

CHIANG MAI เทศกาล
DESIGN งานออกแบบ
WEEK เชียงใหม่ 2022





NUTRI-GENOMICS

Unveiling The Future of Longevity Economy

By METAWEE SRIKUMMOOL, PhD

Assistant Professor, Faculty of Medical Science
Naresuan University

LIVE TALK
/Session 2



11.12
2022



TCDC
Function
Room

#iGTCCoLAB

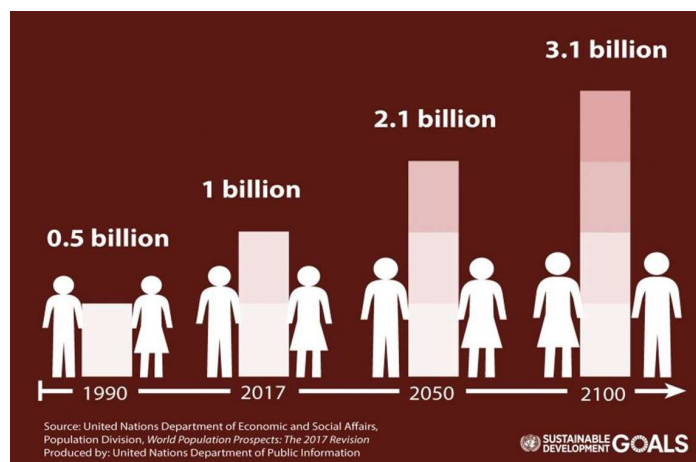
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Ageing society

- ปี 2050 (พ.ศ. 2593) โลกจะมีจำนวนผู้สูงวัยที่มีอายุ 60 ปีขึ้นไปกว่า 2,100 ล้านคน
- จำนวนคนแก่มากกว่าคนหนุ่มสาว โดย 1 ใน 5 ของประชากรโลกในปี 2050 (พ.ศ. 2593) จะเป็นผู้สูงวัย
- ในปี 2578 ไทยจะเข้าสู่สังคมผู้สูงอายุระดับสูงสุด โดยมีประชากรสูงอายุถึง 30%

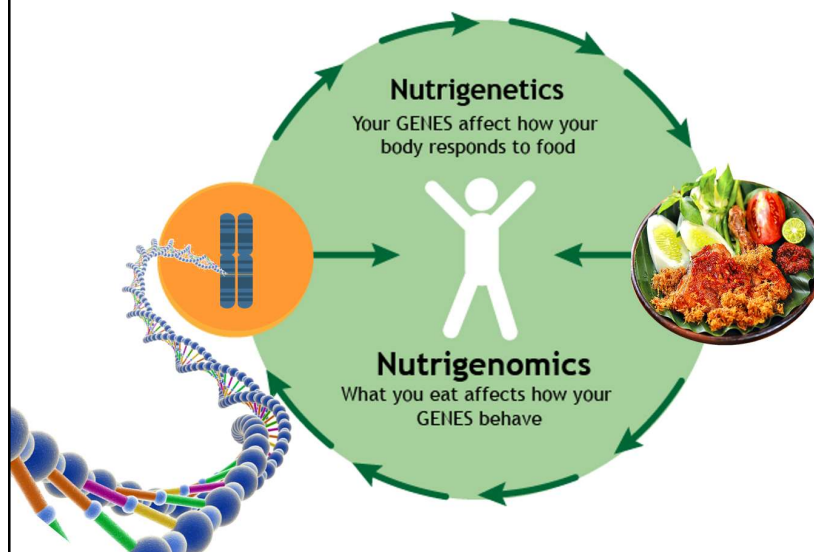


Opportunity and Challenge in ageing society

- Residential: nursing home
- Amusement: entertainment, social engagement
- Food and Beverage: nutrition, quality, hygiene
- Services
- Wellness community
- Furniture design
- Law and regulation
- Renovation: elderly-friendly

