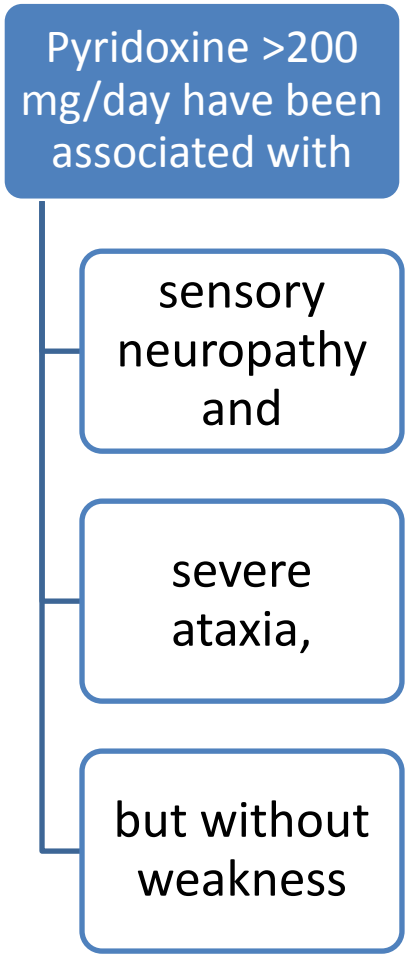


glossitis

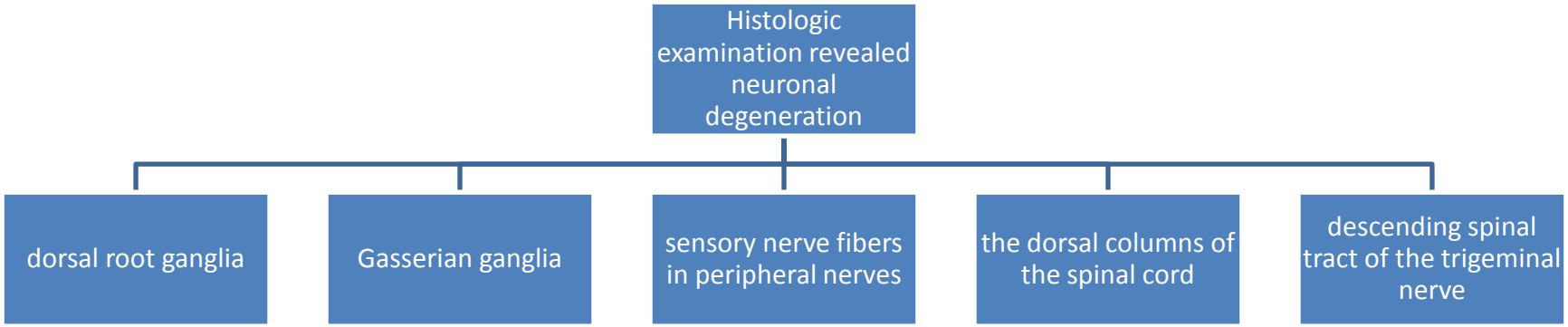
peripheral neuropathy

convulsions

Vitamin B6 Intoxication



Vitamin B6 Intoxication

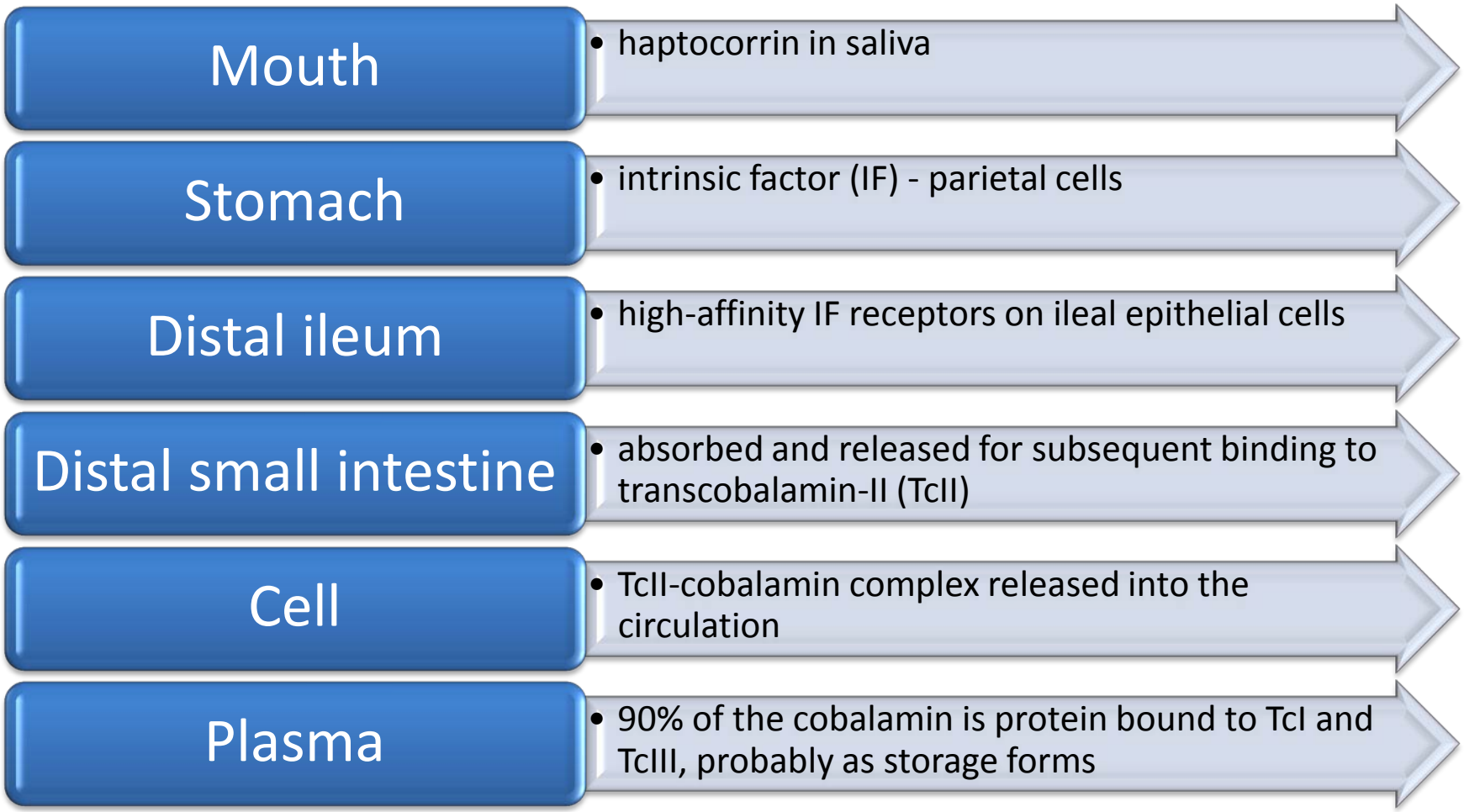


Vitamin B12 (Cobalamin)

Cobalamin absorption involves at least five separate

- cobalamin-binding molecules,
- receptors, and
- transporters

Vitamin B12 (Cobalamin)



Pathogenesis of Cobalamin Deficiency

Cobalamin deficiency impairs conversion of

- L-methylmalonyl CoA → succinyl CoA →
- Methylmalonic acid (MMA)
- impairs *methylation reactions,*
- *no* synthesis of methionine,
- synthesis of *S-adenosyl methionine (SAM)*
- synthesis of neurotransmitters
  - norepinephrine
  - glutamate,
- myelin synthesis

