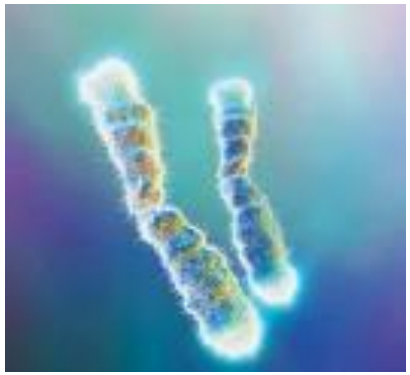
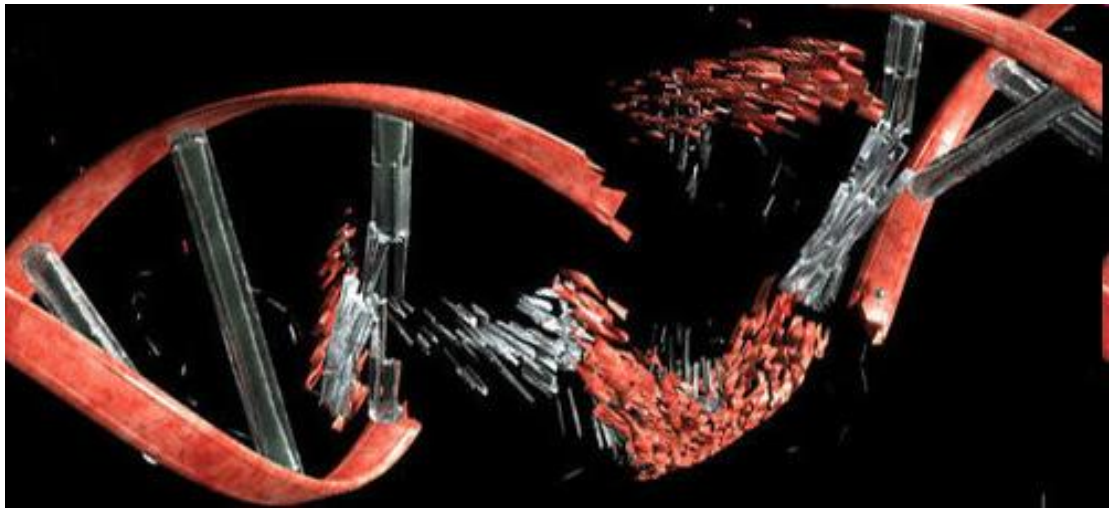




