National University of Pharmacy

Department of chemistry of natural compounds and nutriciology

NUTRICIOLOGY

Introduction into nutriciology

Kharkiv 2020

Nutriciology Plan

- *Introduction to nutriciology*
- *Targets of nutriciology*
- *Tasks of nutriciology*
- *Key words and concepts*
- *Concept of MACRONUTRIENT*
- *Concept of MICRONUTRIENT*
- *Concept of DIET SUPPLEMENTS*
- *Concept of SPECIAL FOOD PRODUCTS*
- *Balanced diet*
- *Nutritional status*

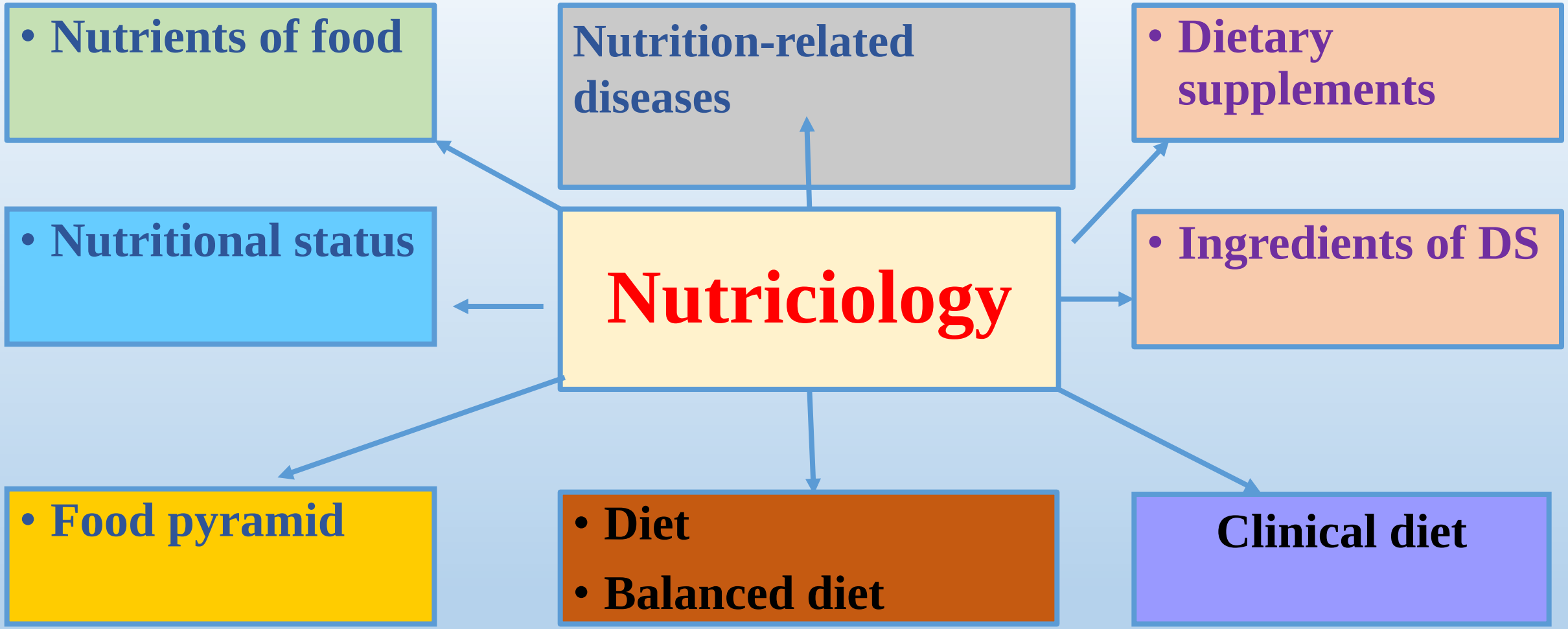
GOALS AND OBJECTIVES of NUTRICOLOGY
Key words and concepts

Nutricology - the science that studies the chemical composition of natural food components (nutrients), their **importance for the functioning** of the body, the impact on human health.

Nutricology goal - to ensure a **balanced diet**, capable of **regulating** the **metabolism** and normalize the function of cells, individual organs and systems for healthy person, help to alleviate the condition and **recovery** of sick people, as well as to prevent disease in individuals belonging to certain risk groups.

NUTRICIOLOGY TASKS

- The study of **MACRO-AND MICRONUTRIENT** composition of food raw materials and food products.
- Search and potential new sources of **essential nutrients**.
- Justification nutrition, reducing diseases associated with **IMPAIRED NUTRITIONAL STATUS.**
- Participation in the creation of a nutrition program, improving the legal framework for the development and implementation **of STANDARDS OF CLINICAL NUTRITION.**
- Create, study the application and new doses of **BIOLOGICALLY ACTIVE FOOD SUPPLEMENTS or DIETARY SUPPLEMENTS**


• Nutrients of food
Nutrition-related diseases
• Dietary supplements
• Nutritional status
Nutriciology
• Ingredients of DS
• Food pyramid
• Diet
• Balanced diet
Clinical diet

The World Health Organization (WHO), the role of nutrition in mortality

According to WHO :
More than 60 % of all causes of death are directly **related to preventable nutritional disorders :**

- **Cardiovascular** (*atherosclerosis* , *heart attack*, *stroke*, *hyperlipidemia*),

Every second death in the world - from cardiovascular disease,

- **Cancer** (75-80 % of harmful environmental factors ingested with food and drinking water),
- **Osteoporosis** (suffers almost everyone older than 50 years),
- **Diabetes mellitus type II -** (incidence is growing and " younger"),
- **Nutritional deficiencies** (affects about 5 billion people),

"... If ever medicine and will be successful in eliminating heart disease and malignant tumors, occupying the first and second leading cause of death, it is only with the permission of nutrition ... “

The most common nutrition-related diseases:

- Atherosclerosis
- Hypertonic disease
- Hyperlipidemia
- Some malignant neoplasms
- Diabetes mellitus
- Obesity
- Gastrointestinal tract diseases
- Osteoporosis
- Gout
- Kidney and urinary tract diseases

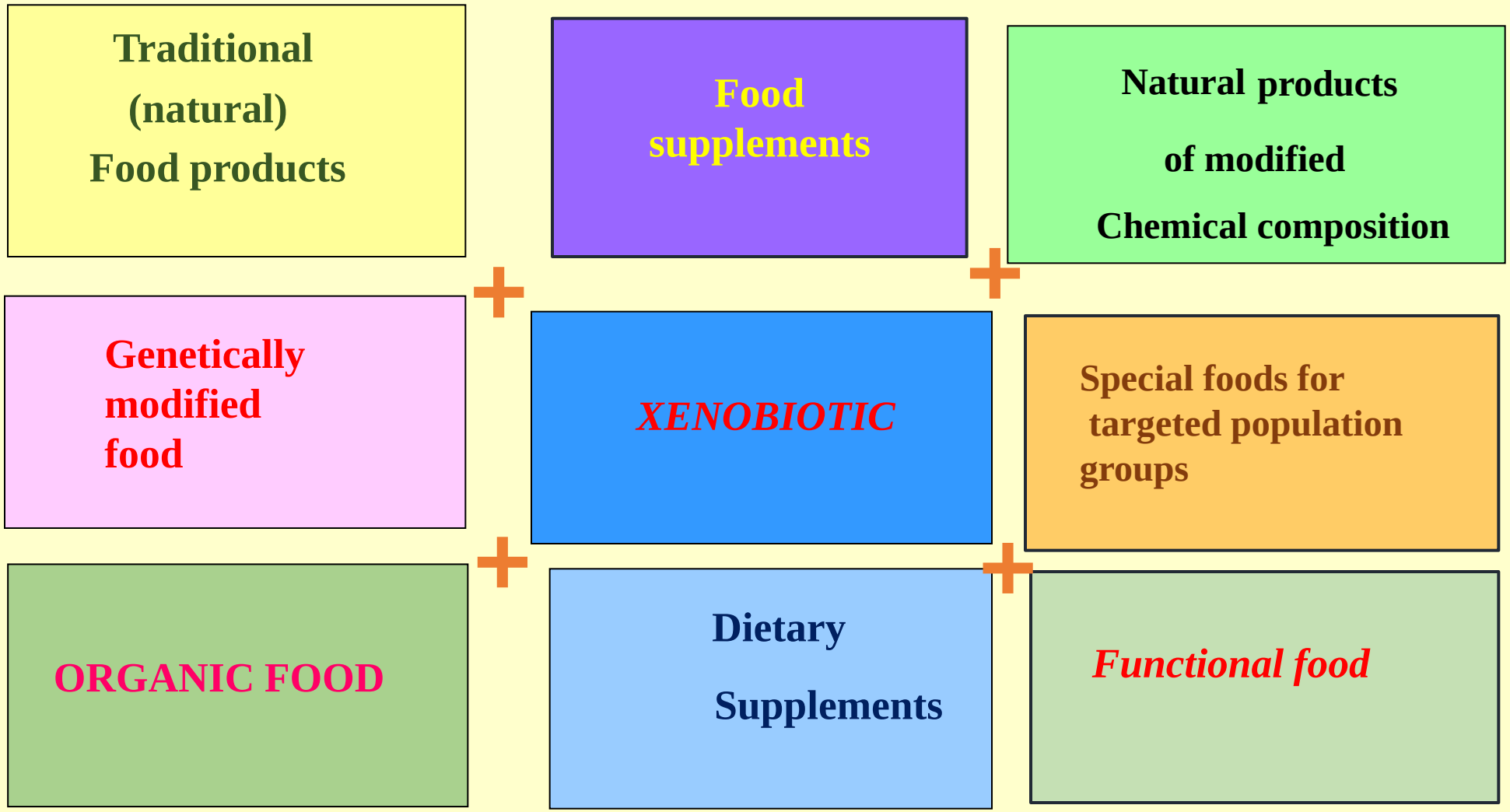
Select nutrient-deficiency diseases

disease (and key nutrient involved)	symptoms	foods rich in key nutrient
xerophthalmia (vitamin A)	blindness from chronic eye infections, poor growth, dryness and keratinization of epithelial tissues	liver, fortified milk, sweet potatoes, spinach, greens, carrots, cantaloupe, apricots
rickets (vitamin D)	weakened bones, bowed legs, other bone deformities	fortified milk, fish oils, sun exposure
beriberi (thiamin)	nerve degeneration, altered muscle coordination, cardiovascular problems	pork, whole and enriched grains, dried beans, sunflower seeds
pellagra (niacin)	diarrhea, skin inflammation, dementia	mushrooms, bran, tuna, chicken, beef, peanuts, whole and enriched grains
scurvy (vitamin C)	delayed wound healing, internal bleeding, abnormal formation of bones and teeth	citrus fruits, strawberries, broccoli
iron-deficiency anemia (iron)	decreased work output, reduced growth, increased health risk in pregnancy	meat, spinach, seafood, broccoli, peas, bran, whole-grain and enriched breads
goitre (iodine)	enlarged thyroid gland, poor growth in infancy and childhood, possible mental retardation, cretinism	iodized salt, saltwater fish

NUTRICIOLOGY TASKS

- Creation of special foods (SF) for various categories of the population and those with impaired nutritional status.
- Improvement and development of methods of quality and safety of dietary supplements and SFP.
- Improving the system of control over the production and marketing of dietary supplements.
- Information outreach, media, doctors about the purpose of dietary supplements and their admission rules for preserving health.