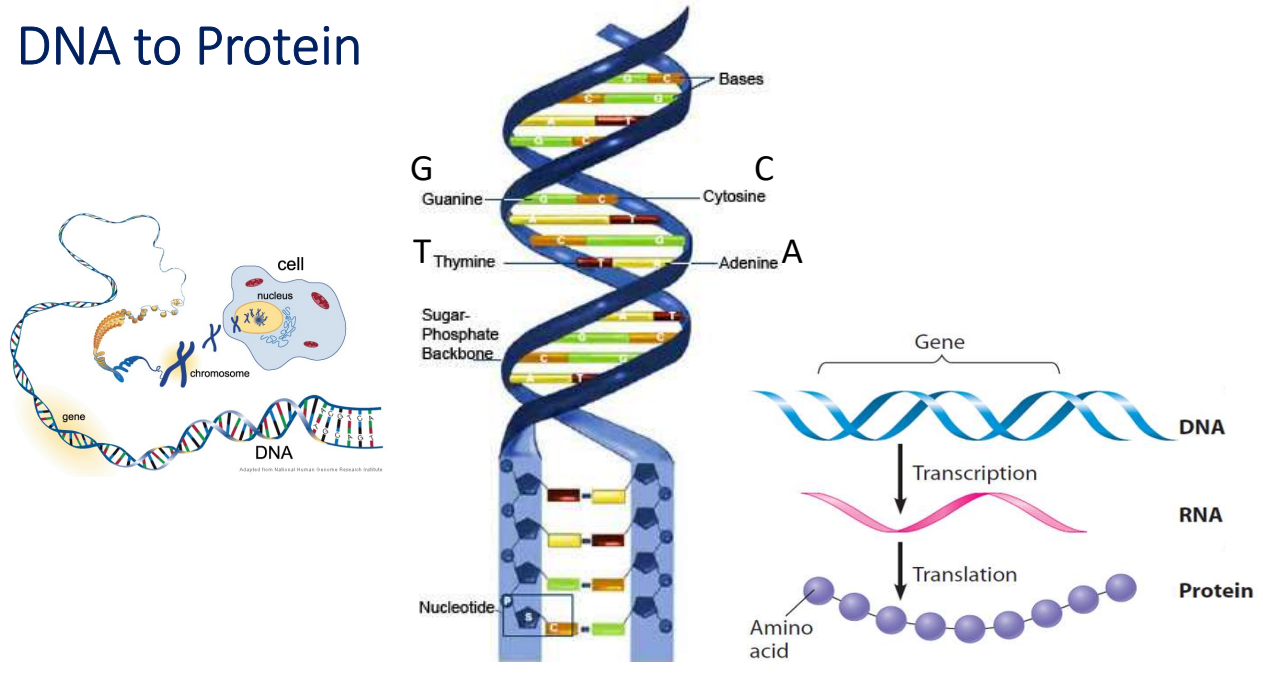


Nutrigenetics and Nutrigenomics: the keys to healthy aging

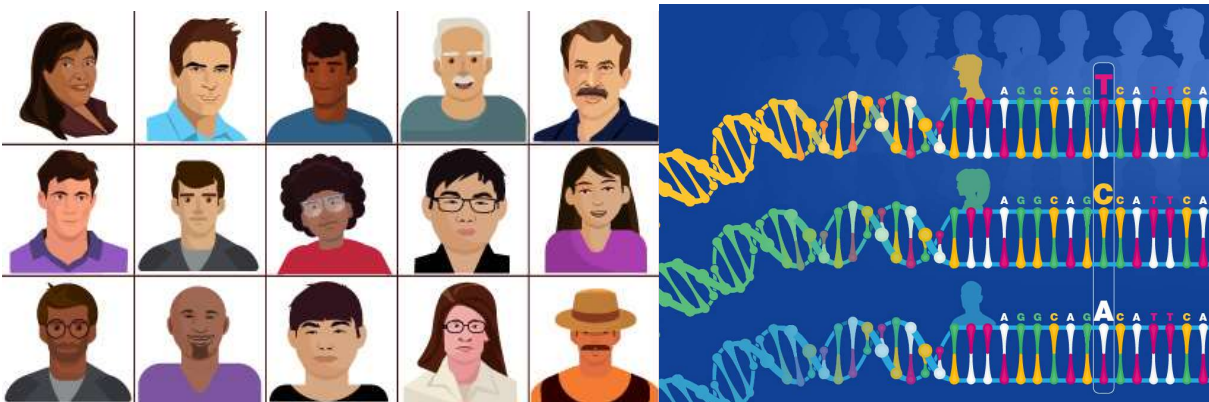


- **Nutrigenetics** : the branches of science dealing with the effect of genetic variation on nutritional response
- **Nutrigenomics** : the function of nutrients and bioactive food compounds in influencing gene expression

