Unit B2: Health & Wellness Profiling

Unit B3: Early Cancer Screening & Gut Microbiome

Previous Talks

Unit A1: CBC, Urinalysis, Stool Analysis, BP, Cardiac Examination

Unit A2: Blood Glucose, Lipid Profile, Uric Acid, Inflammatory markers

Unit A3: Liver Function, Renal Function, Thyroid function, Cardiac markers

Unit B1: Viral Ag & Ab tests, Common Cancer Biomarker tests,

Lab Tests for Wellness
Early Cancer Screening & Gut Microbiome

Dr. Cornelia Man

Wellness Profiling *FEB 21, 2023*

1. Biological/Cellular Aging
2. Anti-oxidants 抗氧化劑 & Micronutrients 微量元素 Profiling
3. Heavy Metal Toxicity

Chronic Disease Prevention & Gut Microbiome *Mar 7, 2023*

1. Liquid Biopsies 液态活檢 (CTC, CtDNA/CfDNA)
2. Molecular Microbiology分子微生物學: Close look at our Gut Microbiome

Most of the chronic diseases are caused by Cellular Aging

Causes of Cellular Aging

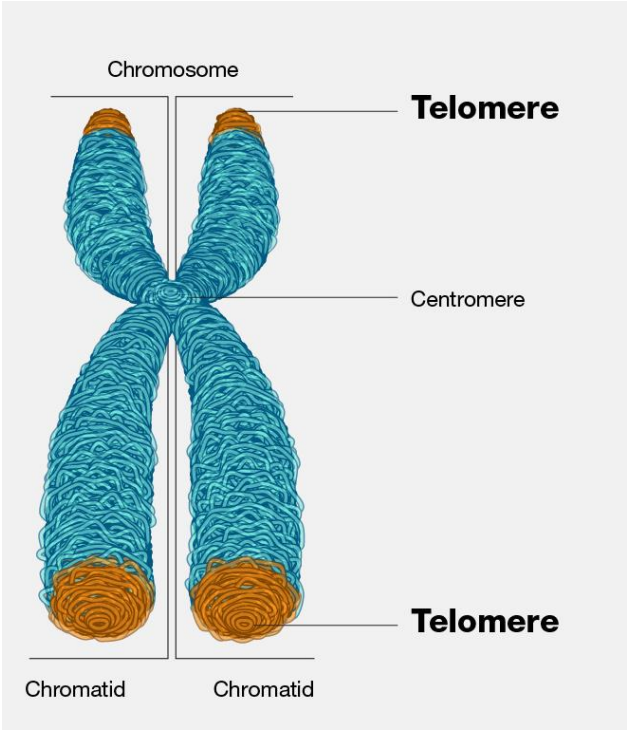
1. Telomere 端粒 Shortening or damage
2. DNA Damage & inability to repair DNA
3. Oxidative Stress 氧化應激
4. Epigenetic Dysregulation 表觀遺傳失調 leading to abnormal gene expression
5. Mitochondria Dysfunction 線粒體功能障礙

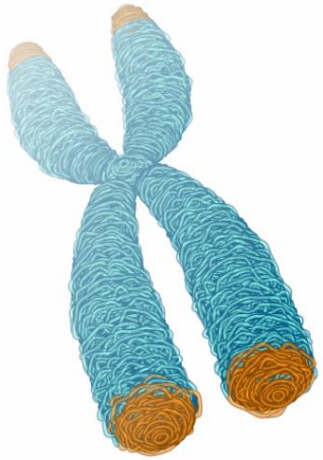
Telomere and Cellular Aging

What is Telomere 端粒?

Telomere is a region of repetitive DNA sequences at the end of a chromosome.

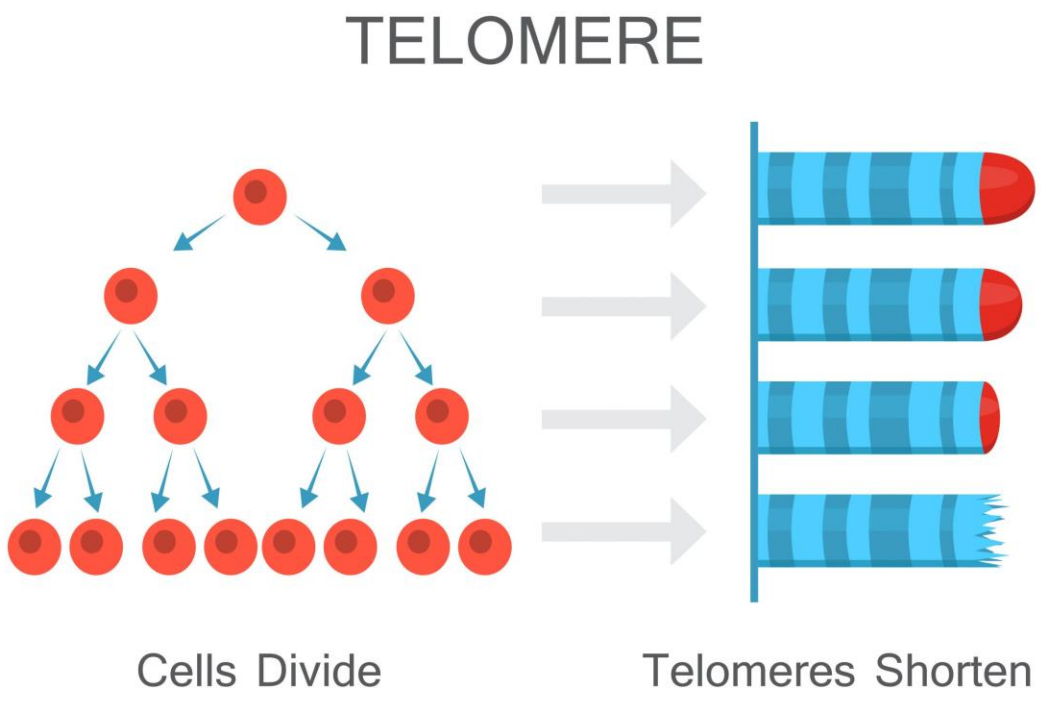
Telomeres protect the ends of chromosomes