FOOD of XXI centure



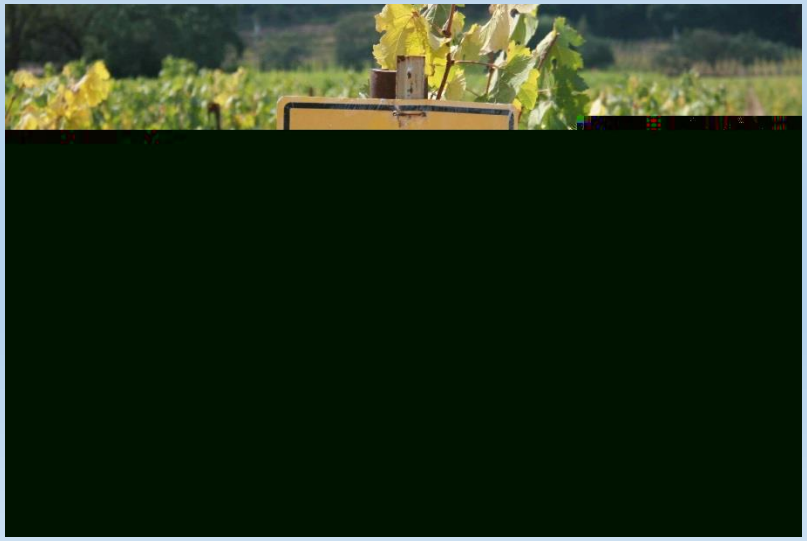
ORGANIC FOOD

- **Organic foods** are produced using methods of **ORGANIC FARMING** – with limited modern synthetic inputs such as synthetic pesticides and chemical fertilizers, though organic pesticides, such as Bt toxins, are still used.
- Organic foods are also not processed using irradiation, industrial solvents, or chemical food additives.
- The organic farming movement arose in the 1940s in response to the industrialization of agriculture that became known in the 1960s as the **Green Revolution**.
- Organic food production is a heavily regulated industry, distinct from private gardening. Currently, the European Union, the United States, Canada, Japan and many other countries require producers to obtain **special certification** in order to market food as organic within their borders.
- In the context of these regulations, **organic food is food produced in a way that complies with organic standards set by national governments and international organizations**.

Organic farming:

Forbidden to use

- synthetic fertilizers,
- pesticides,
- toxic chemicals;
- hormones,
- growth stimulants;
- flavor enhancers,
- preservatives;
- artificial additives



Organic food Logotypes EU USA

GENETICALLY MODIFIED FOODS (or GM foods) are foods produced from organism that have ***had specific changes introduced into their DNA*** using the methods of **genetic engineering**. These techniques have allowed for the introduction of new crop traits as well as a far greater control over a food's genetic structure than previously afforded by methods such as **selective breeding** and **mutation breeding.**

EXAMPLES OF GM FOODS

- Corn
- Rice
- Tomatoes
- Rapeseed
- Honey
- Cotton
- Soybean
- Sugar Cane
- Canola
- Potatoes
- Cattle
- Papaya
- Squash

Possible Benefits of GM Foods

- Improved crop quality
  - Development of *frost resistant* crops
  - Development of *disease resistant* crops
  - Development of *flood resistant* crops
- Improved nutritional quality
  - Development of foods designed to meet *specific nutritional goals*

Possible Risks for GM Foods

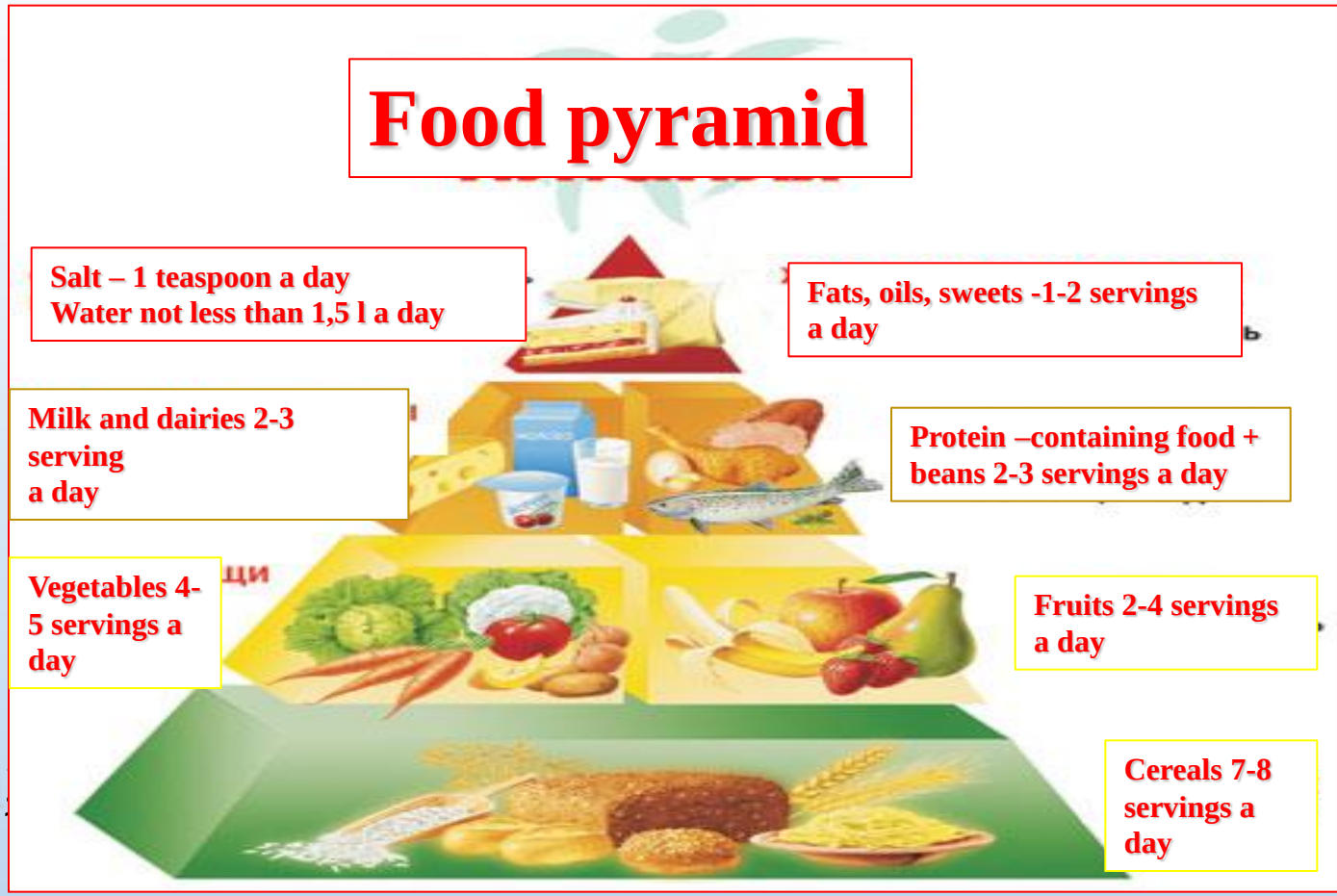
Benefits of GMOs	Risks of GMOs
Nutritional value of foods could be improved (e.g. by introducing proteins, vitamins or vaccines)	New traits could cause adverse health reactions (e.g. new proteins may cause allergic responses)
Crops can be produced that lack known allergens	Removal of traits could have unknown effects
Crops can grow in arid conditions for better yield (e.g. by introducing drought resistant genes)	Crops may limit biodiversity of local environment (increased competition with native species)
GM crops can produce herbicides to kill pests	Cross pollination could lead to 'super weeds'
Improve food supply / agriculture in poor countries (GM crops can be engineered for improved yields)	Patents restrict farmers from accessing GM seeds (biotech companies hold monopolies over crop use)
GM crops may have longer shelf lives (less spoil)	Foods with GM components may not be labeled
Reduces economic costs and carbon footprint – less need for land clearing and pesticide usage	Different governments may have conflicting regulatory standards concerning safe usage

A **FOOD PYRAMID** or **diet pyramid** is a triangular diagram representing the optimal number of servings to be eaten each day from each of the basic food groups

???

What should be here, on the base of pyramid, think about it…

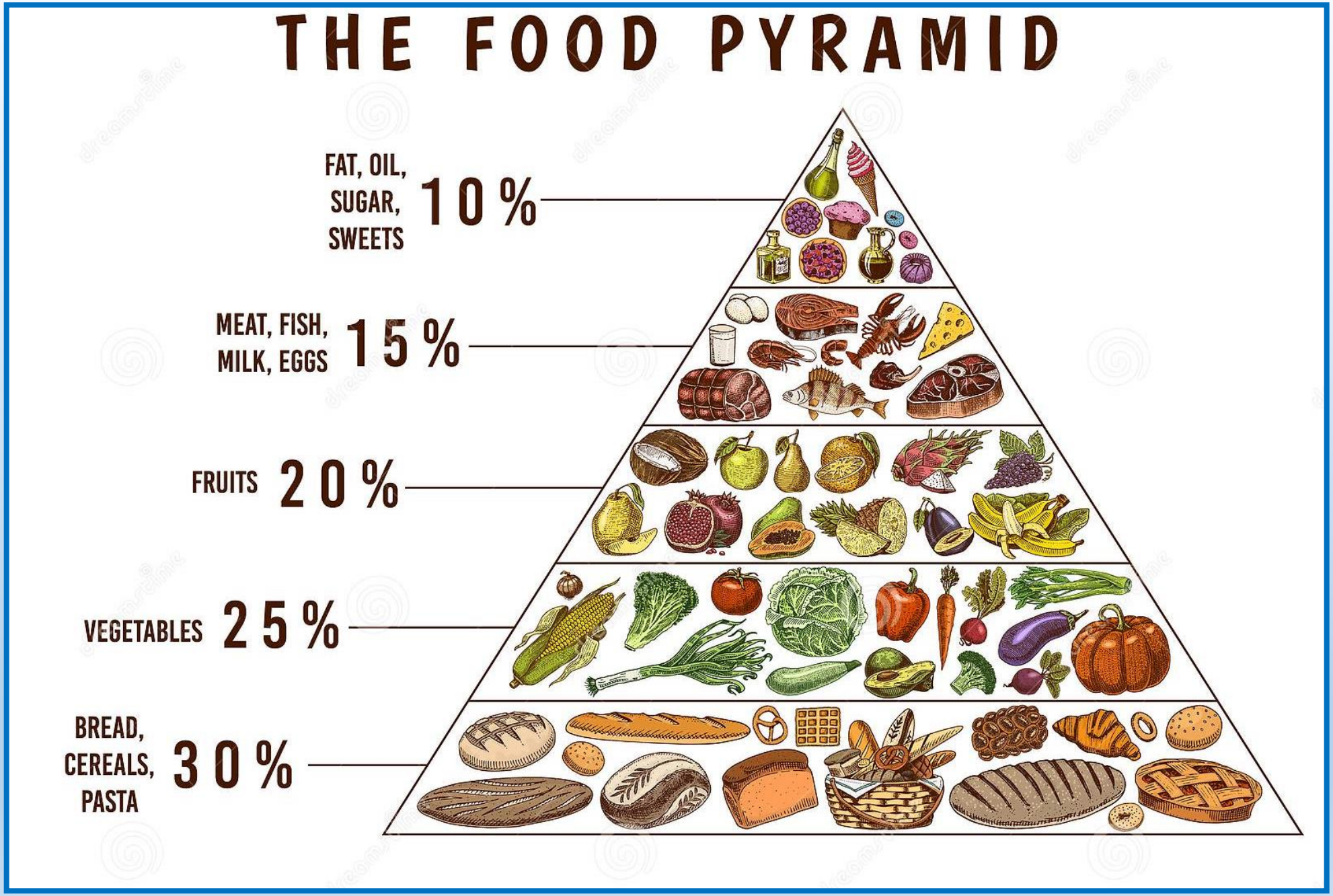
Food pyramid created using color scheme of lights