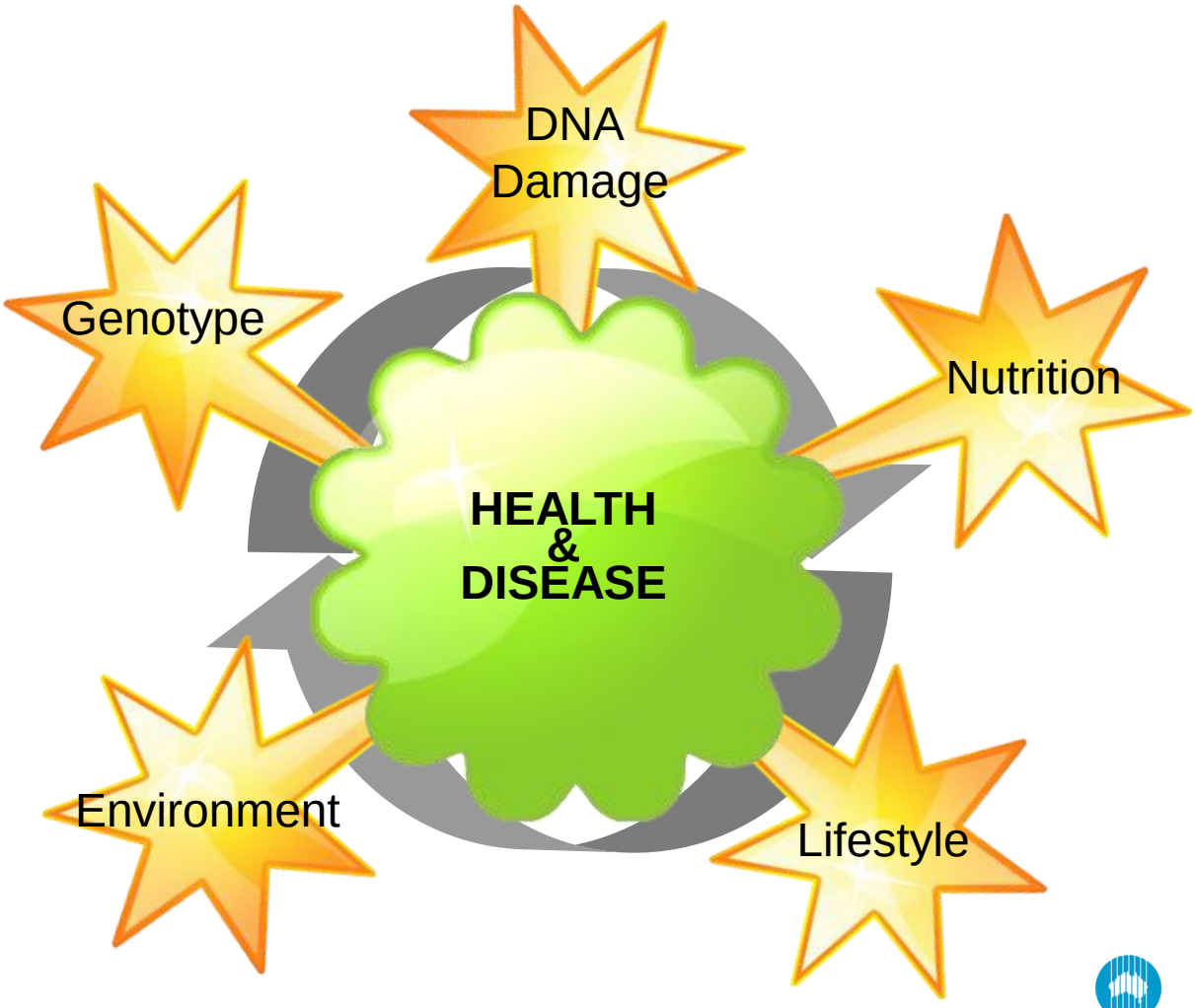
Nutrition and chromosome health in kids

Nathan O'Callaghan
Nutritional Genomics & DNA Health Diagnostics
Food and Nutritional Sciences

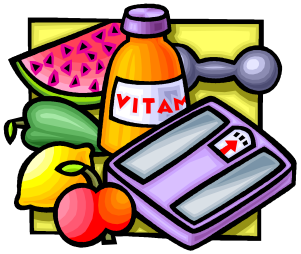
CSIRO

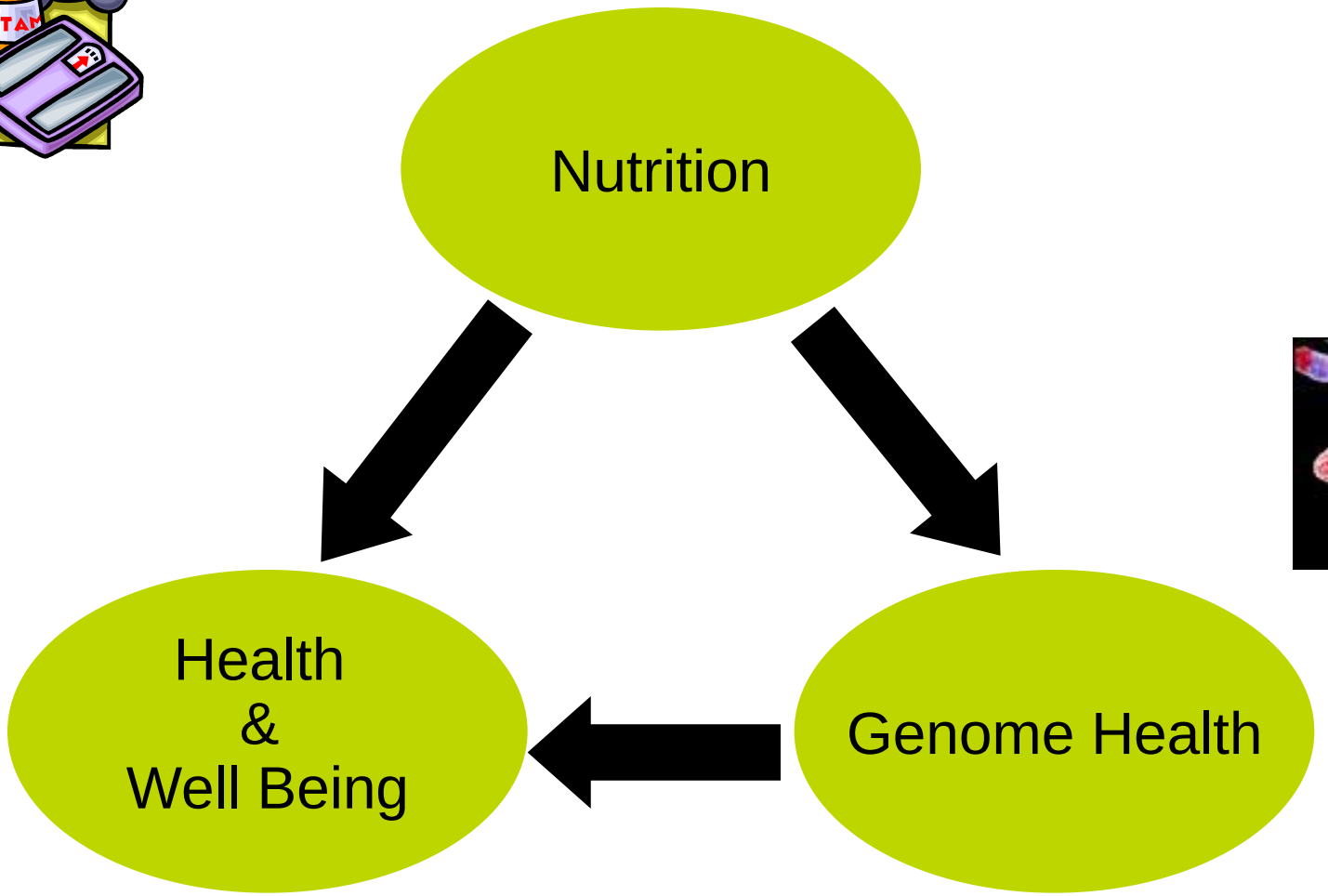
Overview

- Background
  - Nutrition and health
  - Chromosome health
  - Evidence for nutrition affecting DNA
- Genome health and nutrient status in children
- Knowledge gaps
- Future