Treatment

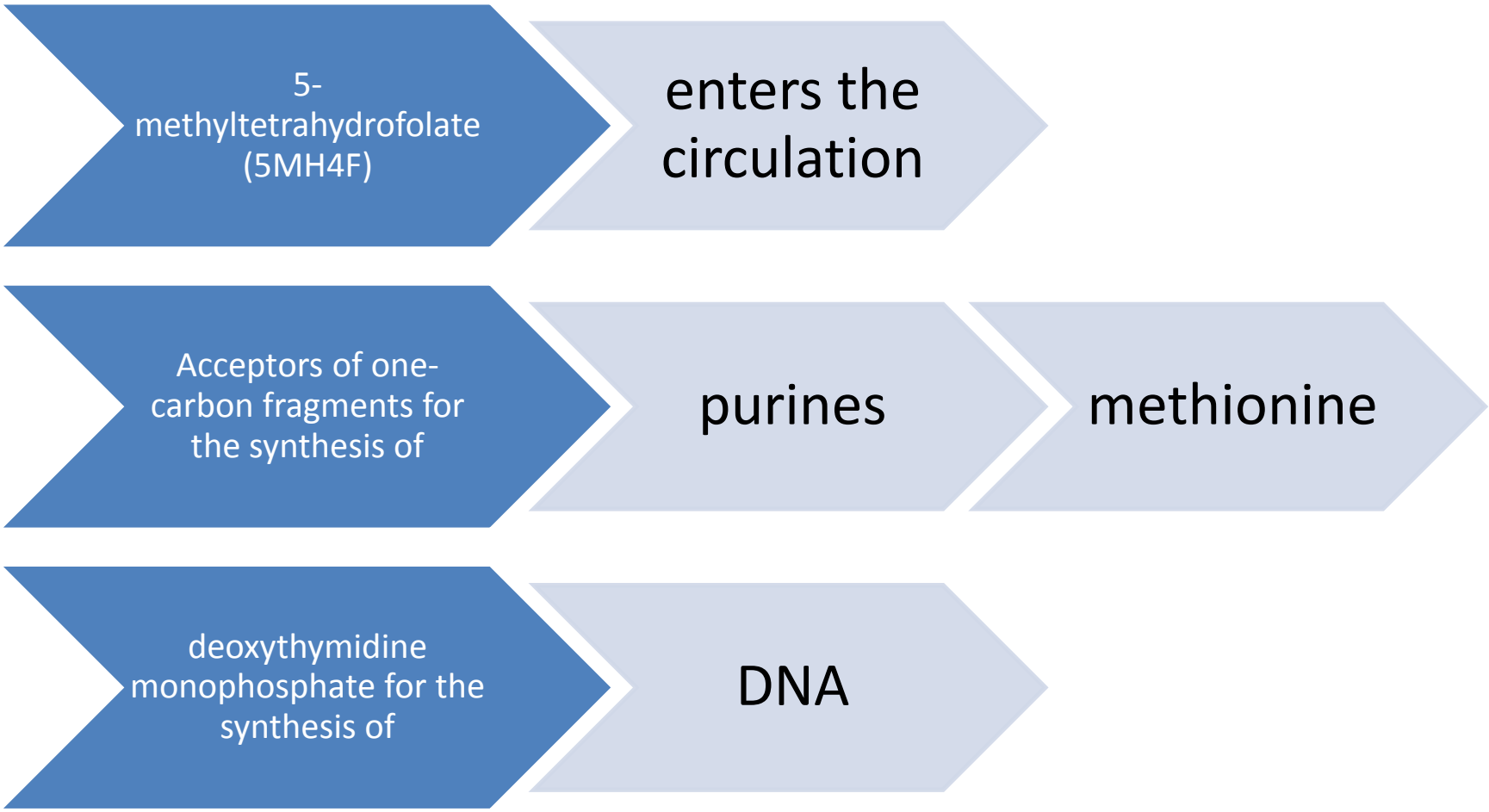
intramuscular injections of 1000 g of vitamin B12 daily for 5 days to replenish the stores,

followed by monthly injections of 500 to 1000 g indefinitely

A sublingual form of vitamin B12 is also available.