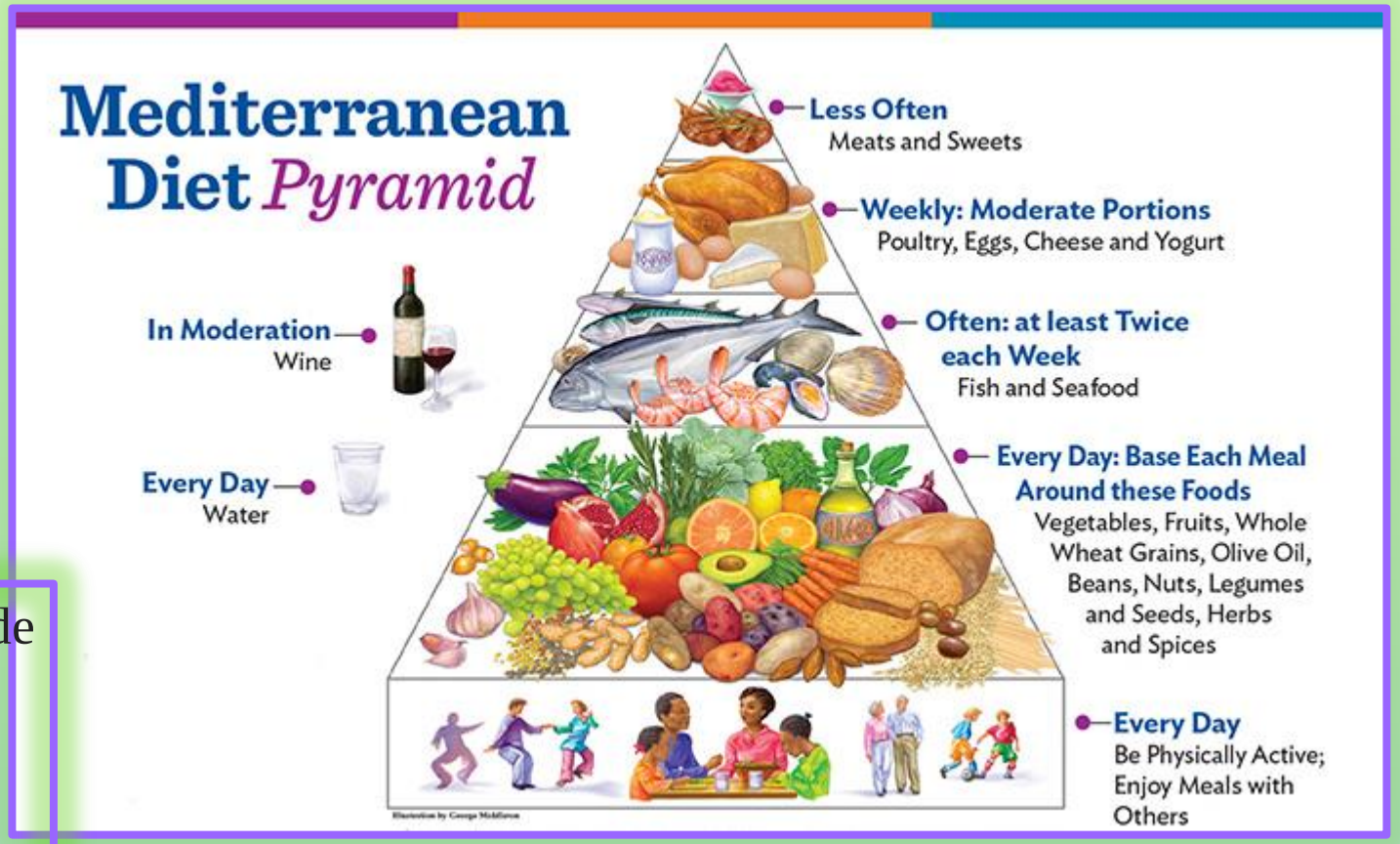


- **green** - Eat without restriction,
- **Yellow** - Consume with caution,
- red - think it worth to use?

- Food pyramid recommended by WHO as a nutritional model of building a healthy diet. At its foundation laid create necessary for a healthy diet food, variety and value for which it illustrates.

THE FOOD PYRAMID





The principal aspects of this diet include proportionally high consumption of

- **olive oil**,
- **legumes**,
- **unrefined cereals**,
- **fruits**, **and** **vegetables**,
- moderate to high consumption of **fish**,
- moderate consumption of **dairy products** (mostly as cheese and yogurt),
- moderate **wine** consumption,
- and low consumption of non-fish meat products.

MEDITERRANIAN DIET

A medical analysis of more than 1.5 million adults has shown that the transition to a Mediterranean diet **reduces the risk of**

- cardiovascular disease,
- Alzheimer's disease
- and Parkinson's disease.

Key components of Mediterranean diet:

- vegetables,
- fruits, beans, nuts, whole grains,
- herbs and spices instead of salt,
- fish and poultry,
- limited consumption of red meat,
- red wine in moderation.

Scandinavian diet

Recent study published in the American Journal of Clinical Nutrition showed that a Nordic diet helps **reduce inflammation in the body**.

Healthy Scandinavian diet makes a **high fiber content**, a cool attitude to sugar, an abundance of vegetables and fruits. Also, people from Sweden, Denmark, Norway, Finland and Iceland use less processed meat and dairy products.

The key components of Scandinavian diet are: fatty fish (herring, mackerel, flatfish, salmon), seafood, rye bread, fruit, milk, cheese, barley, semolina, rice cereals, rose hips

Japanese diet

A high life expectancy of the Japanese is due to the traditional diet, in which the products of long-term storage are practically not used, and the taste and appearance of the dishes is minimal from the original.

Japanese government encouraged people to consume less processed foods high in carbohydrates. Instead, they recommended eating more rice and vegetables. After 10 years, the researchers found that among the participants who followed the leadership, the death rate from cardiovascular diseases decreased by 15%.

Key ingredients of Japanese diet: an abundance of fresh products, rice, wheat and buckwheat noodles, fish and seafood, beans, vegetables, moderate meat consumption, green tea match, a wide variety of dishes, small portions.

French diet

Paradox of the French diet: how does this nation manage to eat foods high in saturated fats, but have such low rates of cardiovascular disease and obesity?

One study showed that the key is the **amount of food consumed**. Yes, the French love croissants, cheese and meat, but they use them moderately: most portions in Parisian restaurants contain an average of **277 grams of food**, whereas in the US where obesity has reached epidemic proportions, the average serving **is 350 g**. Key ingredients of French diet: cheese, vegetables, wine, olive oil, beans, greens, apples, poultry, seafood and fish, red wine, cognac.

Dietary factor	1989 WHO Study Group recommendations	2002 Joint WHO/FAO Expert Consultation recommendations
Total fat	**15–30%**	**15–30%**
Saturated fatty acids (SFAs)	**0–10%**	**<10%**
Polyunsaturated fatty acids (PUFAs)	**3–7%**	**6–10%**
n-6 PUFAs		**5–8%**
n-3 PUFAs		**1–2%**
Trans fatty acids		**<1%**
Monounsaturated fatty acids (MUFAs)		**By difference**
Total carbohydrate	**55–75%**	**55–75%**
Free sugars	**0–10%**	**<10%**
Complex carbohydrate	**50–70%**	**No recommendation**
Protein	**10–15%**	**10–15%**
Cholesterol	**0–300 mg/day**	**< 300 mg/day**
Sodium chloride (Sodium)	**< 6 g/day**	**< 5 g/day (< 2 g/day)**
Fruits and vegetables	**≥ 400 g/day**	**≥ 400 g/day**
Pulses, nuts and seeds	≥ 30 g/day (as part of the 400 g of fruit and vegetables)	
Total dietary fiber	27–40 g/day	From foods
NSP	16–24 g/day	From foods

Rules for food intake

- 1. Do **not eat immediately after serious physical activity**: sports, heavy physical work, hypothermia or overheating of the body, and after a ***stormy emotions***.
- 2. Each meal should start with ***raw vegetables or fruits***. Eat them whole or in salads.
- 3. Raw fruits and vegetables should not be consumed ***after a meal***! Eat fruit for dessert is harmful!
- 4. Chew food in a proper way.
- 5. Eat slowly, take breaks between meal of at least 5, preferably 10 minutes.

Breakfast and dinner should last at least an hour, lunch, at least 40 minutes.

Rules for food intake

- 6. Do not need to **drink just before eating, during and immediately** after a meal. Exception can be made only if eat very dry food , which can drink small sips . Need to drink at least half an hour before a meal and not before an hour after eating.

7. Do not drink very **cold** (well below room temperature) and very **hot** (scalding mouth and lips), food and beverages . Desirable to combine in one meal of hot and cold dishes.

8. Immediately after a meal **not get to work and get some rest**. But do not lie and do not sleep. Best leisurely stroll. Break must be at least 15 minutes for light work and not less than half an hour in the case of severe physical . And for serious sports break between the end and the beginning of a workout meal should be at least an hour.

•BALANCED DIET

The theory of a balanced diet (nutrition) developed by Academic A.A. Pokrovsky.

According to theory nutrition is characterized by ***optimal matching amounts and ratios of all components (nutrients) of the food to the physiological demands of the body***.

Balanced diet

The diet of a balanced diet - the ratio between proteins, fats and carbohydrates normally taken for:

1: 1.1: 4.5 - for men and young women, engaged in mental work, and
1: 1.3: 5 - at heavy physical labor.

The diet of healthy individuals living in a temperate climate and is not engaged in physical labor,
proteins must be an average of 15%,
fat - 30%
carbohydrates - 55% of daily caloric diet that provides the energy needs of the body and plastic.

Balanced diet

It should be balanced:

- ***PROTEINS*** **with ESSENTIAL and NON-ESSENTIAL amino acids,**
- ***FATS*** **with different SATURATED and UNSATURATED fatty acids,**
- ***CARBOHYDRATES*** **with different numbers of monomers, and the presence of dietary fibers (cellulose, pectin, etc.),**
- ***VITAMINS*** **and macro-and microelements.**

The human body is subject to the laws of thermodynamics.
According to them, there are SOME PRINCIPLES of GOOD NUTRITION (balanced diet):

***First principle*: the food ENERGY value should correspond to the body's energy expenditure.**

***Second principle*: chemical composition of food matching physiological needs of the body.** proteins, fats and carbohydrates should be in a ratio of 1: 1: 4.