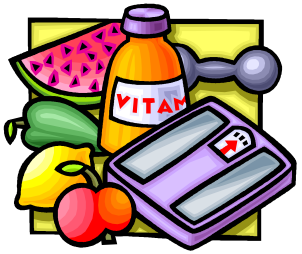


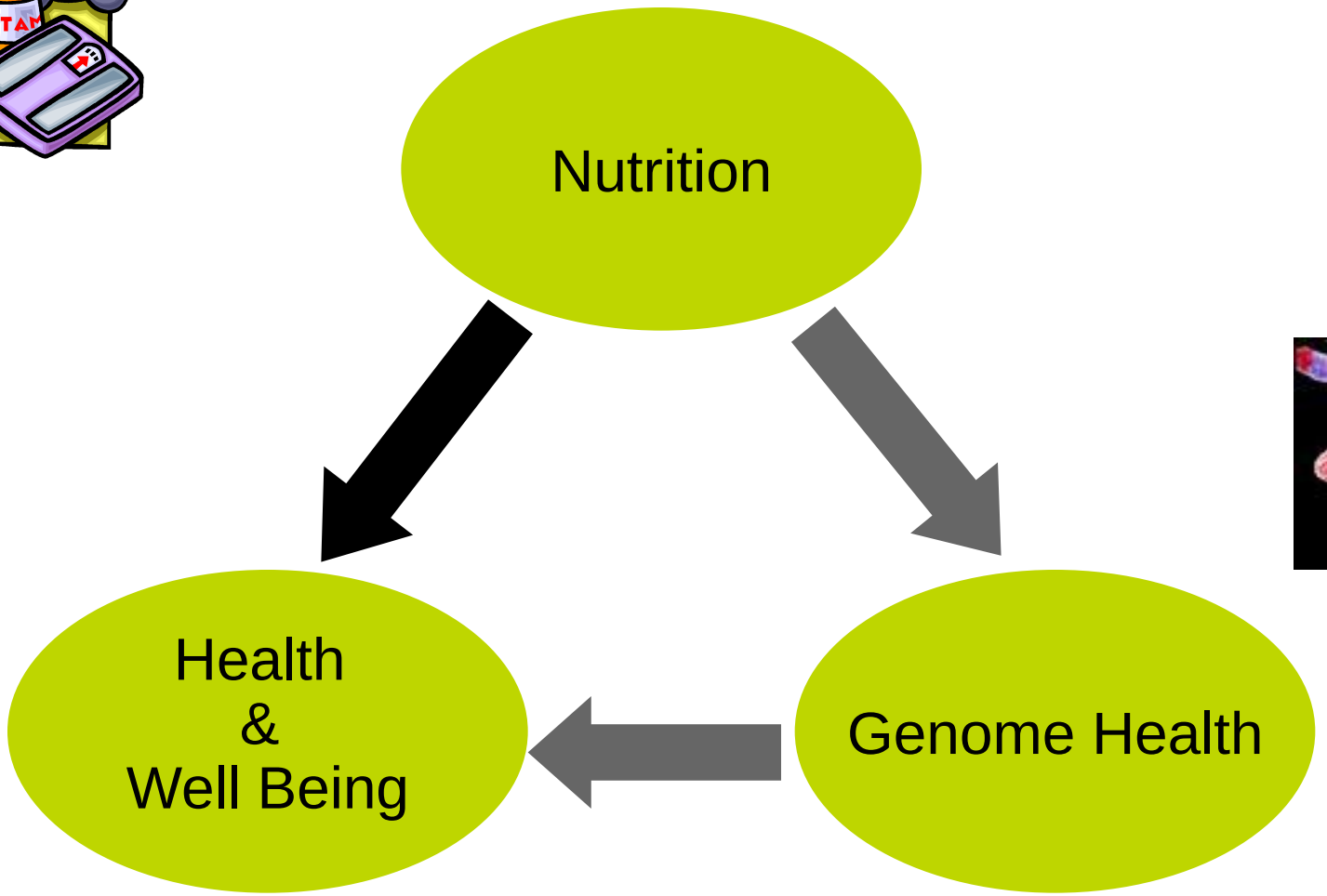
Nutrition, health and DNA





Nutrition, health and DNA





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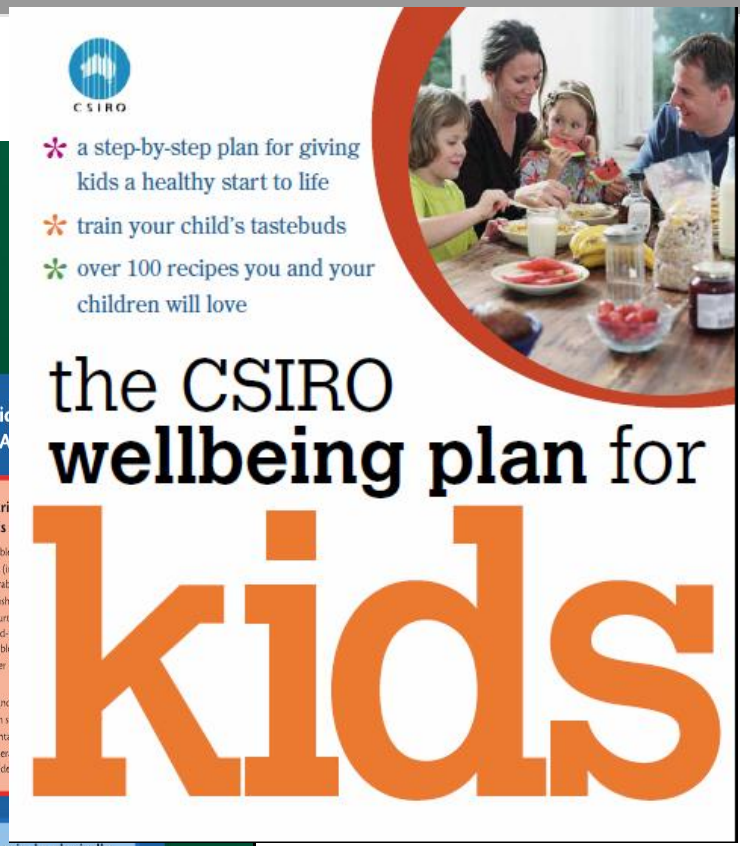
Nutrition and Health