DNA to Protein

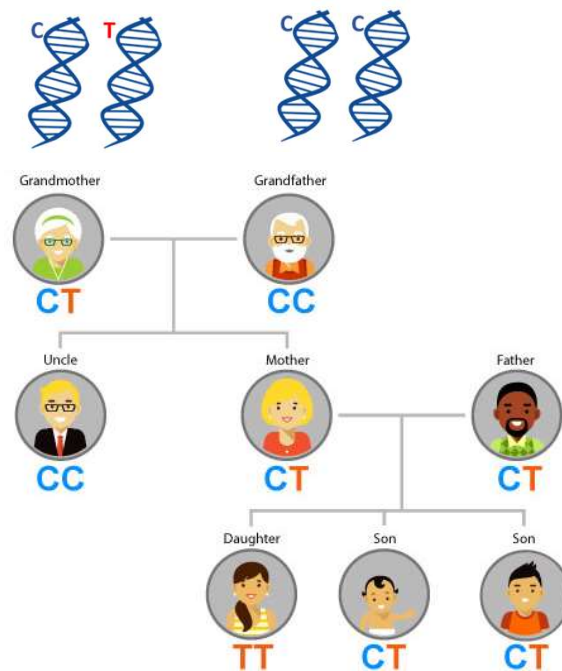


Variation



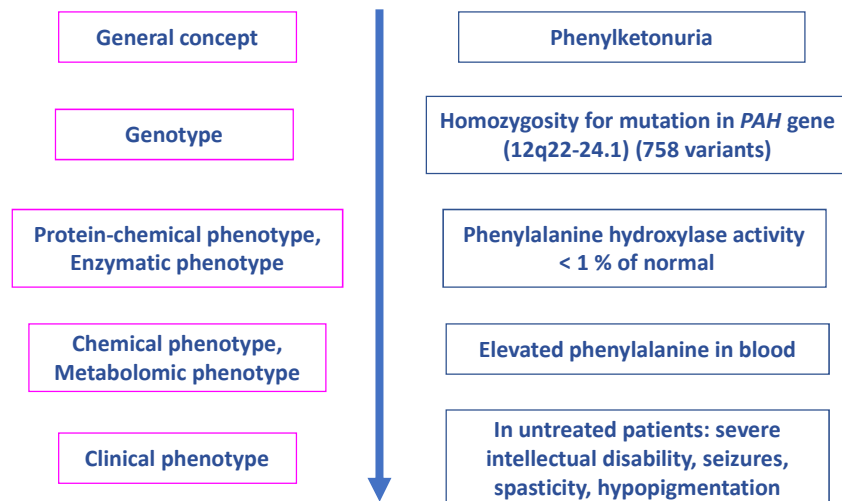
Genotype

- รูปแบบของยีนที่อยู่เป็นคู่กันที่ตำแหน่งเดียวกันในสายดีเอ็นเอจากพ่อและแม่
- Homozygous: CC / TT
- Heterozygous: CT

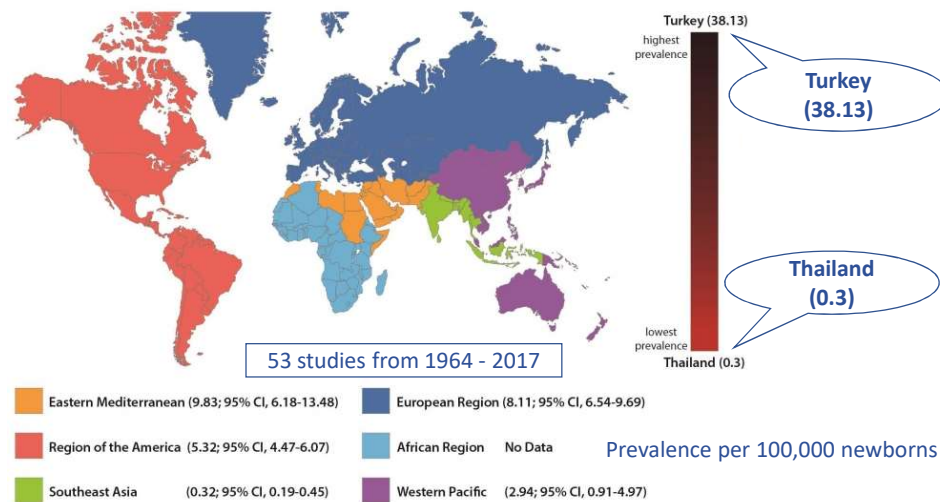


From Genotype to Phenotype

- Phenotype results from multiple factors, both genetics as well as non-genetics.