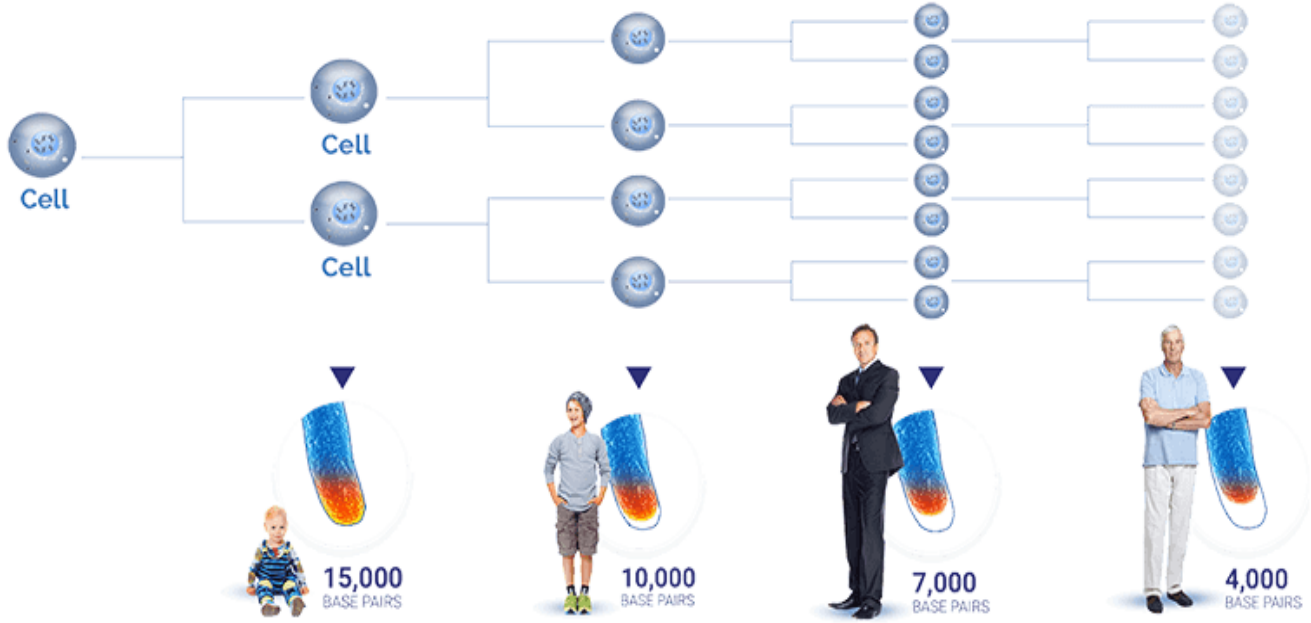
Telomere Length as a Biomarker in Biological & Cellular Aging

- Telomere is the key biomarker in aging process.
- Each time a cell divides, the telomeres become shorter.
- Eventually, they become so short that the cell can no longer divide. The cell will senesce 衰老 or die



Disease Indications associated with Telomere Shortening

- Cellular senescence or cell death
  - Affect lifespan of an individual
- Increased Incidence of diseases:
  - Cancer
  - Cardiovascular diseases
  - Neurodegenerative diseases
  - Diabetes
  - Infertility

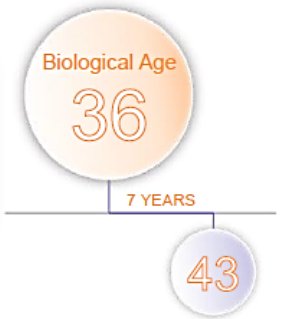


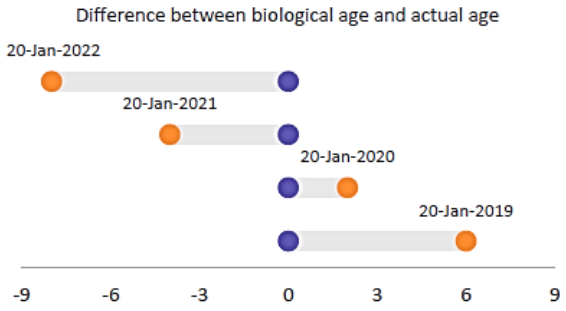
Telomere Length Test

YOUR TEST RESULTS

Your Average Telomere Length is: **7.75 kilobases (kb)**

Your biological age (by Telomere) is
36 years old
Based on the Telomere length, you are **younger** than your actual age.