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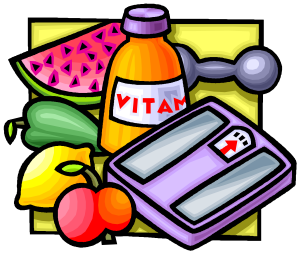
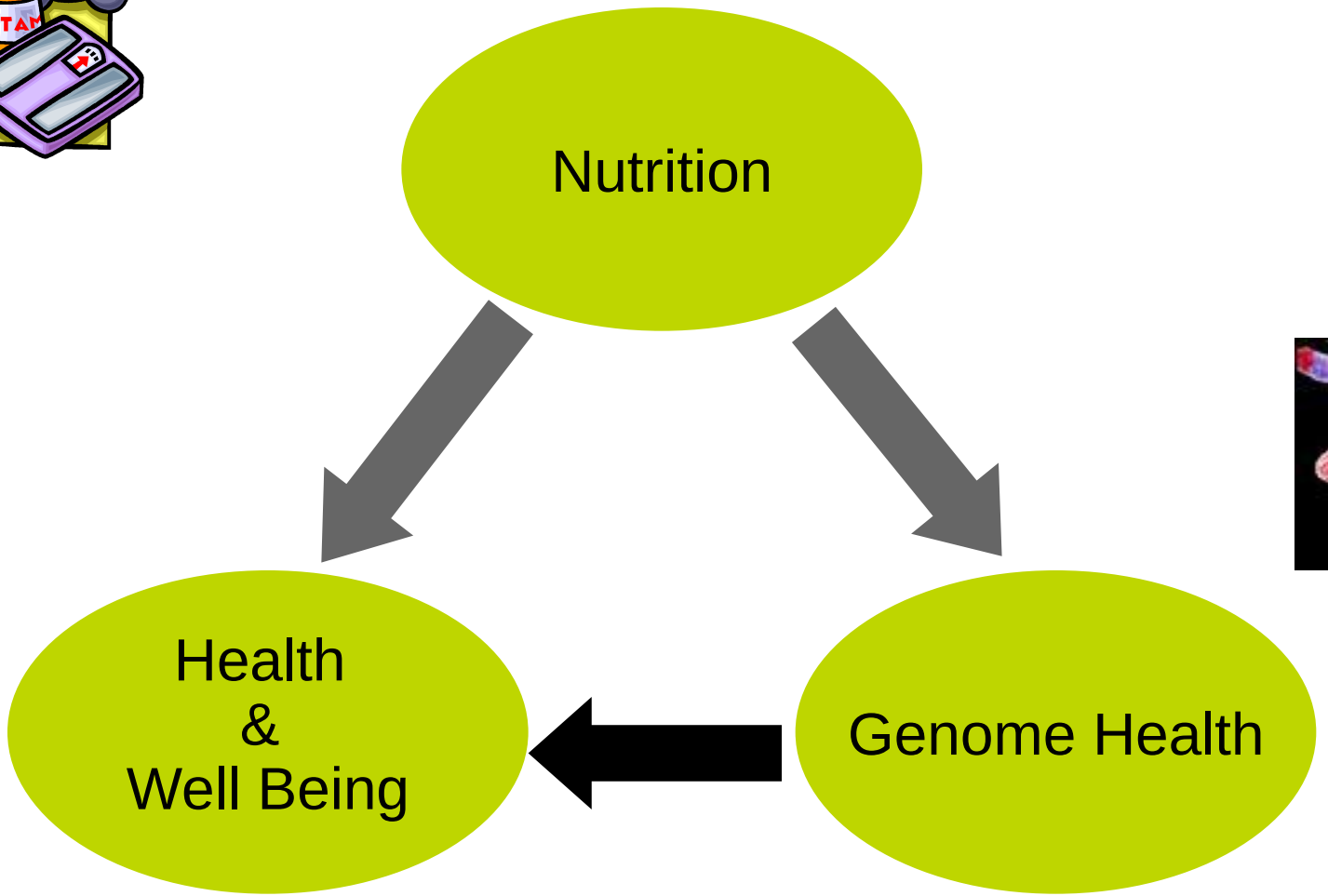
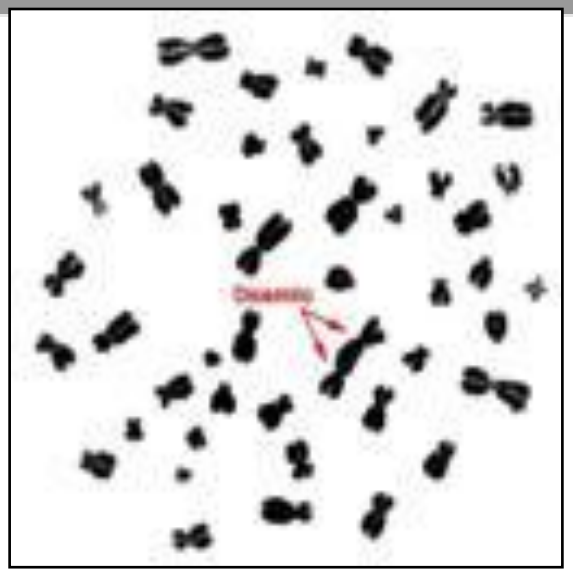
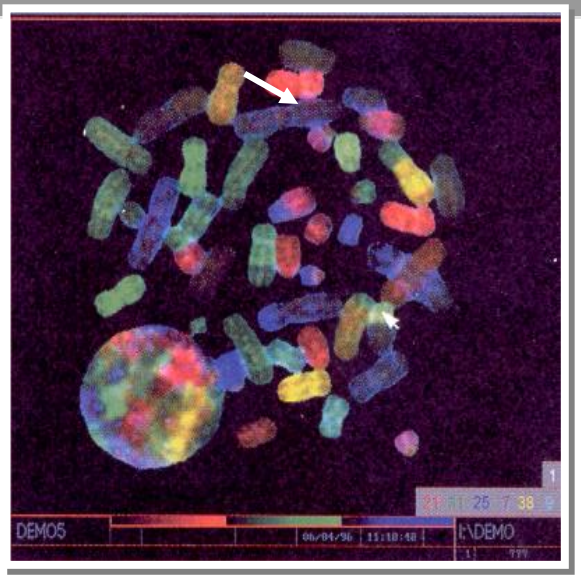
Nutrition, health and DNA