Phenylketonuria: PKU

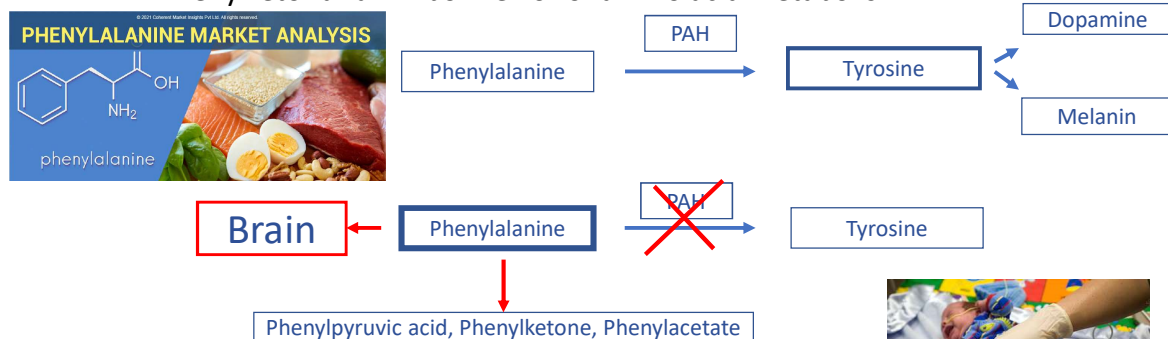


The pooled prevalence of classic PKU in the World Health Organization Regions

Shoraka et al., Clin Exp Pediatr 2020; 63(2), 34-43.

Phenotype and Food

- Phenylketonuria : In born error of amino acid metabolism



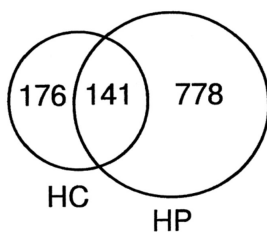
- PKU is not curable, genetic disease.
- Newborn detection
- Dietary treatment, Nutritional supplement, Enzyme substitutes

Nutrigenomics at transcriptomic level



Volume 84, Issue 5
November 2006

Blood samples taken before
and 2 h after breakfast
consumption.



High-protein and high-carbohydrate breakfasts differentially change the transcriptome of human blood cells ^{FREE}

Marjan J van Erk , Wendy AM Blom, Ben van Ommen, Henk FJ Hendriks

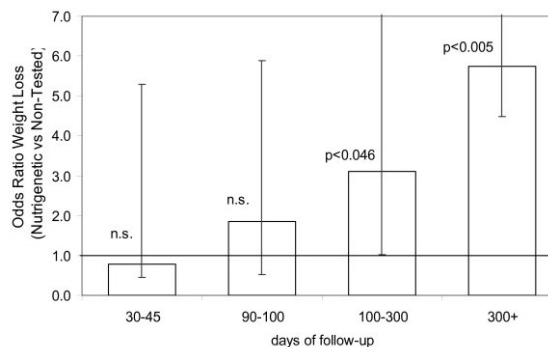
The American Journal of Clinical Nutrition, Volume 84, Issue 5, November 2006,
Pages 1233–1241, <https://doi.org/10.1093/ajcn/84.5.1233>

Published: 01 November 2006 **Article history** ▼

- **HC intake** - lower expression of genes involved in glycogen metabolism
- **HP intake** - lower expression of genes involved in protein biosynthesis
- Breakfast consumption - differentially expressed genes, 317 for the HC breakfast and 919 for the HP breakfast.
- Immune response and signal transduction, specifically T cell receptor signaling and nuclear transcription factor κ B signaling, were the overrepresented functional groups in the set of 141 genes that were differentially expressed in response to both breakfasts.

Nutrigenomics: personalized nutrition

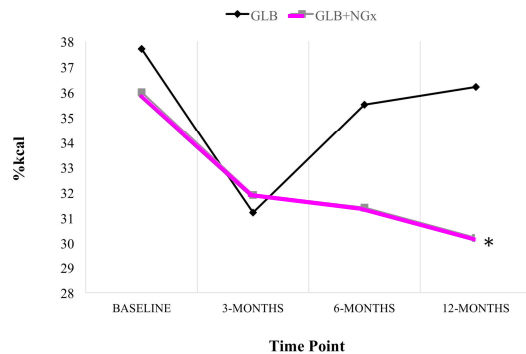
- Genetic profiles improved health and prevent diseases.
- Improved weight management
 - 93 patients with history of failures at weight loss
 - 50 patients : genetic test screening 19 genes
 - 43 patients : not genetic test



Arkadianos et al., *Nutr J* 2007; 6, 29.