***Third principle*: maximum food DIVERSITY.**

***Fourth principle*: respect for optimum diet.**
Follow regime of diet:(volume, calories, time and frequency of intake)

***Fifth principle*:** Food should be correct, that is, meet sanitary and hygienic requirements (without GMOs)

Macronutrients provide energy:

FATS = 9 Kkal:

ALCOHOL = 7 Kkal:

CARBOHYDRATES = 4 Kkal:

PROTEINS = 4 Kkal:

Dietary Supplement (Food Supplement)

- Definition: ***A product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients:***
  - ***Vitamins***
  - ***Minerals***
  - ***Herbs or other botanicals***
  - ***Amino acids***
  - ***Concentrate, metabolite, constituent, extract or combination of above listed ingredients***

Dietary Supplements

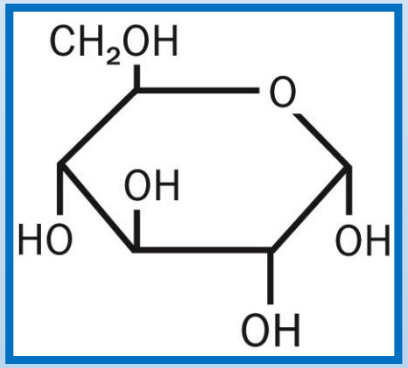
- Distinguished from Drugs:
  - Drug = ***article intended to diagnose, cure, mitigate, treat, or prevent disease***
  - Both intended to affect ***structure*** and ***function*** of body
  - Drug must undergo FDA approval after clinical studies to determine effectiveness and safety
  - ***D/S = no pre-market testing***

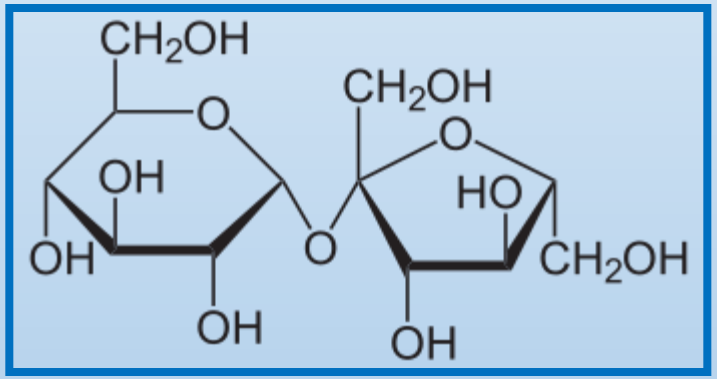
Macronutrients

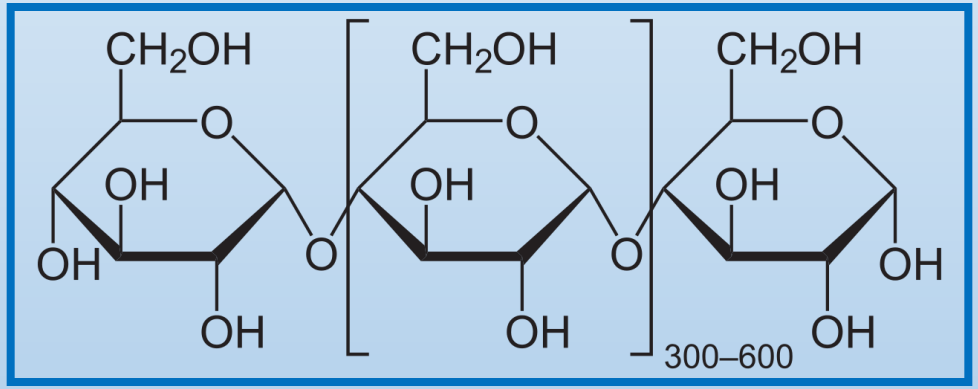
- Macronutrients are defined in several ways.
- The chemical elements humans consume in the largest quantities are carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulphur, summarized as CHNOPS.
- The chemical compounds that humans consume in the largest quantities and provide bulk energy are classified as **carbohydrates, proteins, and fats. Water** must be also consumed in large quantities.
- Calcium, sodium, potassium, magnesium, and chloride ions, along with phosphorus and sulfur, are among the macronutrients because they are required in large quantities, compared to micronutrients, such as vitamins and minerals.

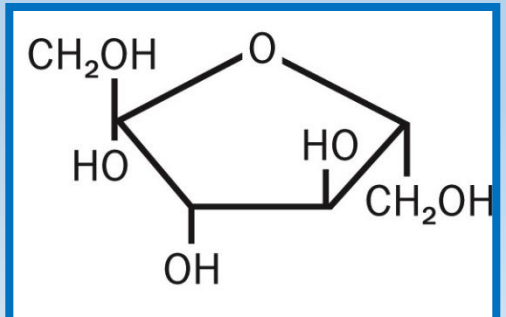
Macronutrients: CARBOHYDRATES

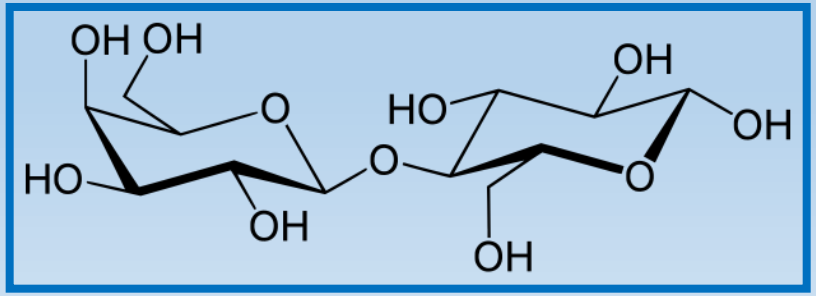
Carbohydrates are compounds made up of types of sugar. Carbohydrates are classified according to their number of sugar units: monosaccharides (such as glucose and fructose), disaccharides (such as sucrose and lactose), oligosaccharides, and polysaccharides (such as starch, glycogen, and cellulose).

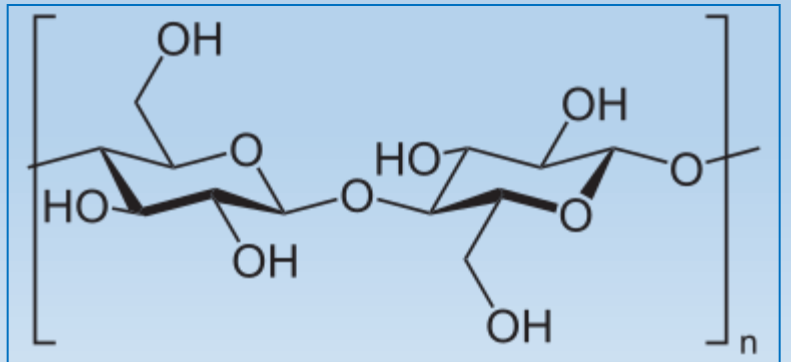












Carbohydrates

- Carbohydrates supply the body with the **energy** it needs to function. They are found almost exclusively **in plant foods, such as fruits, vegetables, peas, and beans**.

There are two groups — **simple carbohydrates and complex carbohydrates**. *Simple carbohydrates*, sometimes called simple sugars, include **fructose** (fruit sugar), **sucrose** (table sugar), and lactose (milk sugar), as well as several other sugars. Fruits are one of the richest natural sources of simple carbohydrates.

Complex carbohydrates include **fiber and starches**. Foods rich in complex carbohydrates include vegetables, whole grains, peas, and beans.

Carbohydrates are the main source of blood glucose, which is a ***MAJOR FUEL*** for all of the body's cells and the only source of energy for the brain and red blood cells.

When choosing carbohydrate-rich foods for your diet, always select unrefined foods such as fruits, vegetables, peas, beans, and whole-grain products, as opposed to refined, processed foods such as soft drinks, desserts, candy, and sugar. Refined foods offer few, if any, of the vitamins and minerals that are important to your health. In addition, if eaten in excess, especially over a period of many years, the large amounts of simple carbohydrates found in refined foods can lead to a number of disorders, including diabetes and hypoglycemia (low blood sugar).

Carbohydrates

Insufficient intake: lack of use of sweet carbohydrates leads to

- a reduction of energy in the body,
- decreases the tonus CNS,
- decreased attention,
- increases sensitivity to cold,
- Stimulate breakdown of fat and proteins, that lead to formation of ***toxins*** on the body
- Insufficient consumption of **food fibers** leads to bad function of colon, premature aging, development of obesity, diabetes, cardio-vascular disease, liver problem and cancer of colon, hemorrhoids, changes in microflora, bad synthesis of vitamins, increase level of toxins which transfer into blood stream

Carbohydrates

Excessive consumption

an excess of carbohydrates leads

- to dental caries,
- disruption of the normal ratio between the inhibitory

and stimulating processes in the nervous system in children and that unbalanced behavior

- **Stimulate inflammatory process**
- Not recommended for persons with diabetes mellitus (especially simple carbohydrates)
- Excessive consumption of simple sugar causes high level of insulin, stimulates the pancreas function and than to **exhaustion and diabetes**
- Excess of carbohydrates transfer into **fat** which is consist of saturated fatty acids
- Excessive consumption of food fibers causes bad absorption of vitamins

Carbohydrates Consumption

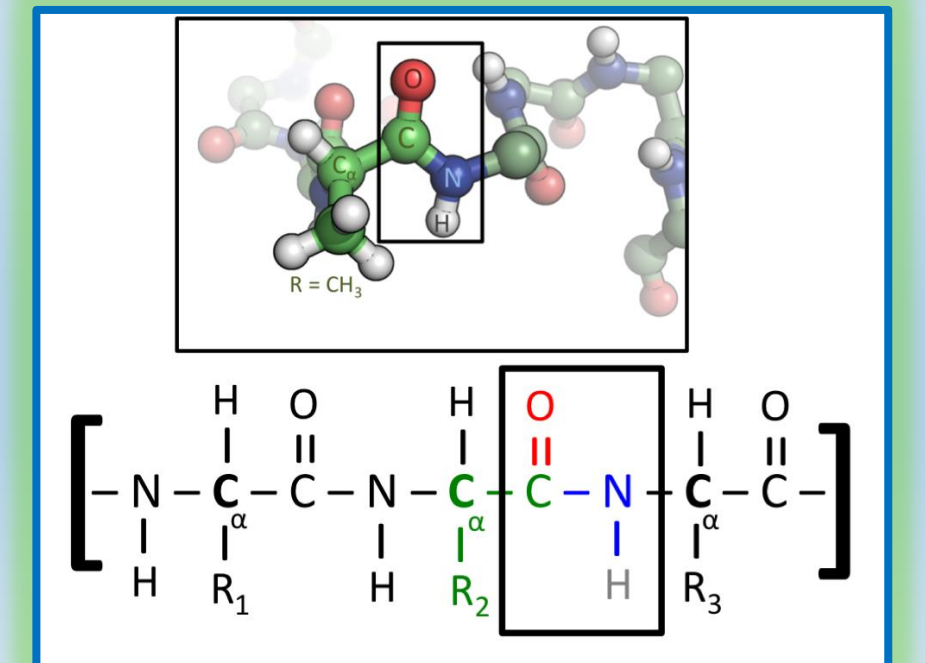
- Total **350-400-500 g** per day:
- Starch 350-400 g,
- Mono-disaccharides **50-100 g** (divided into 3-4 time, by 20-25 g / time)
- Food fibers (cellulose, hemi-cellulose, pectins, inulin) – 25-30 g /day

Macronutrients: PROTEINS

Proteins are organic compounds that consist of amino acids joined by peptide bonds.

Since the body cannot manufacture some of the amino acids (termed essential amino acids), the diet must supply them.

Through digestion, proteins are broken down by proteases back into free amino acids.



Proteins

- Protein foods provided 13% of the energy needs of the body
- 50% protein should be of animal origin
- Minimum of protein consumption is 0,3- 0,4 g a day into 1 kg of human body

Usually this dose is **0,8- 0,9 g a day into 1 kg** of human body
WHO recommends to use **85-90 g a day**

WHO recommends to use proteins with HIGH BIOLOGICAL VALUE

the need for protein in **children 4- 1,5 g** into 1 body kg **a day**

ESSENTIAL AMINOACIDS

Some "**essential amino acids**" must be originally be supplied by your diet, because your body does not have the ability to make (synthesize) them.

Valine:	**cereals, legumes, meat, mushrooms, dairy products, peanuts.**
Isoleucine:	almonds, cashews, chicken, chickpeas (chickpeas), eggs, fish, lentils, liver, meat, rye, most seeds, soybeans.
Leucine:	meat, fish, lentils, nuts, most of the seeds, chicken, eggs, oats, brown (brown) rice.
Lysine:	fish, meat, dairy products, wheat, nuts, amaranth.
Methionine:	milk, meat, fish, eggs, beans, kidney, beans, lentils and soybeans.
Threonine	dairy products, eggs, nuts and beans.
Tryptophan:	beans, oats, dried dates, peanuts, sesame seeds, pine nuts, milk, yogurt, cottage cheese, fish, chicken, turkey and meat.
Phenylalanine:	legumes, nuts, beef, chicken, fish, eggs, cottage cheese, milk. Also formed in the body by the decay of the synthetic sweetener - aspartame is used extensively in the food industry.
Arginine	(conditionally essential amino acid): pumpkin seeds, pork, beef, peanuts, sesame seeds, yogurt, Swiss cheese.
Histidine:	tuna, salmon, pork tenderloin, beef tenderloin, chicken breast, soy beans, peanuts, lentils.