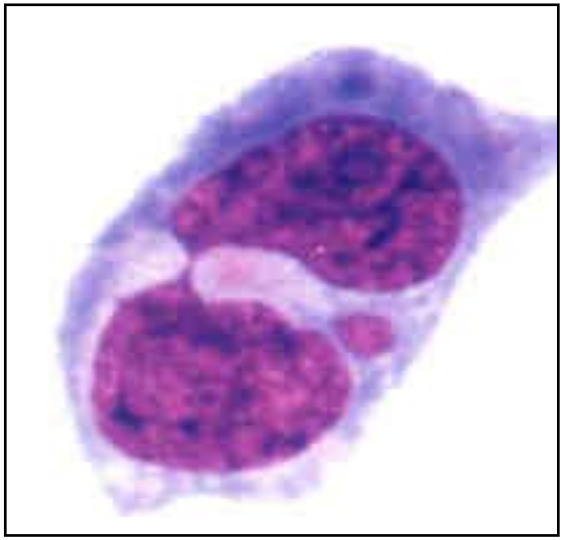


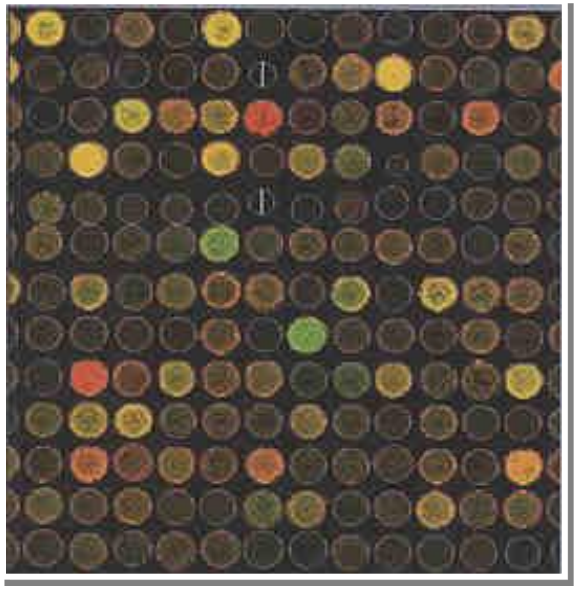


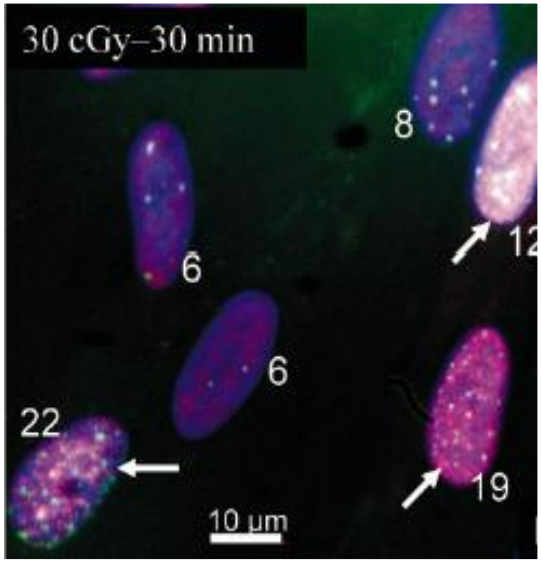
How to measure DNA damage

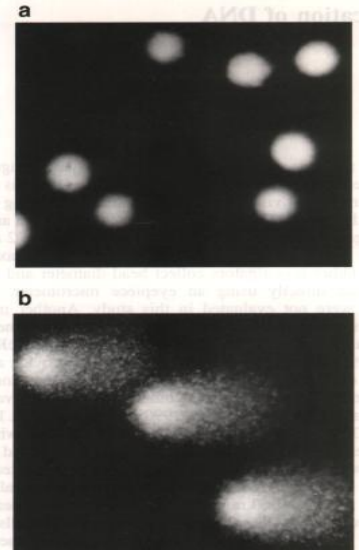