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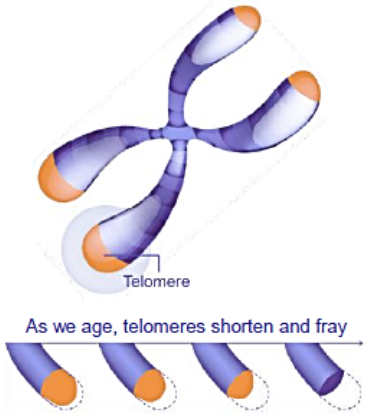
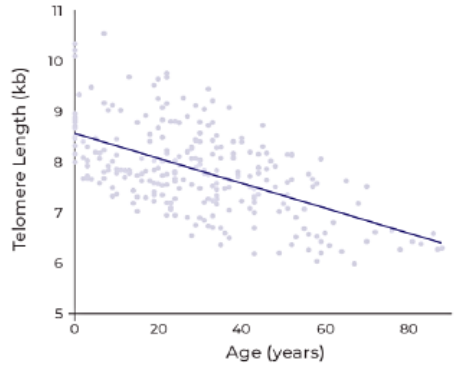
ABOUT THIS TEST

The test is designed to measure the average telomere length of human white blood cells. Telomere length is compared to that of a single copy gene. The reference genomic DNA sample with known telomere length serves as a reference for calculating the absolute telomere length. The telomere length distribution for the healthy individuals were analyzed based on the established studies. Telomere length is a useful marker of biological aging. Monitoring biological age can be used to assess the aging process and to determine how external factors influence aging rates.





Registered MLT: LO Pui Ying

Report Date: Version 1.0

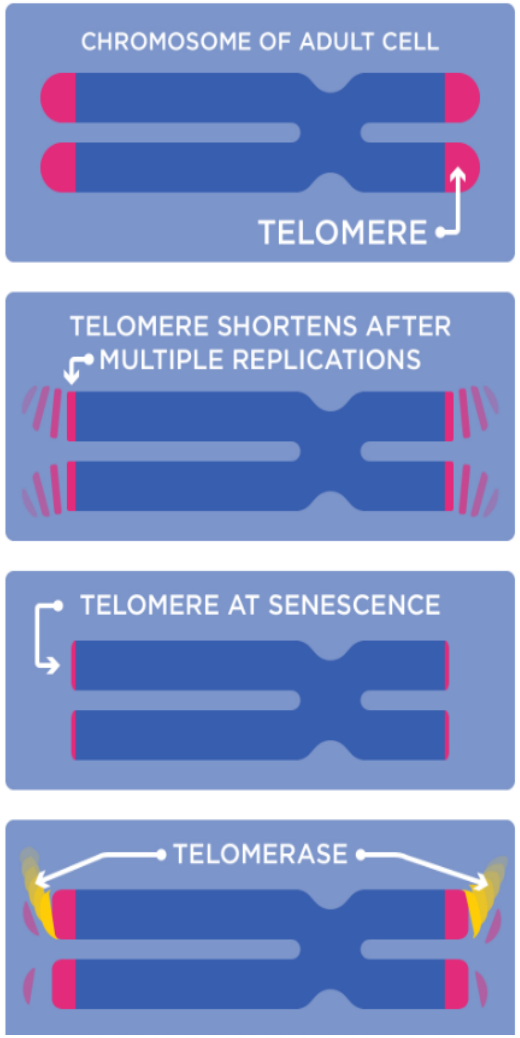
LIMITATIONS AND DISCLAIMER

TELO-VITA™ is measuring the average telomere length of total white blood cell population in the collected specimen. For research use only; not for application in clinical or in vitro diagnostic

- qPCR based 定量核酸檢測
- Sensitive method to quantify Telomere Nucleic acid/DNA Sequence length
- Sample needed: 10 ml peripheral blood

Telomerase 端粒酶 & Telomerase Activators

- An enzyme called telomerase can keep adding more of telomeric repeating sequences to the end of the chromosomes
- Telomerase is less active, leading to telomeres shortening over time:
  - Aging
  - Oxidative stress 氧化應激/ Antioxidants deficiency 抗氧化劑缺乏
  - Inflammation
  - Mitochondrial dysfunction 線粒體功能障礙
- Telomerase activators:
  - TCM: Astragalus Membranaceus 蒙古黃芪/膜莢黃芪, Centella Asiatica 雷公根
  - Vitamin C, Vitamin D

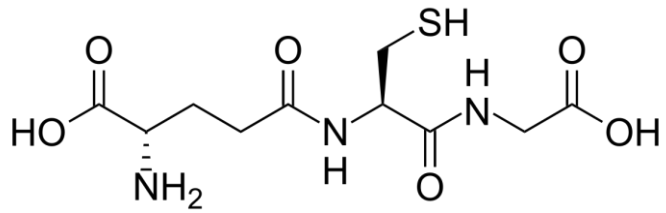


Oxidative Stress

Antioxidants & Micronutrients Detection

Antioxidant: Glutathione

- Very important Antioxidant produced in our body
- Natural Detox Agent 天然排毒劑
- Roles in:



1. Reducing Oxidative Stress
2. Combating Free Radicals 自由基 including Reactive Oxygen Species ROS 活性氧
3. Detoxification of carcinogens 致癌物 & toxins 毒素
4. Anti-Inflammation
5. Anti-pathogen 病原體
6. Worked with Vitamin C

Indications with decreased Glutathione level

- Not directly from our diet
- Produced in the liver
- Decreased glutathione level in blood have been associated with:
  Parkinson's disease, liver disease, renal disease, cancer, Stroke
- Food source:
  Sulphur-rich 富含硫磺 food containing Cysteine半胱氨酸 for Glutathione Production: Beef, Fish, Broccoli, Cauliflower, garlic, onion. Natural source: mushroom, spinach, avocados, asparagus.