Macronutrients: PROTEINS

- Primary role is to maintain structural and functional integrity
  - Muscle tissue, skin, bone, organs, enzymes, hormones, neurotransmitters, fluid and acid-base balance, cellular transport, and blood clotting
- Proteins are made up of amino acids
- Some amino acids **are essential, others are non-essential,** and still others are “conditionally” essentially

Macronutrients: PROTEINS in Vegetarian Diets

- Vegetarian diets can be a very healthy option
- Complete vs. Incomplete
  - Complete proteins contain all 9 essential amino acids (e.g., milk, egg, chicken, meat, fish)
  - Soy is the only plant-based complete protein
  - Incomplete proteins are lacking in 1 or more essential amino acids
  - It is <u>not</u> necessary to combine incomplete proteins at a meal
    - More important to eat a variety of foods consumed throughout the day to provide the most diverse amino acid and protein sources

Macronutrients: FATS

FATS consist of a glycerin molecule with three fatty acids attached.
Fatty acid molecules contain a -COOH group attached to unbranched hydrocarbon chains connected by single bonds alone (saturated fatty acids) or by both double and single bonds (unsaturated fatty acids).

Fats are needed for:

- construction and maintenance of cell membranes,
- to maintain a stable body temperature,
- and to sustain the health of skin and hair.

Because the body does not manufacture certain fatty acids (termed essential fatty acids), they must be obtained through one's diet.

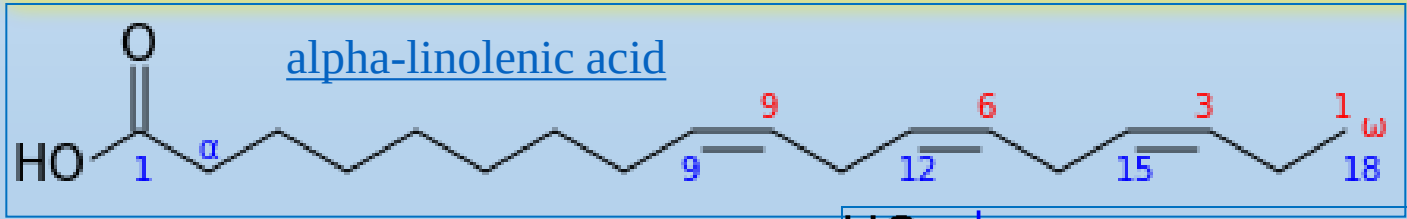
Essential nutrients

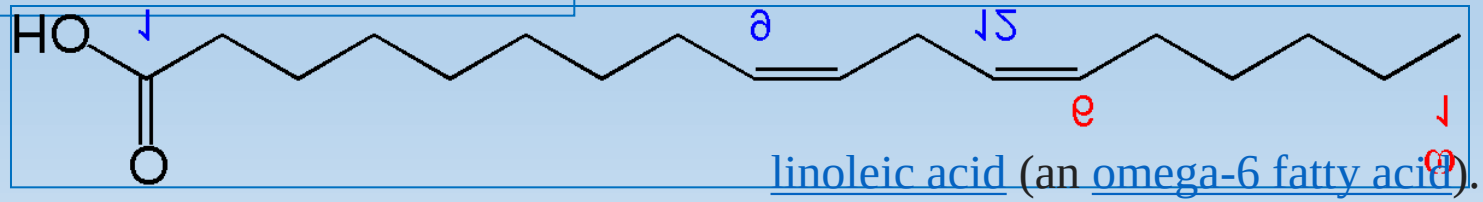
Essential fatty acids, or **EFAs**, are fatty acids that humans and other animals must ingest because the body requires them for good health but cannot synthesize them. Those not essential are **non-essential fatty acids**.

The term "essential fatty acid" refers to fatty acids required for biological processes but does not include the fats that only act as fuel. Essential fatty acids should not be confused with essential oils, which are "essential" in the sense of being a concentrated *essence*.

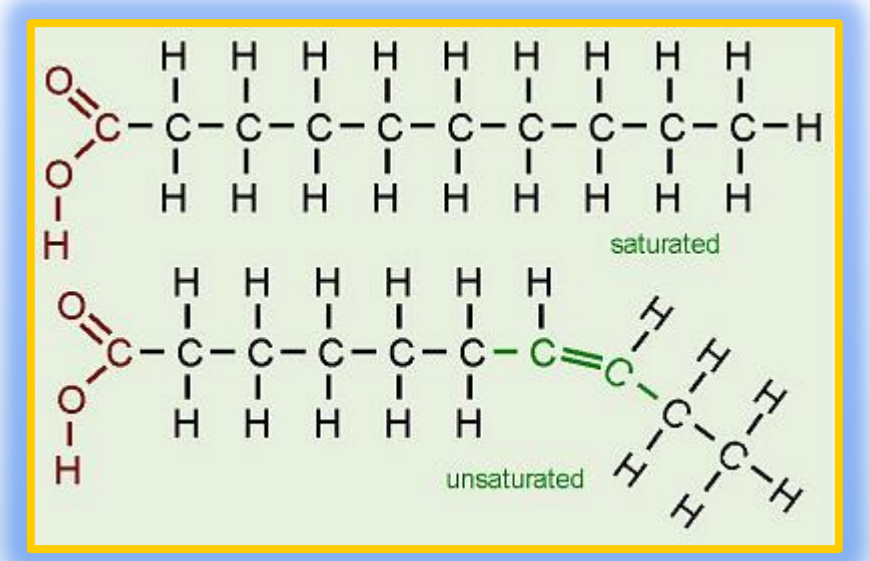
Only two fatty acids are known to be essential for humans: alpha-linolenic acid (an omega-3 fatty acid) and linoleic acid (an omega-6 fatty acid).

Some other fatty acids are sometimes classified as "conditionally essential," meaning that they can become essential under some developmental or disease conditions; examples include docosahexaenoic acid (an omega-3 fatty acid) and gamma-linolenic acid (an omega-6 fatty acid).

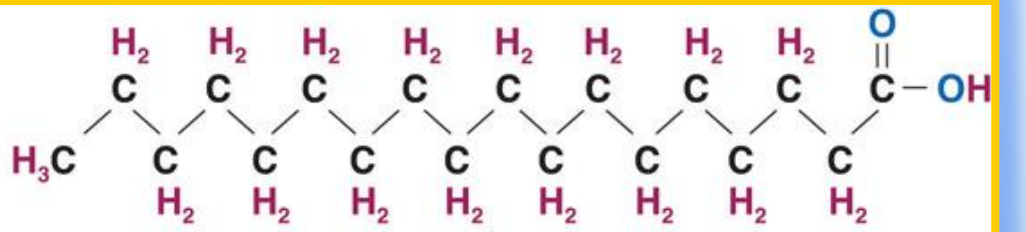




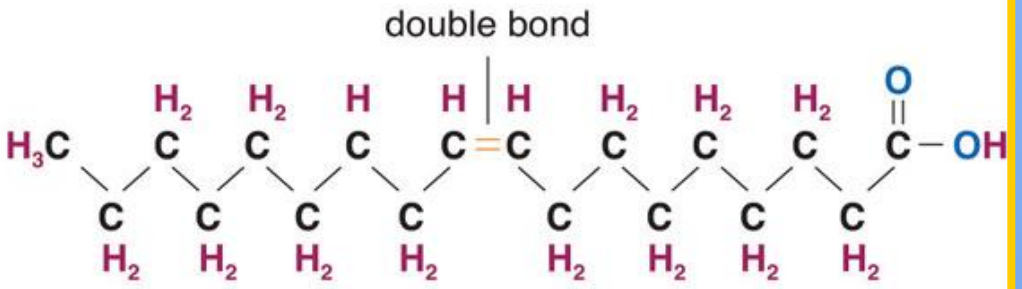
linoleic acid (an omega-6 fatty acid).



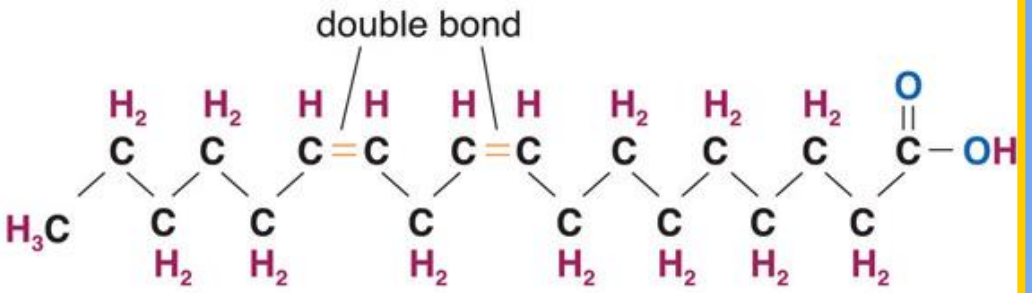
Stearic acid
$C_{18}H_{36}O_2$
A saturated fat



Oleic acid
$C_{18}H_{34}O_2$
A monounsaturated fat



Linoleic acid
$C_{18}H_{32}O_2$
A polyunsaturated fat



FATTY ACIDS Trans fat or Hydrogenated oil (fat)

Proteins **Excessive** consumption

- excessive protein in the diet leads to increased formation of ammonia in tissues,
- Toxic products in the large intestine,
- large load on the liver, in which is their disposal
- and kidney, because they are excreted

Insufficient protein intake:

- continued lack of protein leads to a suppression of **pituitary-adrenal system**, the deterioration process of formation of **conditioned reflexes**, reduced **thyroid function**

- Insufficient protein intake reduces the body's **resistance to harmful factors**

Macronutrients: FATS

- Unsaturated dietary fat
  - Monounsaturated fatty acids (MUFA)
    - Olive and canola oils
  - Polyunsaturated fatty acids (PUFA)
    - Corn, safflower, sunflower, fish oils
- Trans fats
  - Very small amount of trans fats are naturally occurring in dairy foods, meat, and darker-meat poultry
- Cholesterol from the diet
  - Only found in animal-based foods
  - Whole fat dairy products, egg yolks, meat, poultry skin and dark poultry meat

Macronutrients: FATS

- Essential for health:
  - Cellular membrane structure and function,
  - Myelin sheath in nervous system,
  - Fat tissue keeps us warm, provides some protection to our organs.
- Concentrated **source of calories** (9 kcal/gm)
  - Saturated dietary fats:
    - Animal-based
      - butter, lard, whole and 2% milk, meat, skin
    - Plant-based
      - coconut and coconut oil, palm kernel oil, palm oil, cocoa butter

Saturated fat deficiency

- signs and symptoms of fat deficiency:
- skin disease (eczema),
- hair loss,
- liver disease,
- nervous system,
- infertility,
- heart disease,
- growth retardation

PUFA deficiency (polyunsaturated fat)

➢**Daily 5-10 g**

signs and symptoms of deficiency:

➢general or chronic ailments from mild fatigue to heart attack,
➢exacerbation of cardiovascular disease,
➢an increase of blood pressure,
➢joint pain, arthritis,
➢impaired digestion, constipation,
➢low immunity,
➢frequent colds,
➢sore throat,
➢depression,
➢inattention, pomyati deterioration,
➢fatigue,
➢malaise,
➢dryness of mucous membranes, tear ducts, mouth
➢Daily 5-10 g

Macronutrients:

- **Ethanol** (**C_2H_5OH)** supplies calories.
- For spirits (vodka, gin, rum, etc.) a standard serving in the United States is 1.5 US fluid ounces (44 ml), which at 40% ethanol (80 proof) would be 14 grams and 98 calories.
- At 50% alcohol, 17.5 grams and 122.5 calories.
- Wine and beer contain a similar amount of ethanol in servings of 5 US fluid ounces (150 ml) and 12 US fluid ounces (350 ml), respectively, but these beverages also contain non-ethanol calories.
- A 5-ounce serving of wine contains 100 to 130 calories.
- A 12-ounce serving of beer contains 95 to 200 calories. According to the U.S. Department of Agriculture, based on NHANES 2013–2014 surveys, women ages 20 and up consume on average 6.8 grams of alcohol per day and men consume on average 15.5 grams per day.
- Ignoring the non-alcohol contribution of those beverages, the average ethanol calorie contributions are 48 and 108 cal/day, respectively.