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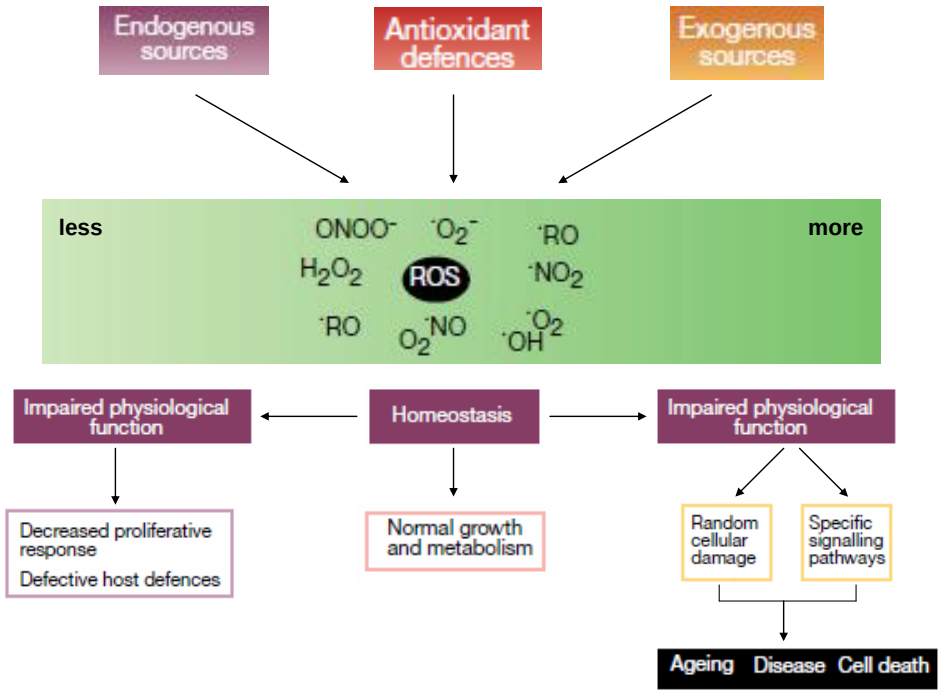
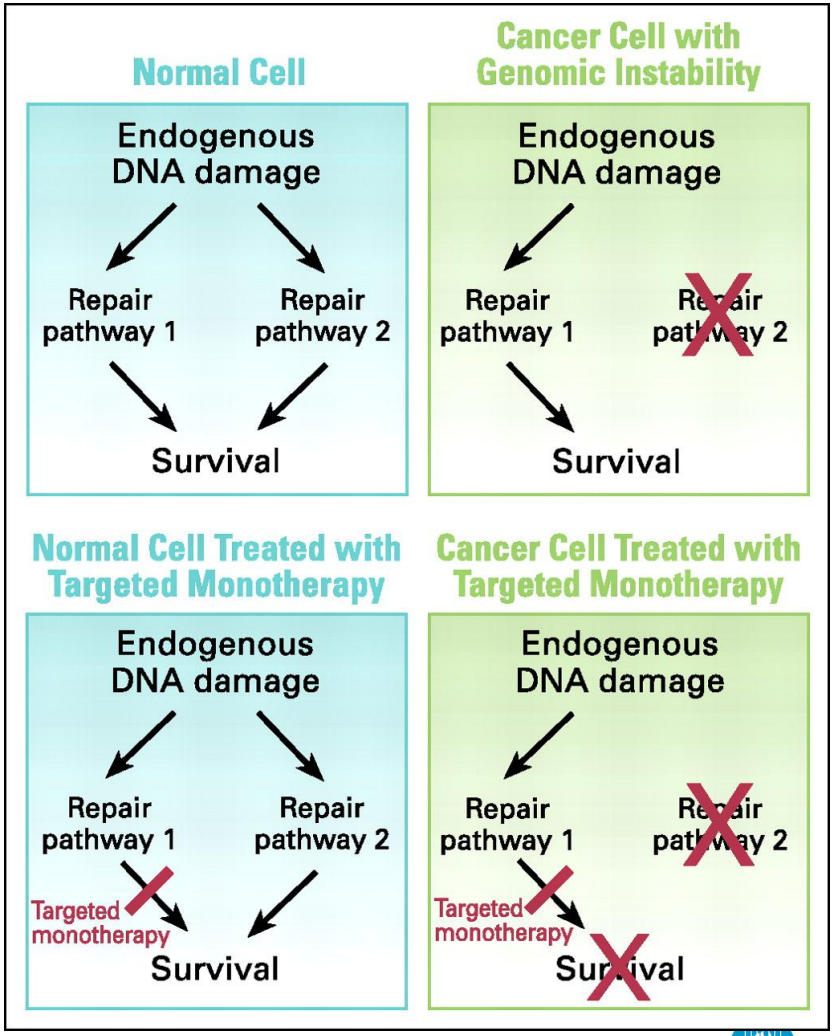
Sources of DNA damage