For preventive treatment, oral preparations of vitamin B12 appear to be adequate

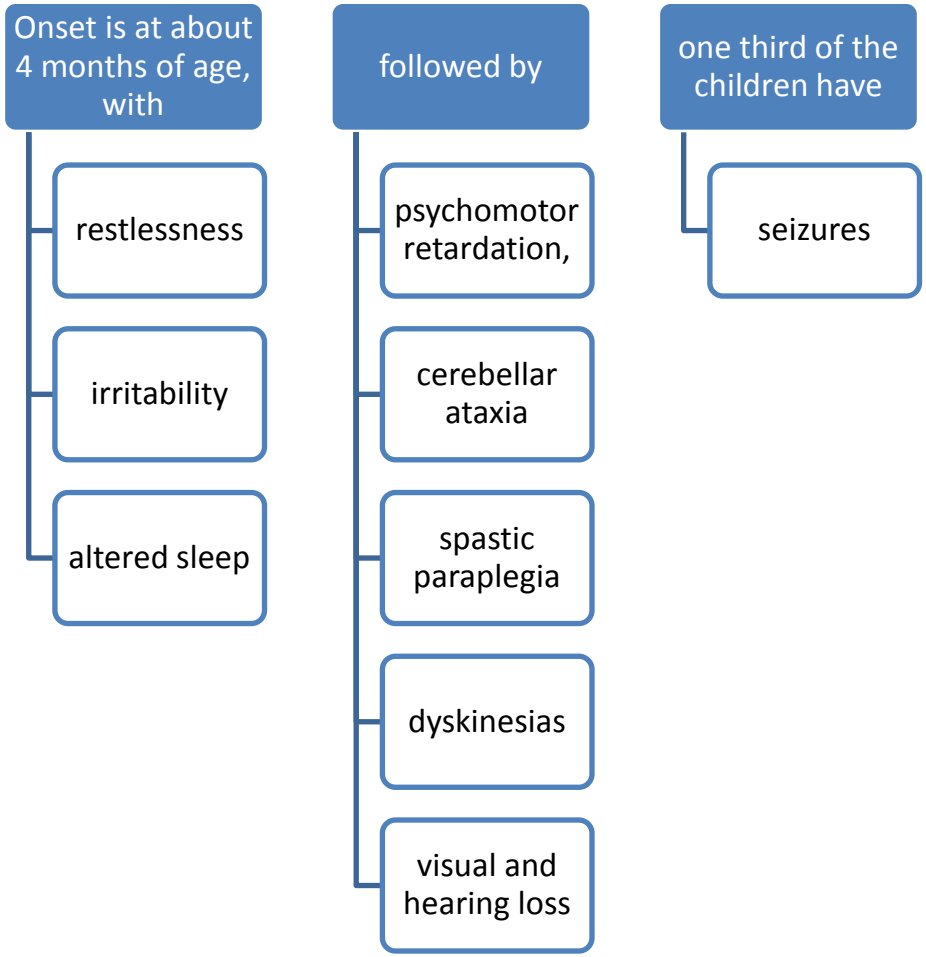
Folic Acid


5-methyltetrahydrofolate (5MH4F)
enters the circulation
Acceptors of one-carbon fragments for the synthesis of
purines
methionine
deoxythymidine monophosphate for the synthesis of
DNA

Neurologic Manifestations of Folate Deficiency

- Neurologic syndrome in children
- idiopathic cerebral folate deficiency
- low CSF levels of 5MH4F
- Normal folate metabolism outside the nervous system

Neurologic Manifestations of Folate Deficiency



DIETARY AND VITAMIN TREATMENT IN NEUROLOGY

Numerous neurologic conditions, ranging from migraine, stroke, and hepatic encephalopathy to rare metabolic disturbances

- respond to dietary treatment or to specific vitamins

Migraine

Avoid

- ice-cold foods
- hypoglycemia
- nitrates,
- monosodium glutamate,
- biogenic amines, in particular tyramine and phenylethylamine