  Reference daily intake: 500mg.

How do we test for Glutathione Deficiency ?

1. Glutathione Level in RBC

The Glutathione Tripeptide can be tested by Spectrophotometry-based Protein Assay or liquid chromatography-based methods

2. Glutathione S Transferase (GST) concentration in plasma

GST catalyzes the conjugation of substrates to Glutathione.

GST enzyme can be tested by Enzyme Immunoassay

3. Genetic Tests (NGS SNPs Sequencing)

GSTT/GSTM gene family is often polymorphic or deleted in Chinese Population

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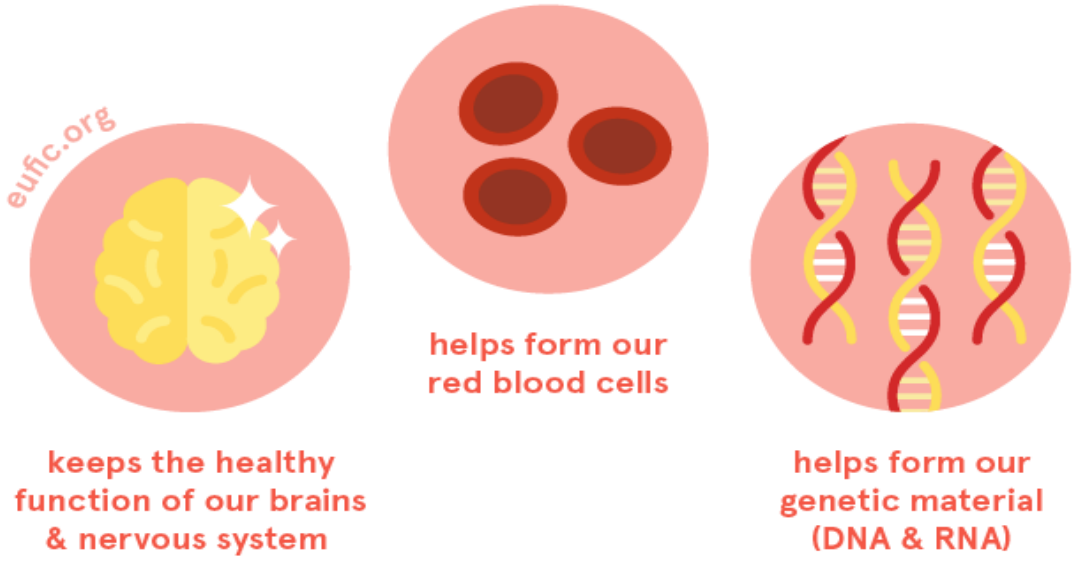
3. Genetic Tests (NGS SNPs Sequencing 次世代定序單核苷酸多態性測序)

GSTT/GSTM gene family is often polymorphic 多態的 or deleted in Chinese Population

Active Vitamin B12

- Function :
  - Produce RBCs
  - Maintaining brain and nervous system health
  - Required for copying DNA and repairing DNA



- Reference daily intake: 2.4 micrograms ug daily.

Active Vitamin B12

- Food source:
  - Fish, shellfish, liver, red meat, eggs, poultry, dairy products
- Conditions associated with abnormal Vitamin B12 level:
  - increase risk of depression, cognitive decline and dementia

How do we test for Active Vitamin B12 ?

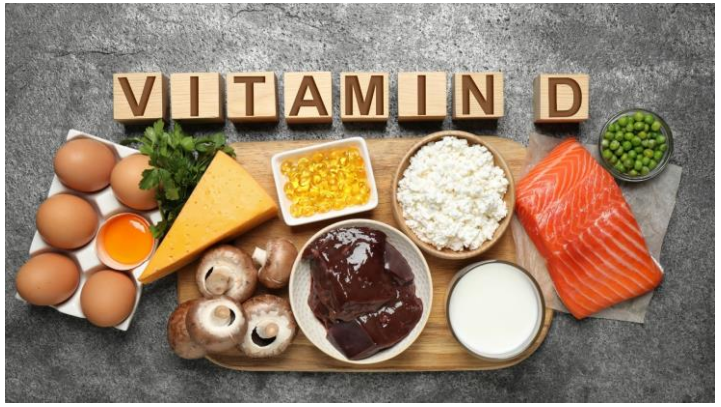
- Vitamin B12 testing in Blood (serum血清)
  - Total Vitamin B12
  - Active Vitamin B12

- Active vitamin B12 makes up 6-20% of total blood vitamin B12 level.

- It is an earlier and more sensitive indicator of vitamin B12 deficiency.