- Alcoholic beverages are considered empty calorie foods because, other than calories, they contribute **no essential nutrients**.

essential nutrients

An **essential nutrient** is a nutrient required for normal human body function that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health (e.g. niacin, choline), and thus must be obtained from a dietary source.

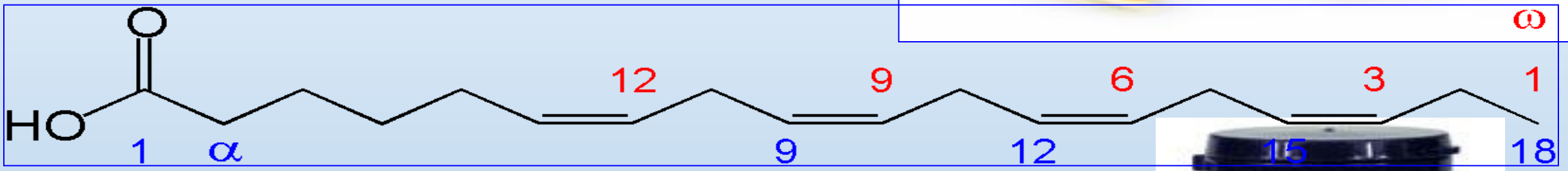
Essential amino acids

Essential fatty acids

Essential vitamins

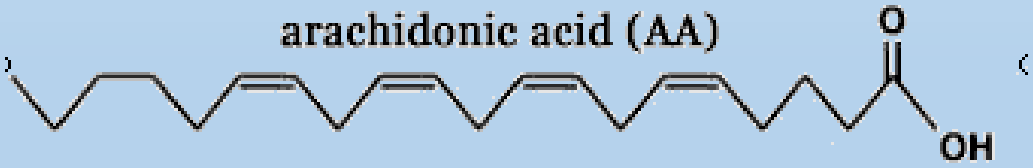
ESSENTIAL FATTY ACIDS =

= PUFA = omega acids = ω-3,6,9,12 acids



eicosapentaenoic acid (EPA)

arachidonic acid (AA)



docosahexaenoic acid (DHA)

Omega-3 Essential Fatty Acids

"Omega-3 fatty acids are most important, as they bring balance to our hormones, reduce inflammation, regulate our blood sugar, prevent blood clotting, keep our cholesterol and triglycerides in balance, relax our blood vessels, and make our cells healthy and resilient.

- The Natural Hormone Makeover by Phuli Cohan

flaxseeds

navy beans

pecans

cold-water salmon

walnuts

leafy greens

cold-pressed olive oil

kidney beans

winter squash

ESSENTIAL VITAMINS:

Essential Vitamins:

biotin (vitamin B7, vitamin H),

choline (vitamin Bp),

folate (folic acid, vitamin B9, vitamin M),

niacin (vitamin B3, vitamin P, vitamin PP),

pantothenic acid (Vitamin B5),

Riboflavin (vitamin B2, vitamin G),

Thiamine (vitamin B1),

Vitamin A (retinol)

Vitamin B6 (pyridoxine, pyridoxal, pyridoxamine or)

Vitamin B12 (cobalamin)

Vitamin C (ascorbic acid)

Vitamin D (ergocalciferol or cholecalciferol)

Vitamin E (tocopherol)

Vitamin K (naphthoquinones).

MICRONUTRIENTS (**amino acids, essential fatty acids, vitamins and provitamins, minerals, dietary fiber and other organic compounds**) - a substance that required by the body **in small amounts** (on the order of a gram and milligrams) and are involved in the absorption of energy, regulation of the functions and implementing processes of growth and development.

Micronutrients: Vitamins

Water-soluble

- *Not stored* in the body
- *Deficiencies* may develop quickly if inadequate intake occurs
  - B vitamins
    - Folic acid (folate)
    - B12 (cobalamin)
    - Thiamin (B1)
    - Riboflavin (B2)
    - Niacin (B3)
  - Vitamin C

Fat-soluble

- *Stored* in liver and fat tissue for long periods of time
- Deficiencies develop very slowly
  - Vitamin A
  - Vitamin D
  - Vitamin E
  - Vitamin K

SIGNS OF NUTRITIONAL DEFICIENCIES

EYES

- Dark circles or bags under the eyes: Allergies, food intolerances, dehydration
- Poor night vision: Vitamin A
- Ruptured blood vessels in the eyes: Vitamin C
- Nearsightedness: Vitamin D
- Pale lower eyelid: Iron

TEETH & GUMS

- Bleeding gums: Vitamin C, folic acid
- Crowded teeth: Calcium, Vitamin K

HAIR

- Hair loss: B2, B5, Biotin, D, Zinc
- Dry hair: Vitamin A, E, Omega 3, Protein, Iodine, Selenium, Biotin
- Dandruff: Selenium, Omega 3, Vitamin A

NAILS

- Spoon shaped nails: B12, Iron
- White marks: Calcium or Zinc
- Pale nails: Iron, Biotin
- Brittle nails: Calcium, Magnesium, Iodine
- Cuticles tear easily: Protein

MUSCLES & JOINTS

- Muscle cramping: Magnesium, B1, B2,B6
- Twitching: B1, B2, B3, B6, B9, Vitamin D, Magnesium, Calcium,
- Edema/Swelling: B1, B6, Potassium
- Numbness or tingling: B12, B5
- Clicking Joints: Manganese

MOUTH

- Canker sores: B3, B12, Folic acid,Calcium
- Cracks in the corner of the mouth: B2
- Weak tooth enamel: Vitamin A, D, K Calcium
- Painful tongue: B2, B3, Folic Acid
- Loss of smell or taste: Zinc

SKIN

- Bumps on the back of the arms: Vitamin A
- Dry or rough skin: Vitamin A, E
- Unusual nosebleeds: Vitamin C
- Easy bruising: Vitamin C
- Acne during menstruation: B6
- Dermatitis: B2, B3, Biotin
- Red stretch marks: Zinc

EMOTIONAL/MENTAL

- Depression: B1, B5, Biotin, PABA
- Dementia: B1, B3, B12, folic acid,
- Nervousness/Irritability: B1,B6, B5
- Insomnia: B3, B5, B6, D3
- Dizziness: Iron, B2, B12

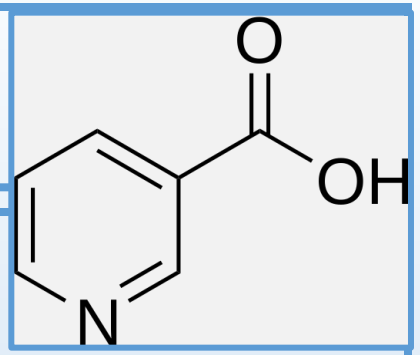
MICRONUTRIENTS: Major Minerals and their Common Food Sources

- **Calcium**
  - dairy products, dark leafy green vegetables, tofu
- **Phosphorus**
  - Animal proteins, dairy foods, legumes; wide-spread in food supply
- **Magnesium**
  - Whole grains, "**hard**" water
- **Sodium**
  - Processed foods, preserved foods, added salt in cooking and at the table
- **Potassium**
  - Fruits and vegetables

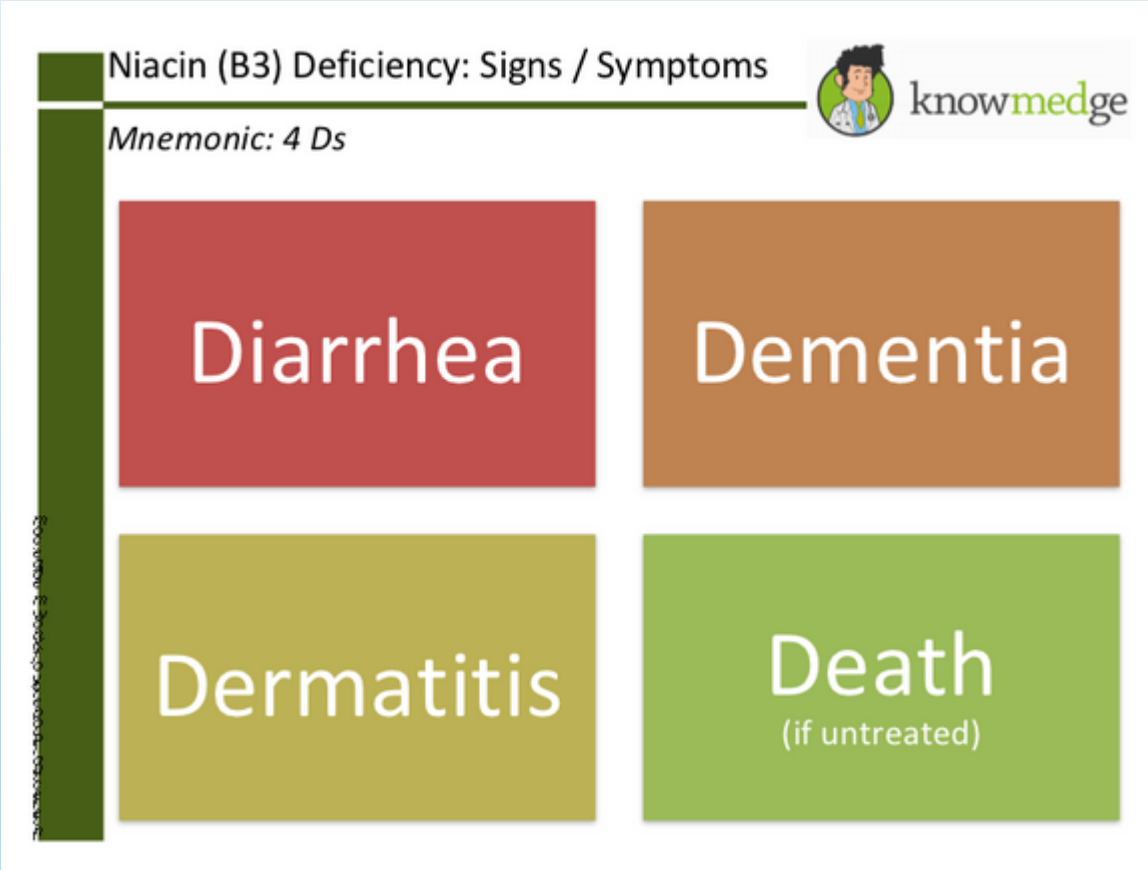
Micronutrients: Trace Minerals and their Common Food Sources