Nutrigenomics : long-term dietary change

- Subjects: 140 patients: Group Lifestyle Balance (GLB) program
 - 70 Standard GLB
 - 70 GLB + Nutrigenomics (6 genes relates to dietary metabolism)



* $p = 0.02$

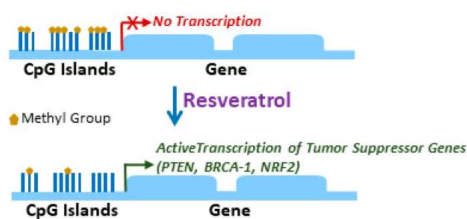
- Participants dropped out, may be due to low incomes

Horne J, et al. *bmjnph* 2020;0. doi:10.1136/bmjnph-2020-000073

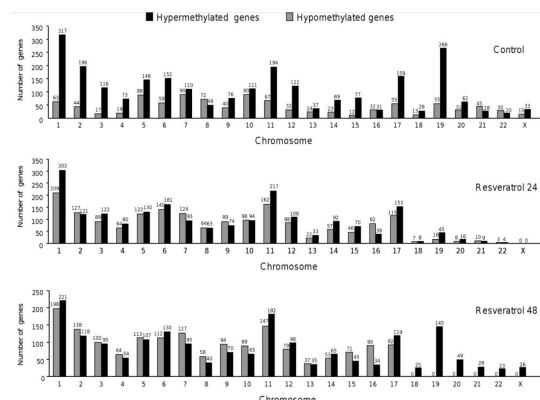
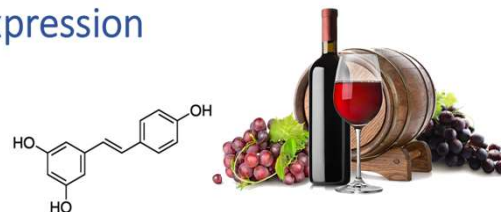
Nutrigenomics: Food regulates gene expression

Resveratrol

- Berries, grapes, wine, peanuts
- Chemopreventive and therapeutic effects
- In culture of breast cancer cells, resveratrol modifies DNA methylation profiles.
- hypomethylated status of key tumor suppressor genes
- hypermethylated status of and oncogenes

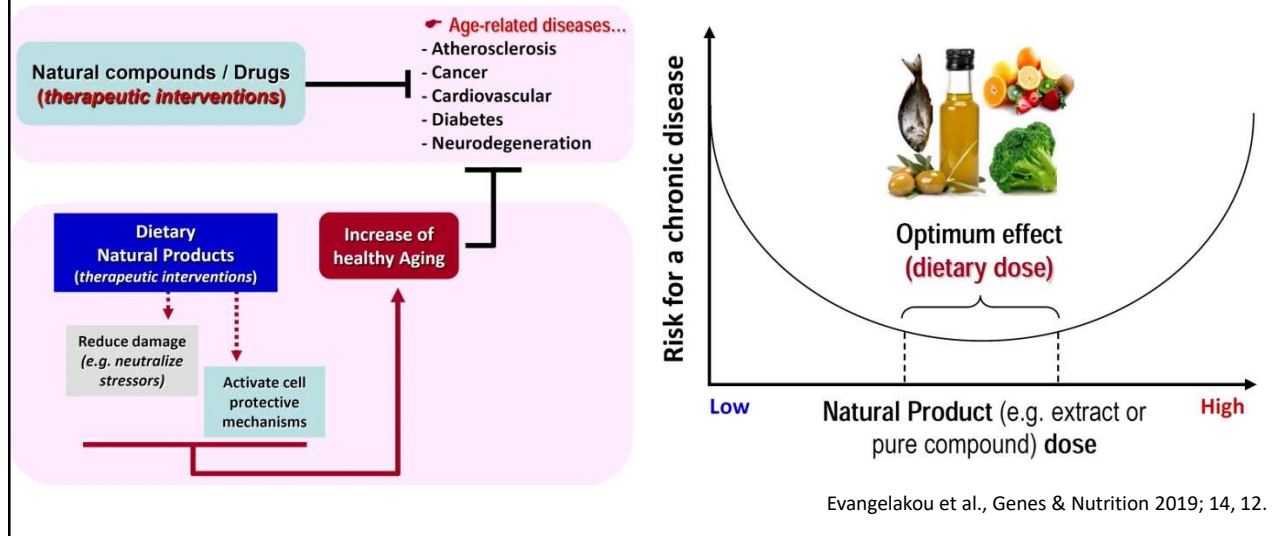


Farhan et al., *Medicines* 2019; 6(1), 24.