Mediterranean Diet

The generic name of the typical diet of people living in the olive-growing areas of the Mediterranean basin

Mediterranean Diet

TABLE 95.3 GENERAL CHARACTERISTICS OF THE MEDITERRANEAN DIETS

1. Abundant plant foods (fruits, vegetables, breads, other forms of cereals, beans, nuts, and seeds)
2. Minimally processed, seasonally fresh, and locally grown foods
3. Fresh fruits as the typical daily dessert; sweets based on nuts, olive oil, and concentrated sugars or honey consumed during festive days
4. Olive oil as the principal source of dietary lipids
5. Dairy products (mainly cheese and yogurt) consumed in low to moderate amounts
6. Fewer than four eggs consumed per week
7. Red meat consumed in low frequency and amounts; fish consumption changing according to region
8. Wine consumed in low to moderate amounts, generally with meals

Adapted with permission from Serra-Majem L, Román B, Estruch R. Scientific evidence of interventions using the Mediterranean diet: a systematic review. Nutr Rev 2006;64:S27–47.

Mediterranean Diet

lowers risk for

- cardiovascular disease,
- myocardial and cardiovascular mortality
- stroke,
- obesity,
- arthritis,
- cancer,
- Alzheimer disease

useful public health approach to prevent

- Stroke
- cognitive dysfunction

Stroke

Decrease the intake of	The DASH diet (Dietary Approaches to Stop Hypertension diet)	Mediterranean diet
• saturated animal fats • *trans-fats* • *sodium (to control* hypertension, hyperlipidemia, and body mass index)	• lowering the dietary intake to 150, 100, or 50 mmol/day of sodium, according to the severity of hypertension and to increase consumption of fruits, juices and vegetables	• excellent dietary approach to stroke prevention

Orthostatic Hypotension

To increase the circulating volume

increase their sodium intake to 150 to 250 mEq/day of sodium (10 to 20 g of salt)

raise their oral fluid intake to 20 oz/day,

along with high potassium supplementation when they are taking fludrocortisone

SUMMARISE


Thank
You

Fitness Tip

A pound of body fat is equal to 3500 calories. If you eat 100 calories more than you expend every day, you will gain more than 10 pounds in a year.

Wellness Tip

Research shows that some protein-rich foods can give you a quick mental boost, which can be helpful before an exam.

Wellness Tip

Certain carbohydrate-rich foods, such as a bagel or a plain baked potato, can have a temporary calming effect on some people during stressful situations.

Wellness Tip

To avoid intestinal discomfort, add fiber to your diet slowly so you can build a tolerance to it.

Fitness Tip

Drink plenty of water before, during, and after workouts, especially when the weather is warm. Proper hydration helps you avoid cramps and heat-related problems such as heat stroke.

Wellness Tip

If you take a supplement, *never* take more than the recommended dosage unless your doctor tells you to.