Vitamin D (Total)

- Function:
  - Bone Health
  - Helps absorb calcium in the gut
  - Keeping calcium and phosphorus 磷 in balance to mineralize 礦化 bones
  - Helps immune balance



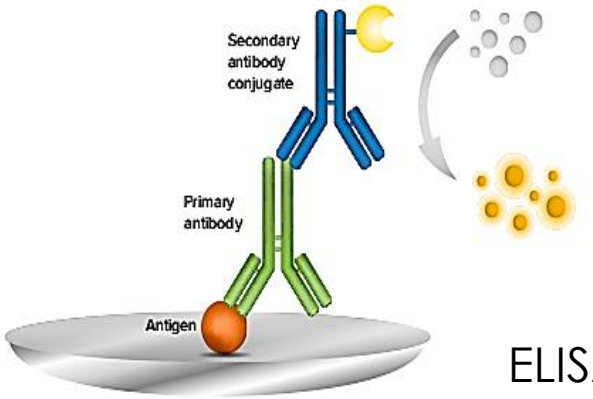
- Sources:
  - Oily fish , red meat, liver , egg yolks

  - Reference daily intake: 15 micrograms ug daily.

How do we test for Vitamin D ?

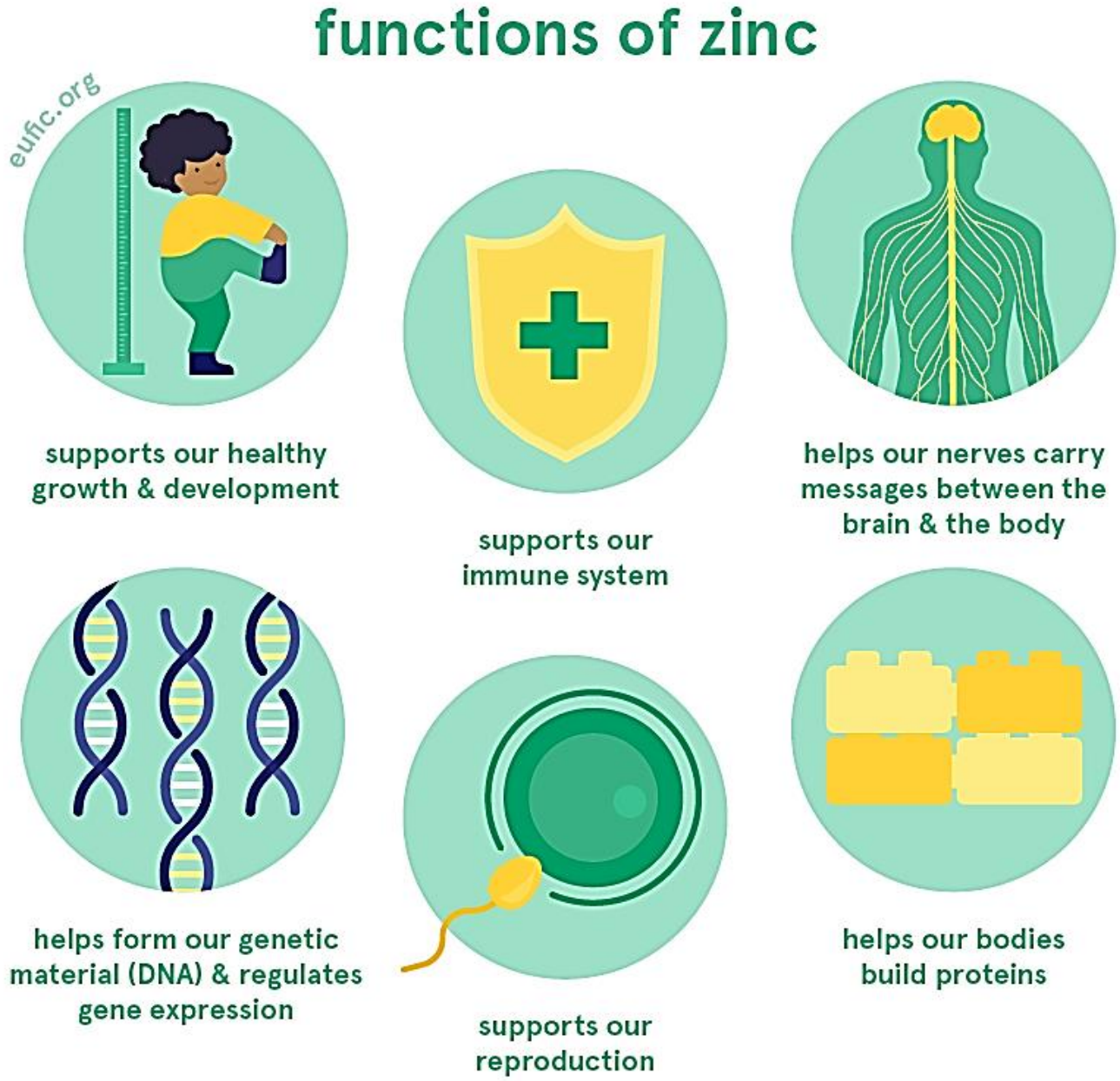
- Symptoms of Vitamin D deficiency:
  - fatigue, back and bone pain, mood problems and muscle weakness

- 25-hydroxy-vitamin D test in blood (serum) is the preferred test for measuring vitamin D status.
  - Immunoassays including ELISA



ELISA

Zinc 鋅


functions of zinc
eufic.org
supports our healthy growth & development
supports our immune system
helps our nerves carry messages between the brain & the body
helps form our genetic material (DNA) & regulates gene expression
supports our reproduction
helps our bodies build proteins