Kennedy R D , D'Andrea A D JCO 2006;24:3799-3808

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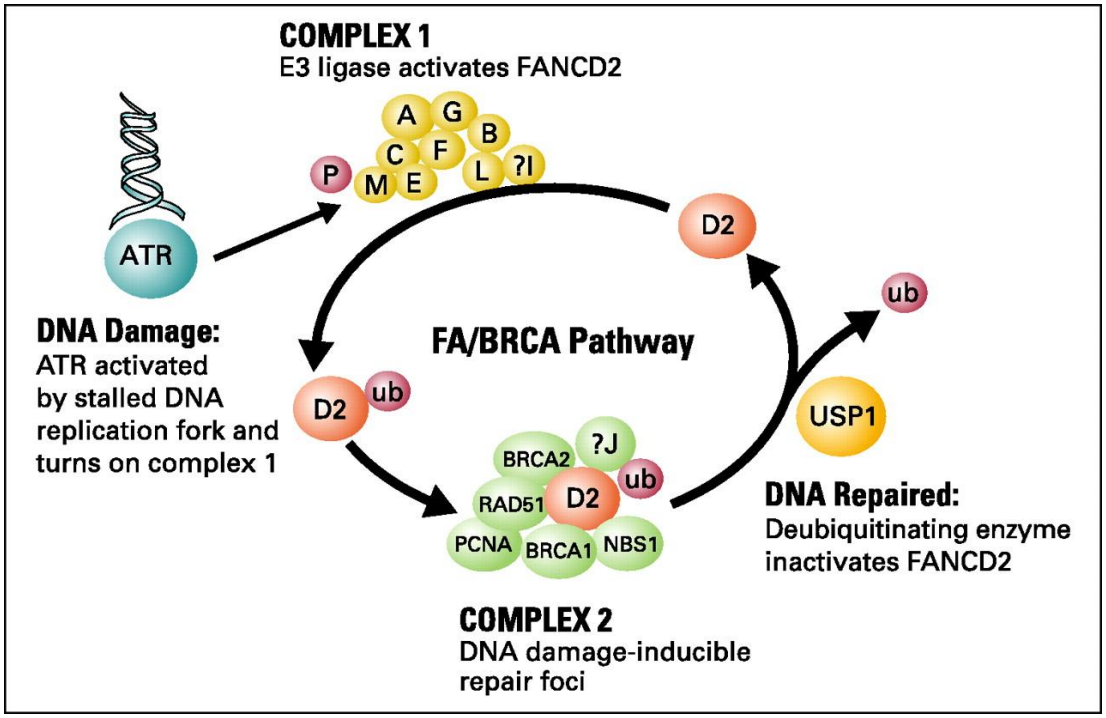
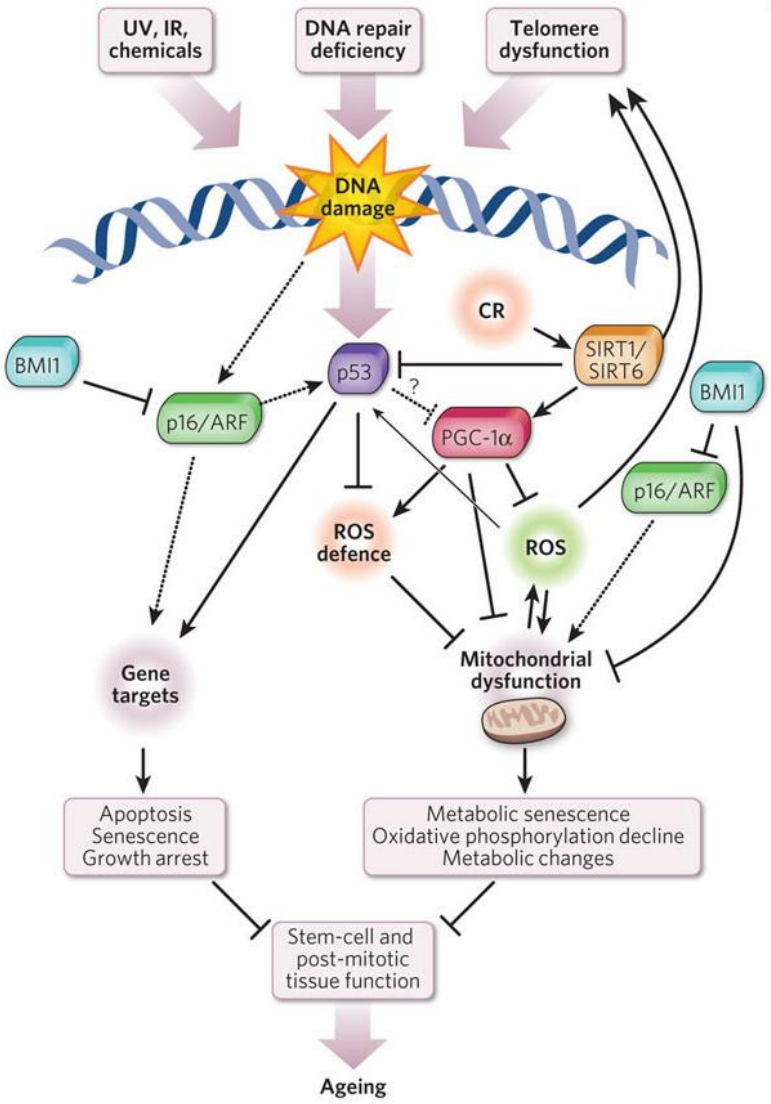
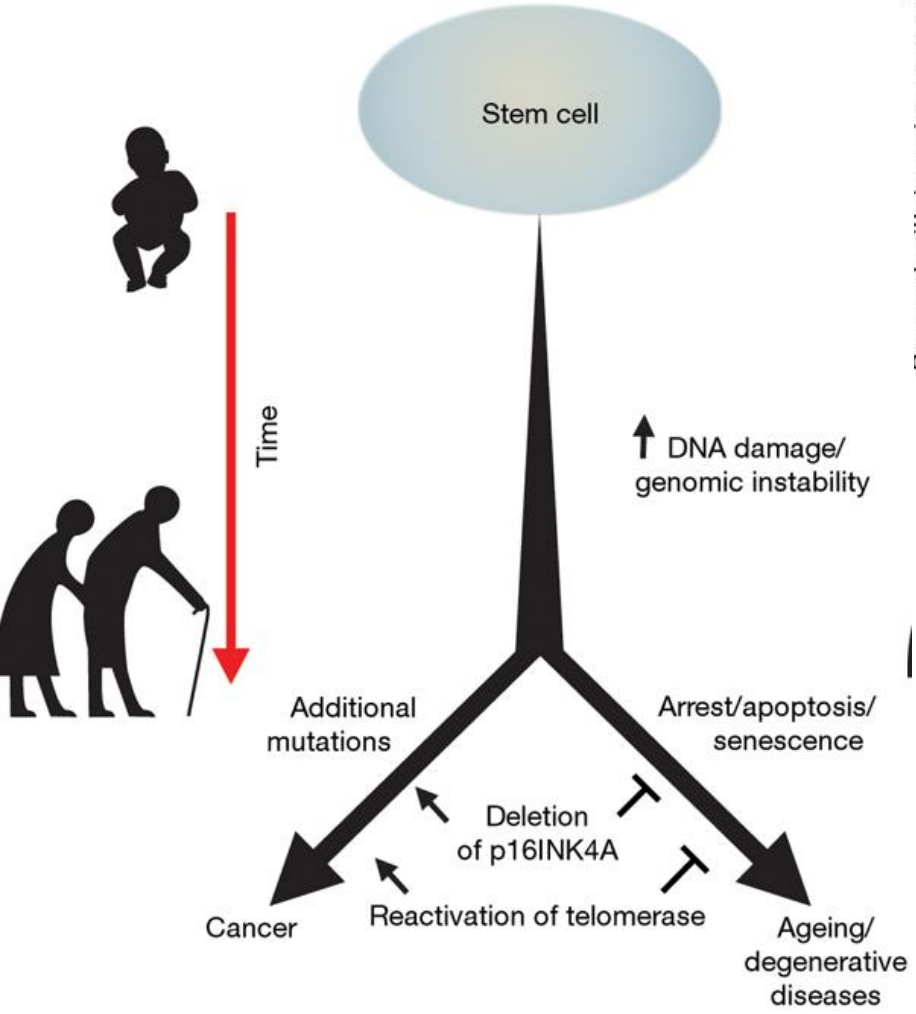
DNA damage *should* be transient