Wellness Tip

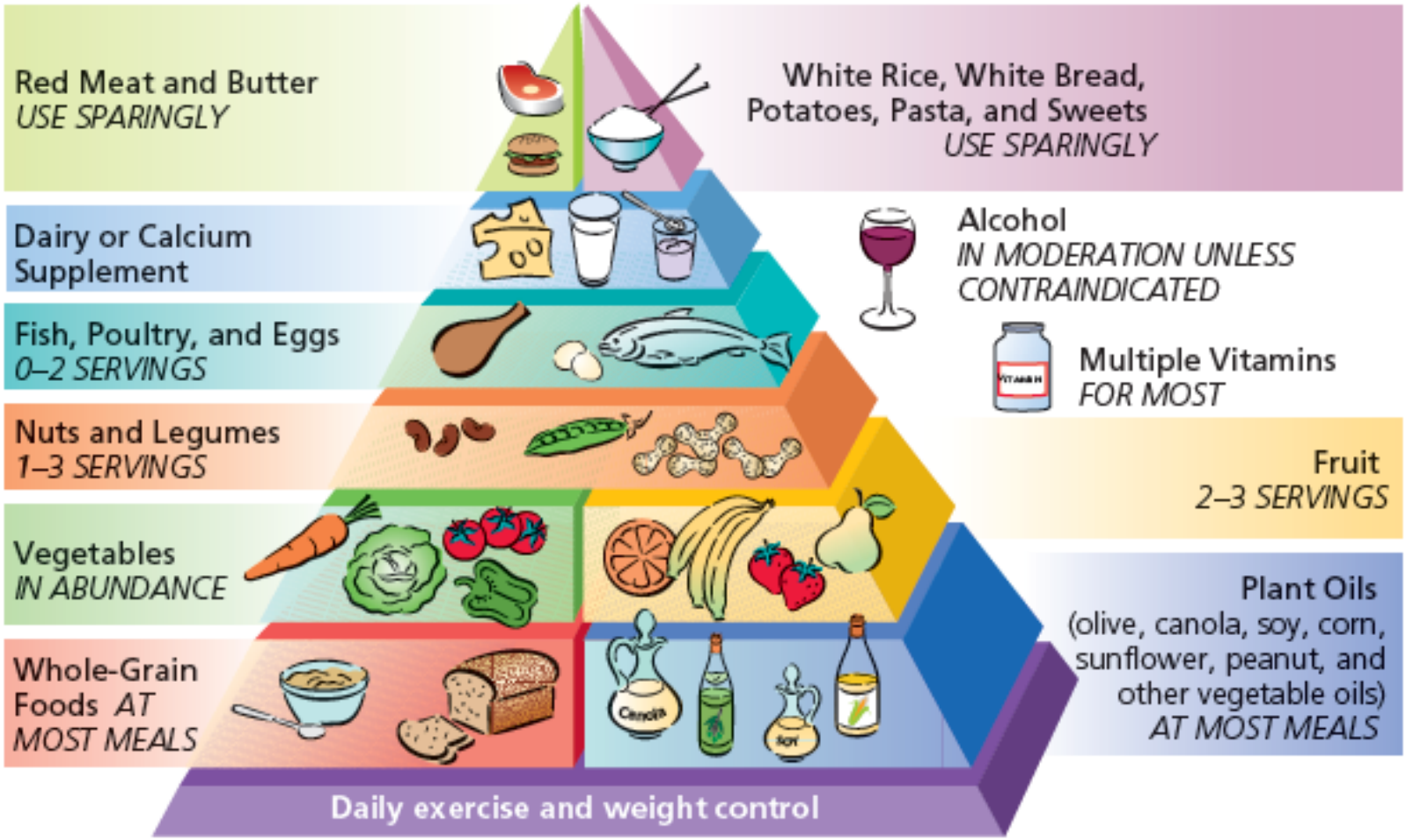
About a dozen major American cities, and the entire state of California, have enacted laws restricting the use of trans fats in commercially prepared foods.

Wellness Tip

To get produce as clean as possible, rub it with a soft brush while holding it under running water.

Fitness Tip

Consumption of red meats, sweets, eggs, and butter is greatly reduced or eliminated entirely in most forms of the Mediterranean diet.


Red Meat and Butter
USE SPARINGLY
White Rice, White Bread,
Potatoes, Pasta, and Sweets
USE SPARINGLY
Dairy or Calcium
Supplement
Alcohol
IN MODERATION UNLESS
CONTRAINDICATED
Fish, Poultry, and Eggs
0–2 SERVINGS
Multiple Vitamins
FOR MOST
Nuts and Legumes
1–3 SERVINGS
Fruit
2–3 SERVINGS
Vegetables
IN ABUNDANCE
Plant Oils
(olive, canola, soy, corn,
sunflower, peanut, and
other vegetable oils)
AT MOST MEALS
Whole-Grain
Foods AT
MOST MEALS
Daily exercise and weight control

Be happy and stay blessed!