Symptoms of Zinc Deficiency

- Delay in growth
- Impaired wound healing
- Dry, scaling skin
- Altered senses of sight, smell and taste
- Impaired immune system
- Hair loss/Alopecia
- Diarrhea
- Impaired testosterone production
- Seizures癲癇發作
- Heart arrhythmia 心律失常

Zinc

- Foods rich in highly absorbable Zinc include:
  - Meat and poultry, Fish, Eggs, Dairy products

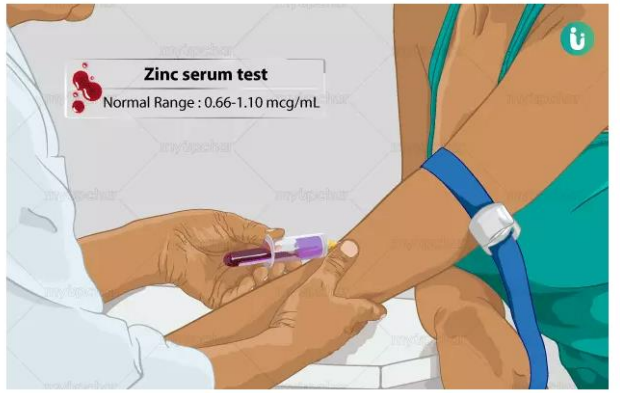
  - Limiting Absorption of Zinc
  - Depending on whether the diet is rich in grains 穀類 and legumes豆類
  - Compound (Phytates) in these foods bind to zinc and interfere our bodies from absorbing zinc

  - Reference daily intake: The dietary reference 7.5-16.3 mg per day

How do we test for Zinc ?

Zinc Serum test 血清:

- Reference Range 0.66-1.10mcg/ml of zinc in their serum
- Zinc and albumin白蛋白 are transported as a complex in the body. Low zinc with normal albumin may indicate a zinc deficiency
- Consumption of excessive zinc supplements can lead to zinc toxicity.



Zinc Urine test:

- Reference Range in urine 20-967 ug/24 hours daily
- Low urinary zinc, along with low serum zinc, may indicate a zinc deficiency
- High urinary zinc is indicative of too much supplement

Vitamin C

- Vitamin C is a water-soluble vitamin.
  - also known as ascorbic acid and ascorbate

- An Essential Nutrient. Roles:

  -Tissue Repair, formation of collagen, production of certain neurotransmitters神經傳遞物質, immune function

  - Same as glutathione, an important antioxidant

- Food source:
  - Citrus, other fruits, Vegetables.

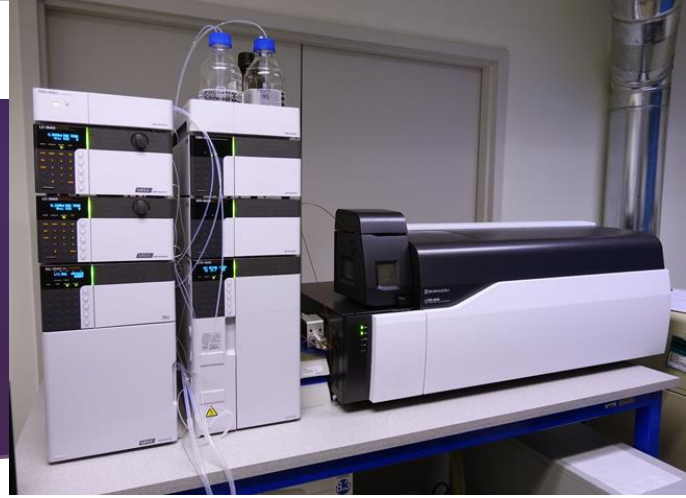
- Reference daily intake: adults: 40 mg/day

Symptoms with Vitamin C Deficiency ?

- Scurvy 壞血病
- flu-like symptoms
- Weakness
- Tendency to bruise or bleed easily
- Fatigue
- Depression
- Inflammation
- Oxidative stressed induced diseases 氧化應激誘發的疾病

- Treatment of Vitamin C deficiency:
  - Oral supplements combined with intake of foods high in vitamin C
  - Ascorbic acid IV Infusion in patients who cannot take the supplement orally or with absorption problems

How do we test for Vitamin C ?

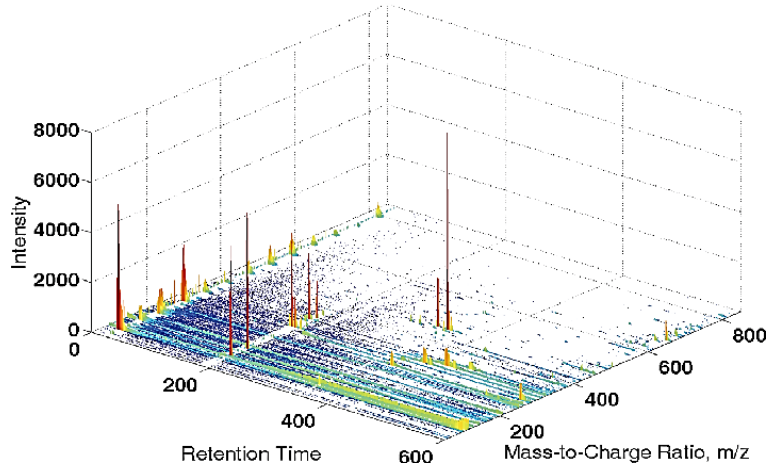


- Vitamin C blood test involved:
  - Plasma 血漿 collection in Sodium heparin tube

  - Protected from light
  - Refrain from eating fruits and from taking vitamin C supplements for 24 hours prior to blood draw