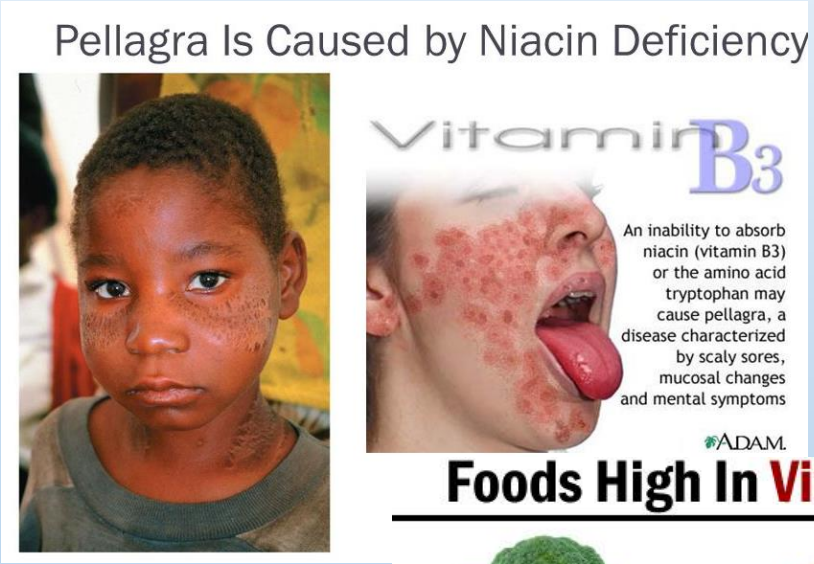
- **Copper**
  - Liver, shellfish, lentils, mushrooms, cashews, sunflower seeds
- **Iodine**
  - Iodized salt, seafood
- **Iron**
  - ***Most well absorbed***: Beef, dark poultry meat, whole eggs, tuna, salmon, legumes, iron fortified cereals, liver
  - ***Less well absorbed***: prunes, raisins, apricots, dark leafy green vegetables, brown rice
- **Selenium**
  - Brazil nuts, tuna, beef, brown rice
- **Zinc**
  - Oysters, meat, poultry, legumes, shellfish, whole grains

Micronutrient (vitamin) Deficiency



- **Pellagra** (Niacin deficiency)
  - The 4 D's: diarrhea, dermatitis, dementia and death





Micronutrient (vitamin) Deficiency

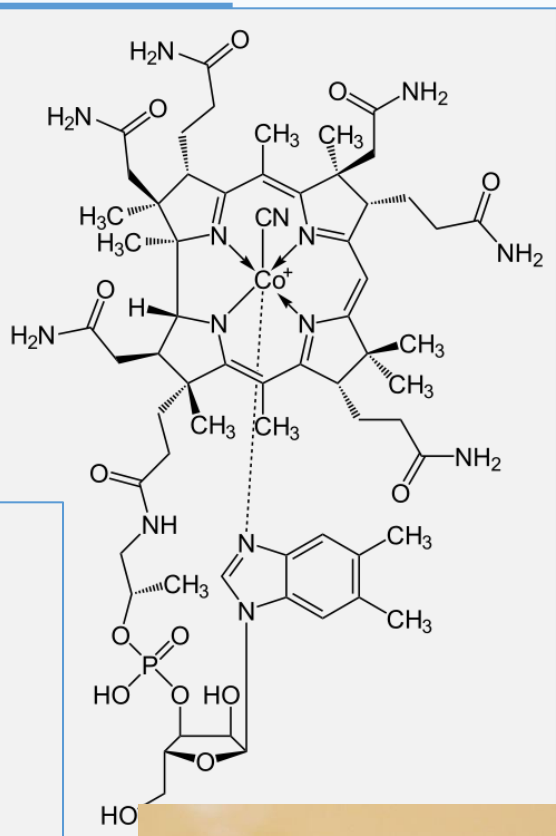
Pernicious Anemia (B12 deficiency)

- Caused from autoimmune destruction for stomach cells needed for intrinsic factor production

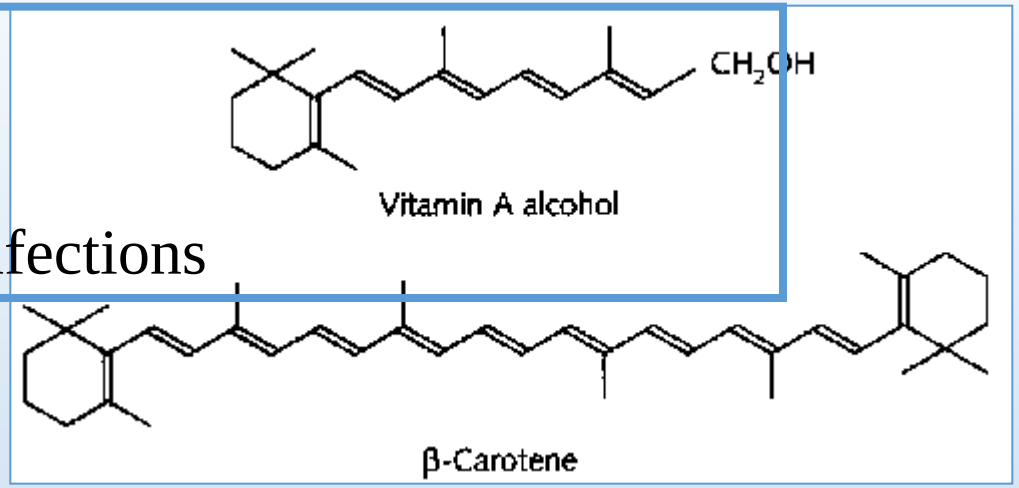
Vitamin B12 deficiency can happen if you have

- Atrophicgastritis, in which your stomach lining has thinned
- Pernicious anemia, which makes it hard for your body to absorb vitamin B12
- Surgery that removed part of your stomach or small intestine, including weigt loss surgery
- Conditions affecting the small intestine, such as Crohn's disease, celiac disease, bacterial growth, or a parasite
- Heavy drinking
- Immune system disoders, such as Graves disease or lupus
- Long-term use of acid-reducing drugs. Stomach acids help break down animal proteins that have vitamin B12.

You can also get vitamin B12 deficiency if you're a **vegan**

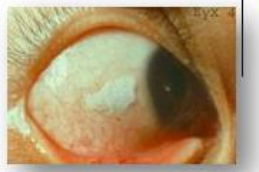


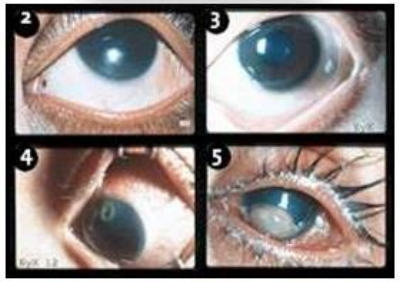
- Vitamin A deficiency
- Leading cause of preventable blindness in children
- Increases the risk of disease and death from severe infections

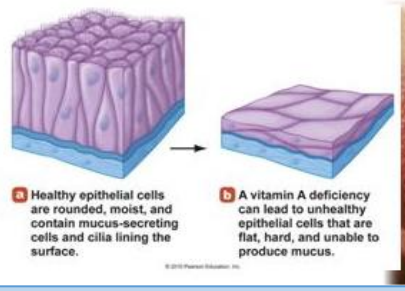


Vitamin A deficiency

- More obvious deficiency symptoms than other vitamins
  - Night blindness
    - Leading cause of blindness in third world countries
  - Cell keratinization
    - Dry skin (treatment and pregnancy?)
    - Xerophthalmia (dryness of cornea & conjunctiva)
  - Reproductive failure
  - Abnormal skeletal development/maintenance
  - Immune dysfunction
  - Respiratory infection.





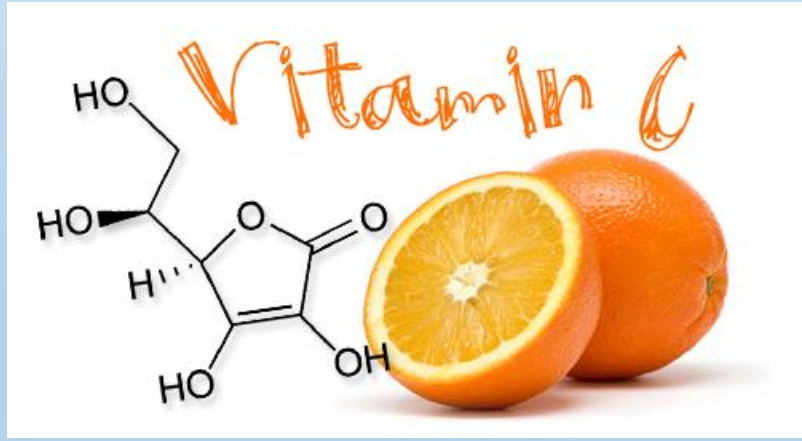


Micronutrient (vitamin) Deficiency

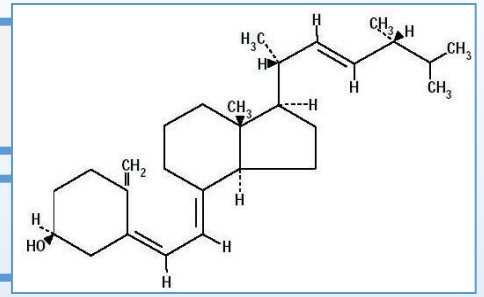
Vitamin C Deficiency Diseases such as:

* scurvy
* anemia
* spongy gums
* bleeding from mucous membranes
* formation of liver spots on the skin
* open wounds
* loss of teeth
* death

Dr. Sloan, MD. - www.drsloanmd.com



Micronutrient (vitamin) Deficiency



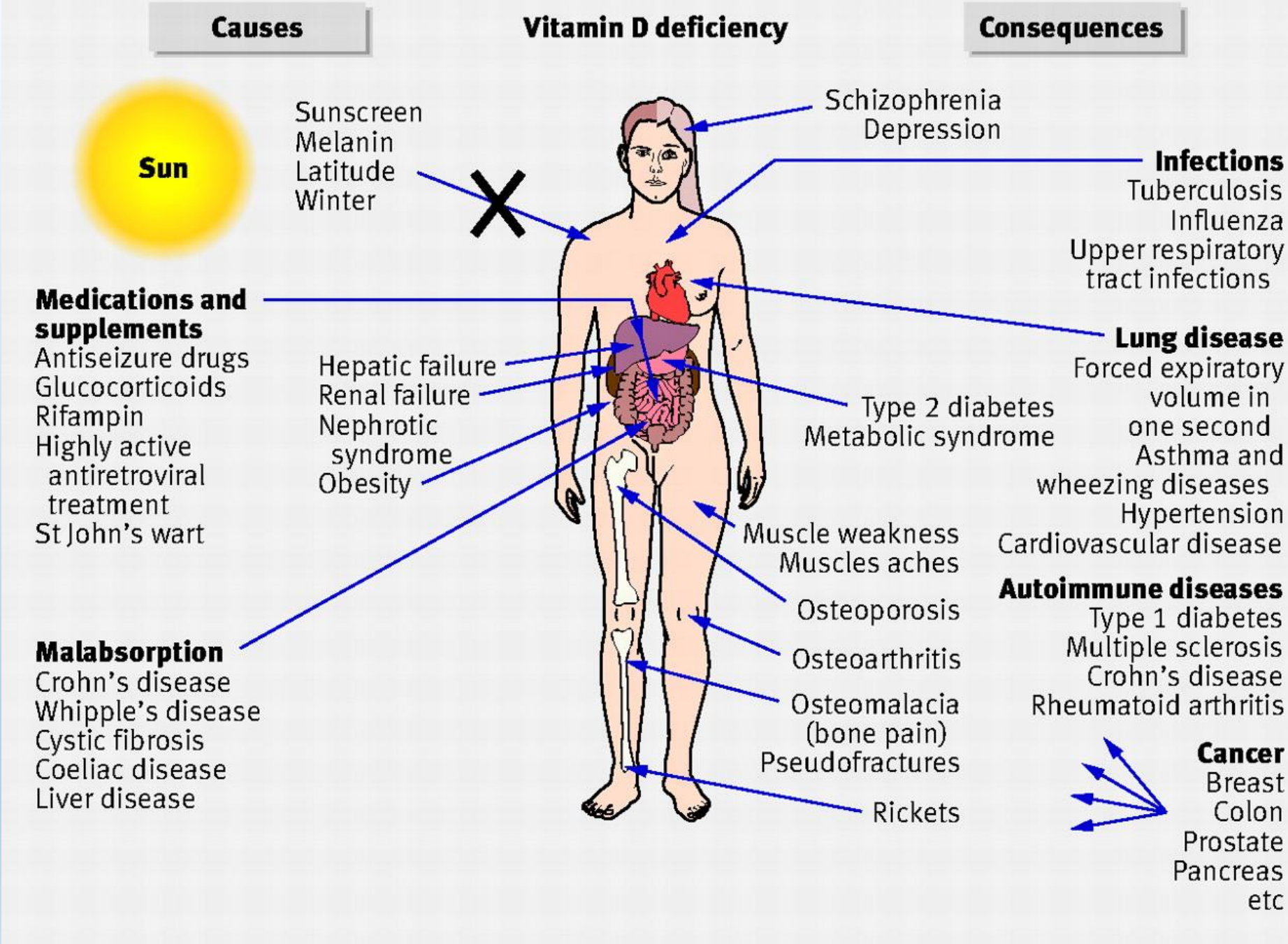
- Rickets and Osteomalacia (**vitamin D** deficiency)

Vitamin D is an essential vitamin required by the body for the absorption of calcium, bone development, immune functioning, and alleviation of inflammation.