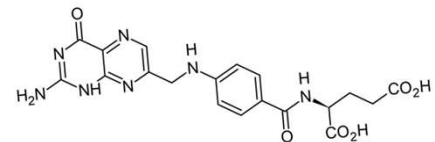
Medina-Aguilar et al., *Plos one* 2016; 11(6), e0157866.

Nutrigenomics: a tool to study the impact of diet on aging and age-related diseases

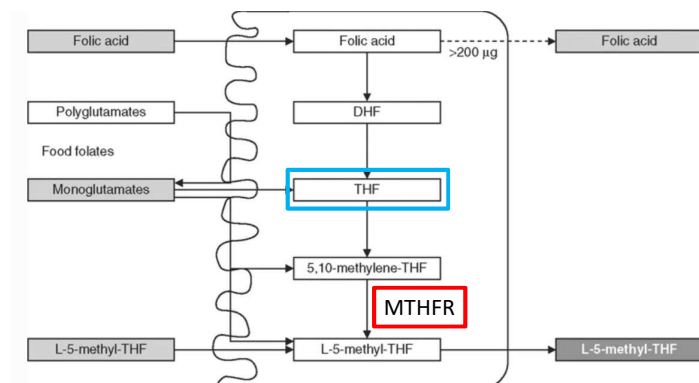


Genetics and Nutrients: Folate pathway

- Folate (folic acid) : Vitamin B9
- 1 carbon metabolism (-CH₃)
- Nucleic acid synthesis
- Amino acid synthesis
- Methylation



Folate absorption



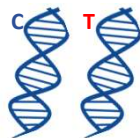
Pietrzik et al., Clin Pharmacokinet 2020; 48, 535-548.

MTHFR: methylenetetrahydrofolate reductase

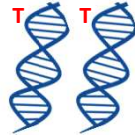
- 5,10-methylene THF → 5-methyl THF
- Variant: *MTHFR* (C677T)



CC : 100 % activity



CT : 67 % activity



TT : 25 % activity

- Prevalence of *MTHFR* TT genotype
 - North, Han Chinese 19.8 %
 - South, Han Chinese 8.1 %
 - Whites, Australia 8.0 %
 - Whites, USA Atlanta 10.7 %
 - Hispanic, USA Atlanta 17.7 %
 - Thai 1.4 %

• *MTHFR* (C677T)

- Cardiovascular
- Cerebral vascular
- Thrombosis
- Psychiatric
- Pregnancy and Neural tube defect
- Cancers
- DNA stability



(Wilcken et.al., J Med Genet 2003; 40(8), 619-625.)

(Angchsuksiri et.al., Acta Haematol 2000; 103(4), 191-196.)

Home / Genetic Tests / MTHFR Genetic Test



MTHFR Genetic Test

Categories: Genetic Tests

Sample Type: Buccal (cheek) swab

Markers: MTHFR genes

Available across Canada and US - except in NY, NJ, MD, RI

FREE Shipping

~~\$129.99~~ \$99.99

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*Instructions for purchases from New York and Maryland.

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\$129.99

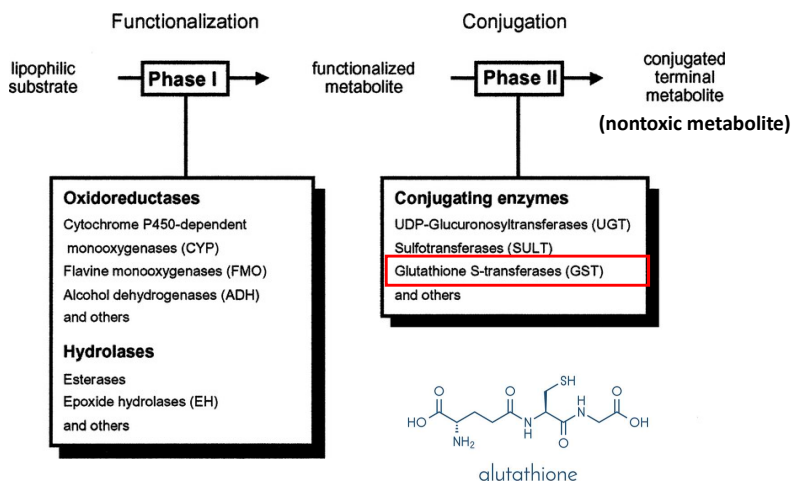
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Xenobiotic detoxification

- The combined operation of two phases converts lipophilic compounds into water-soluble compounds that can be excreted in urine or bile.
- Glutathione plays an important role in phase 2 reactions and is also an intracellular reducing agent.