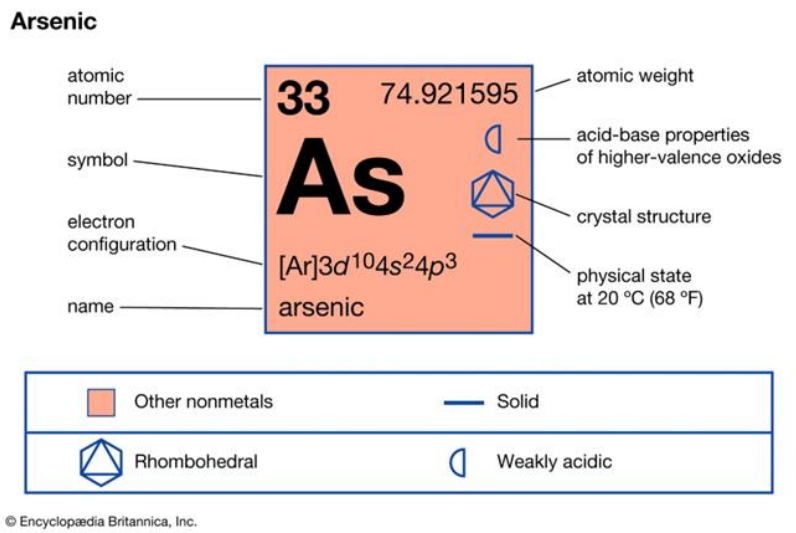
Test method: Liquid chromatography –
Tandem mass spectrometry [LC- MS/MS] 液相層析串聯式質譜儀

- Accurate measurement of quantities in ug
- technique that involves physical separation of analytes followed by mass-based detection of the analytes



Heavy metals Toxicity Detection

Arsenic (As) 砷



- Function:

  No known physiological function in human body

- Source of absorption:
  - Fish, shellfish, meat, poultry, dairy products
  - Contaminated food or water.
  - Inhalation during arsenic-using industrial processes such as alloy 合金, textile and glass
  - Tobacco

Symptoms from Arsenic Toxicity ?

- Red or swollen skin
- Abdominal pain, nausea and vomiting, diarrhea
- Abnormal heart rhythm
- Muscle cramps
- Tingling of fingers and toe
- Respiratory symptoms such as irritation of nasal mucosa, pharynx, larynx, and bronchi
- Neurological symptoms such as tremor, seizure 癲癇發作 and paralysis 麻痺/癱瘓
- Long term exposure to arsenic cause cancers such as melanoma, CA lung, or HCC

How do we test for Arsenic Toxicity ?

- Reasons for testing:
  - People living or working in area with high level of arsenic
  - Patients who display symptoms of arsenic poisoning

- Specimen types:
  - Blood
  - urine (only for acute exposure)
  - Hair (only for chronic exposure longer than 6 months)

- Limitation of the urine test:
  - Arsenic level in urine will drop rapidly after exposure

Lead (Pb) 鉛

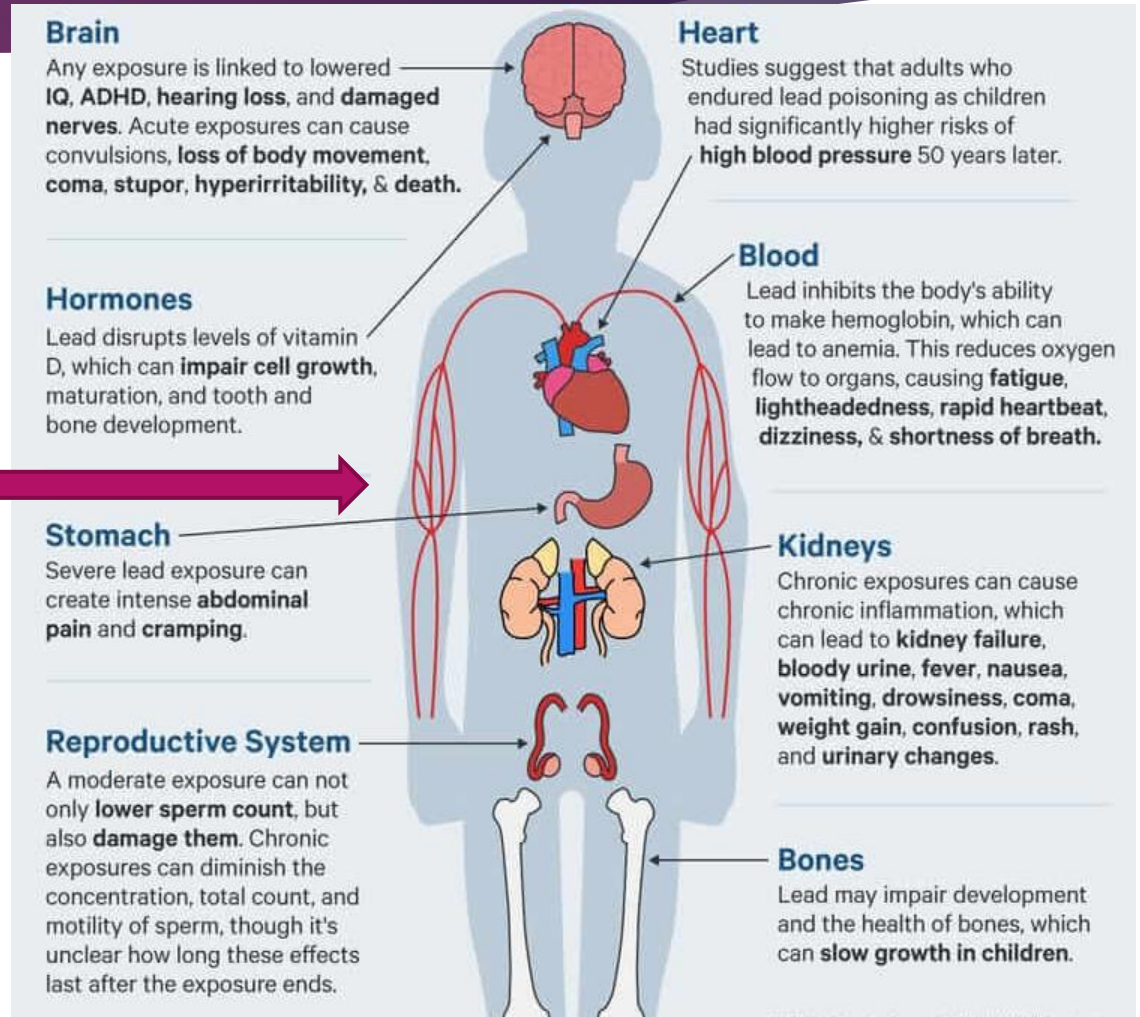
- Biological function of Lead
  - No known functions
- Lead is a neurotoxin:
  - can damage nervous system & interfere with the function of enzymes
  - Iron, vitamin C, calcium can impair the absorption of lead