Vitamin D **deficiency** can lead to **rickets**, a weakened **immune** system, increased **cancer** risk, poor **hair** growth, and osteomalacia.

Excess vitamin D can cause the body to absorb too much calcium, leading to increased risk of heart disease and kidney stones.

Multiple sclerosis (MS) is more common far away from the sunny equator. For years, experts suspected a link between sunlight, vitamin D levels, and this autoimmune disorder that damages the nerves. One newer clue comes from a study of a rare gene defect that leads to low levels of vitamin D – and a higher risk of MS.


Causes
Vitamin D deficiency
Consequences
Sun
Sunscreen
Melanin
Latitude
Winter
Schizophrenia
Depression
Infections
Tuberculosis
Influenza
Upper respiratory tract infections
Medications and supplements
Antiseizure drugs
Glucocorticoids
Rifampin
Highly active antiretroviral treatment
St John's wart
Hepatic failure
Renal failure
Nephrotic syndrome
Obesity
Type 2 diabetes
Metabolic syndrome
Lung disease
Forced expiratory volume in one second
Asthma and wheezing diseases
Hypertension
Cardiovascular disease
Muscle weakness
Muscles aches
Osteoporosis
Osteoarthritis
Osteomalacia (bone pain)
Pseudofractures
Rickets
Autoimmune diseases
Type 1 diabetes
Multiple sclerosis
Crohn's disease
Rheumatoid arthritis
Malabsorption
Crohn's disease
Whipple's disease
Cystic fibrosis
Coeliac disease
Liver disease
Cancer
Breast
Colon
Prostate
Pancreas
etc

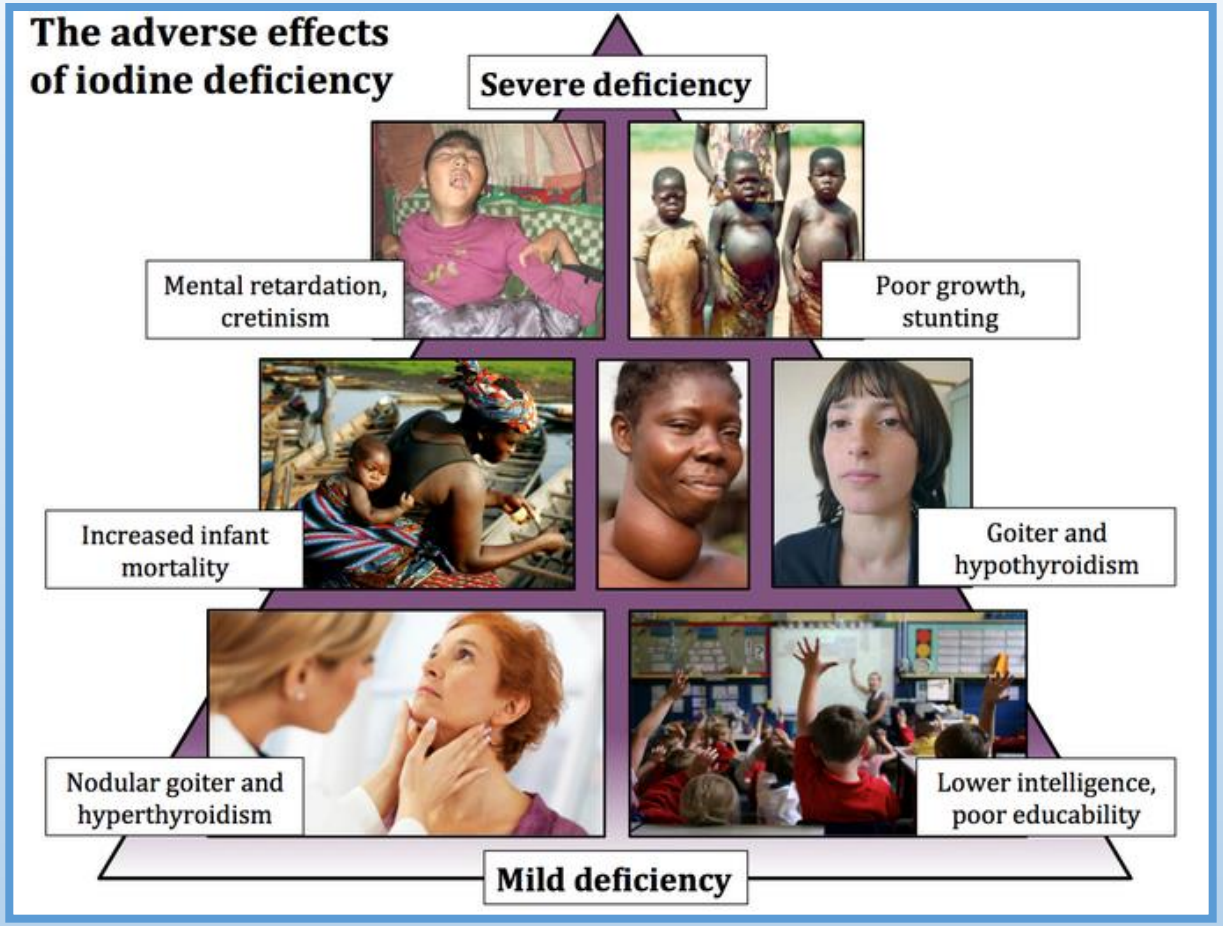
Micronutrient (mineral) Deficiency

Iodine

–Regions at greatest risk include countries of the former Soviet Union, south Asia and parts of Africa

–Thyroid enlargement (goiter) is an early and visible sign of iodine deficiency

Test for Iodine Deficiency



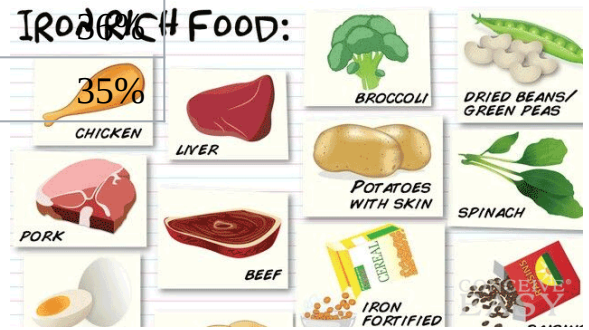
Micronutrient (mineral) Deficiency

- **Iron**
  - Iron deficiency anemia
  - Fatigue, rapid heart rate, and rapid breathing on exertion are the most common signs
- **Selenium**
  - Kashin disease

- Iron deficiency anemia
- Fatigue, rapid heart rate, and rapid breathing on exertion are the most common signs

Richest foods in *heme iron*

Food	Serving Size	Iron	% Guideline
clam	100g	28 mg	**155%**
pork liver	100g	18 mg	**100%**
lamb kidney	100g	12 mg	69%
cooked oyster	100g	12 mg	67%
cuttlefish	100g	11 mg	60%
lamb liver	100g	10 mg	57%
octopus	100g	9.5 mg	53%
mussel	100g	6.7 mg	37%
beef liver	100g	6.5 mg	36%
beef heart	100g	6.4 mg	35%



Richest foods in *non-heme iron*

Food	Serving Size	Iron	% Guideline
raw yellow beans	100g	7 mg	**35%**
spirulina	15g	4.3 mg	24%
falafel	140g	4.8 mg	24%
soybean kernels	125ml=1/2cup	4.6 mg	23%
spinach	125g	4.4 mg	22%
lentil	125ml=1/2cup	3.5 mg	17.5%
treacle (CSR Australia)	20ml=1Tbsp	3.4 mg	17%
molasses (Bluelabel Australia)	20ml=1Tbsp	1.8 mg	9%
candied ginger root	15g~3p	1.7 mg	8.5%
toasted sesame seeds	10g	1.4 mg	7%
cocoa (dry powder)	5g~1Tbsp	.8 mg	4%

Deficiency

Mg

- Changes is nerve & muscle function such as muscle weakness or spasm.
- Heart conditions such as arrhythmia, irregular contractions, and increased heart rate.
- Weakening of the bones
- Imbalanced blood sugar
- Elevated blood pressure
- High excitability
- Brain damage
- Unstable internal cell structure
- Inadequate hormone production
- Headaches
- Seizures
- Depression
- Nausea
- Vomiting
- Lack of appetite

Deficiency

Mg

Causes of Deficiency

Mg

- Chronically low intake of Mg
- Gastrointestinal system disorders that cause a loss of Mg or limit Mg absorption
- Excessive loss of Mg in the Urine which could be due to:

  -Use of Diuretics, some antibiotics, and some medicines used to treat cancer

  -Alcohol consumption

  -Poorly controlled diabetes

XENOBIOTICS - **alien** to living organisms chemicals naturally non biotic cycle, and, as a rule, directly or indirectly generated by economic person's activity. These include: **pesticides, fertilizers, detergents (surfactants), radionuclides, synthetic dyes, free metals (cadmium, lead, mercury), petroleum products**, **plastics** (especially plastic packaging - plastic bags, plastic bottles, etc.) polycyclic aromatic hydrocarbons and halogenated and others, which **adversely affect the body and cause disruption of its activities**.

FUNCTIONAL FOOD

- **Functional food** is a food where a new ingredient(s) (or more of an existing ingredient) has been added to a food and the new product has a new function (often one related to health-promotion or disease prevention).
- Functional foods are one of the fastest-growing segments of the food industry.
  In some countries, functional foods have already become part of the dietary landscape.

Functional food

Probiotics

Prebiotics

Lycopen

Food fibers

Omega acids - 3,6,9,12

Fructose

Vitamins

- **Functional foods** - are foods including whole foods and fortified, enriched, or enhanced foods or dietary components that may reduce the risk of chronic disease and provide a health and physiological benefit beyond the traditional nutrients it contains.

Examples of Disease - risk Reduction Claims:

- Fruits/vegetables– reduced risk of cancer
- Saturated fat- increased risk of heart disease
- Sodium- increased hypertension
- Folic acid- reduced risk of neural tube defects
- Soy- reduced heart disease

Examples of Functional Foods

Oats	Reduces cholesterol
Soy	Reduces cholesterol, certain cancers, heart disease
Eggs with Omega-3 fatty acids	Reduces heart disease
Broccolli and other cruciferous vegetables	High in antioxidants

Referenses

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