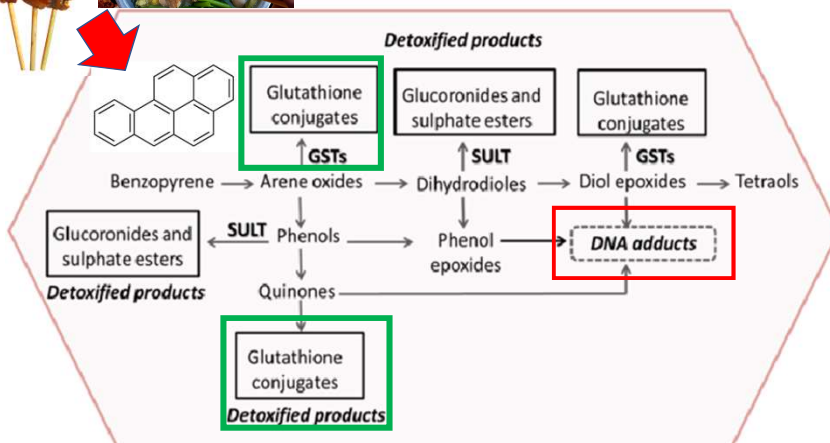


Oesch et al., Nonlinearity Biol Toxicol Med 2004; 2, 21-26.

Glutathione S Transferases: GSTs



GSTM
GSTT
GSTP



Benzopyrene (BAP) is one of the polycyclic aromatic hydrocarbons (PAHs).

PAHs can be generated by incomplete combustion of fuel and organic substances.

Dry heat cooking methods such as roasting and grilling generate PAHs. High fat and high protein food generate more PAHs upon pyrolysis.

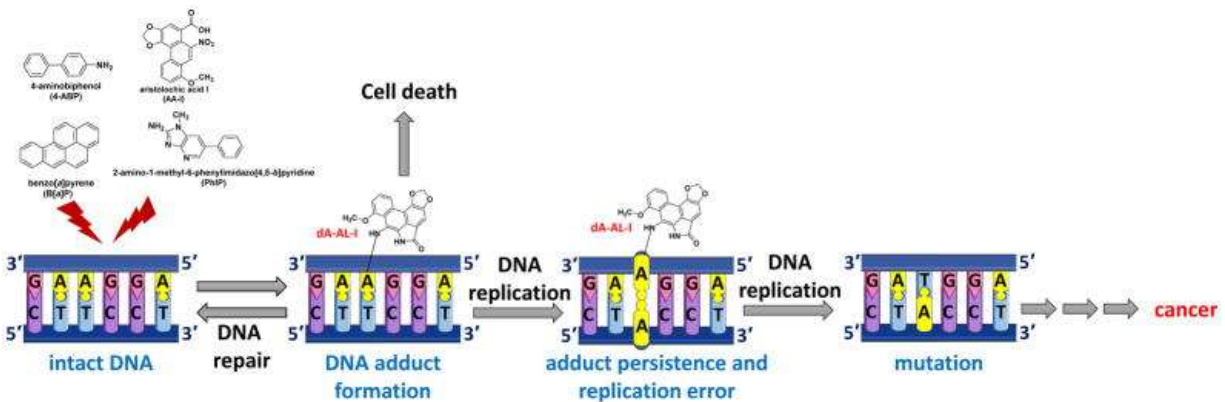
(Group 1: carcinogenic to human, WHO)

Antonova et al., JBUON 2015; 20(6), 1397-1406.