- Lead can be present in food coz it's the environment where foods are grown or processed:
  - Fruit juice, root vegetables, cookies
- Lead can be found in a child's environment.
  - Drinking water from lead pipes & faucets
  - When consumed drinking water with lead, young children absorb 4-5 times as much ingested lead when compared with an adult

Symptoms from Lead Poisoning ?

- Headaches, stomach cramps, constipation
- Muscle/joint pain
- Trouble sleeping, fatigue, irritability

- Exposure to lead can harm a child's health
  - Brain health
  - cardiac health, can affect kidneys, bone development, hormones the reproductive system



How do we test for Lead Poisoning ?

- Testing for lead is important as it is a toxin:
  - A blood sample can be taken to determine the concentration of lead in the body.
  - The National Institute of Occupational Safety and Health (NIOSH) designated >5 ug/dL as an elevated blood lead level in adults. Further assessments are required.
  - Hair can be tested only for chronic exposure.
- Treatment:
  - Chelation therapy 螯合療法 IV EDTA treatments 乙二胺四乙酸治療 may be considered for:
    - children, pregnant women with blood lead levels >44 ug/dL
    - adults with blood lead levels >50 ug/dL

Mercury (Hg) 水银、汞

- Biological function of Mercury
  No known functions

- Food Source:
  - Fish and shellfish consumption is the leading dietary source of mercury exposure.

- Suggested tolerable intake:
  - World Health Organization has estimated a tolerable intake of total mercury of 2 µg/kg of body weight per day

Symptoms from Mercury Poisoning ?

- Feeling numb or dull pain
- tremors
- unsteady walk
- blurry vision, memory loss, seizure

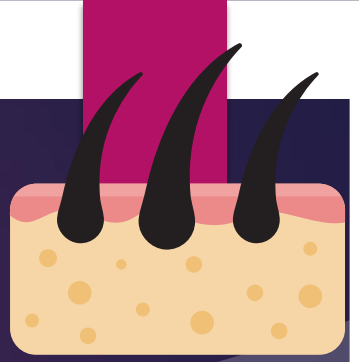
- Chronic Mercury poisoning in children
  - Pink discoloration of the hands and feet (also called pink disease)

How do we test for Mercury Poisoning ?

- Blood test can be used to assess mercury exposure:
  - Blood level greater than 10 ug/L indicates an unusual level of exposure
  - For someone who does not regularly work with mercury.
  - Further assessments are required.
- Hair Sample:
  - can also be used to detect chronic exposure

- Treatments:
  - There is actually no definite safe level of exposure. Ideally, neither children nor adults should have any mercury in their bodies
  - Chelation therapy 螯合療法 which involves IV EDTA or IM Dimercaprol treatments 二巯基丙醇處理

Detection of chronic exposure of Heavy Metals in Hair Samples



- The hair follicle is a record of exposure to toxic elements
- With 0.25g of hair, you can test the following heavy metals:
  - Aluminum (<7µg/g)
  - Arsenic 砷 (<0.08µg/g)
  - Cadmium (<0.065µg/g)
  - Cobalt (0.004- 0.02µg/g)
  - Lead 鉛 (<0.8µg/g)
  - Mercury 汞、水银 (<0.8µg/g)
  - Nickel (<0.2µg/g)
  - Silver (<0.08µg/g)
  - Tin (<0.3µg/g)

Next Talk at Mar 7, 2023

Early Cancer Detection, Disease monitoring, Relapse detection, Target drugs Matching

Liquid Biopsies (CTC, CtDNA/CfDNA)

Gut Microbiome

Molecular Microbiology: Close look at our Gut Microbiome