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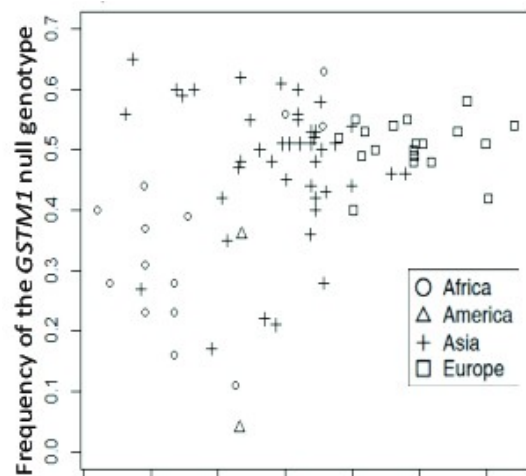
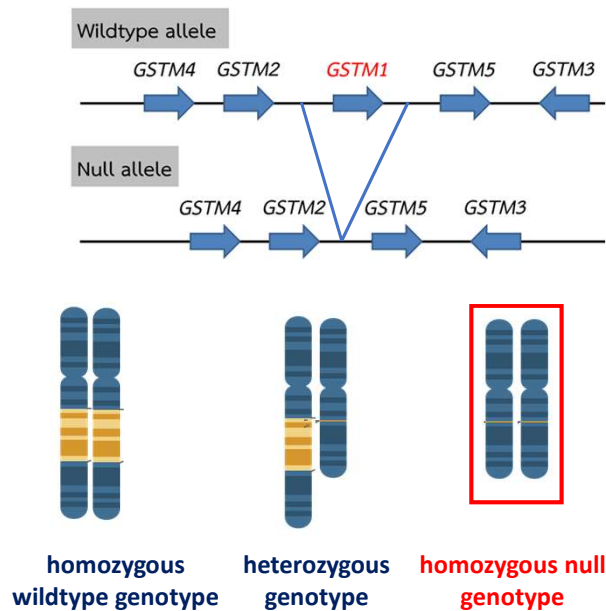
DNA adducts

- Hazardous chemicals in the environment and diet, or to endogenously produced electrophiles, all of which can form covalent adducts with DNA



Yun et al., Mass Spectro Rev 2020; 39(1-2), 55 -82.

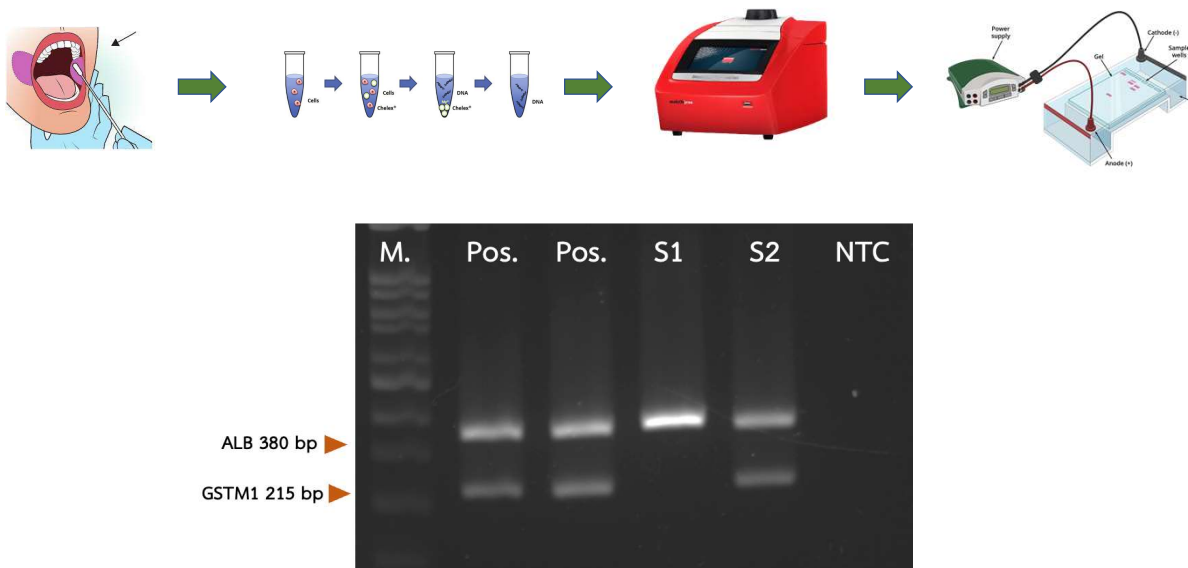
GSTM1 null allele



63 reports, 81 populations

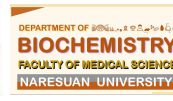
Saitou and Ishida, Asain J Cancer Prev, 2015; 16(1), 335-361.

GSTM1: homozygous null genotype



GSTM1: homozygous null genotype ในประเทศไทย

Populations	Total	Present	Null allele	% Null allele	references
Chiangmai	81	34	47	58.02	Klinchid <i>et al.</i> , 2009
Suratthani	200	116	84	42.00	ดุษฎี ทิวาเวช และคณะ, 2009
Central	56	32	24	42.90	Pongtheerat <i>et al.</i> , 2009
Northeastern	198	73	125	63.10	Natphopsuk <i>et al.</i> , 2015
Southern	53	37	16	30.20	Kietthubthew <i>et al.</i> , 2001
Phitsanulok	176	87	89	50.57	Sapcharoen <i>et al.</i> , 2019



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