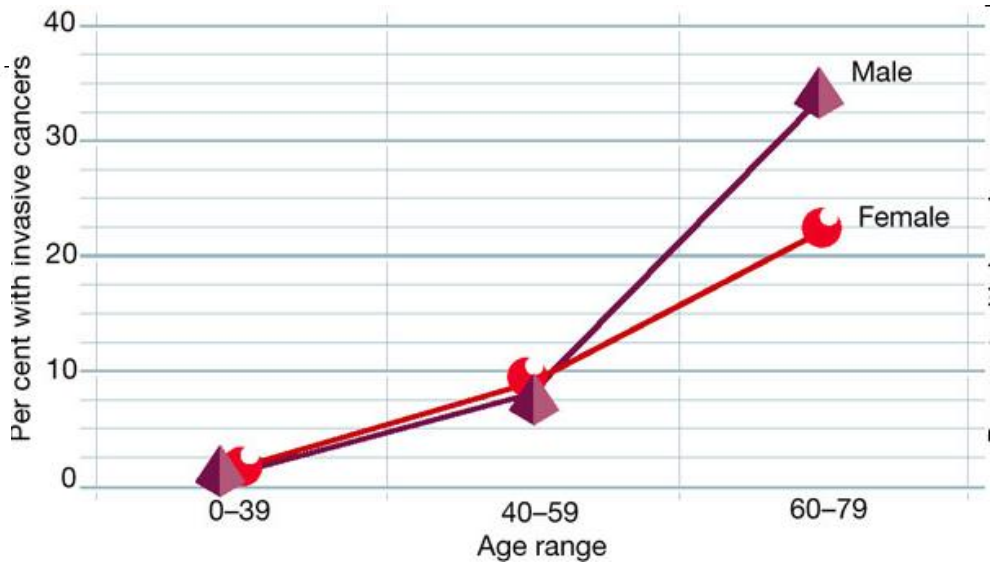




Kennedy R D , D'Andrea A D JCO 2006;24:3799-3808

DNA, ageing and disease



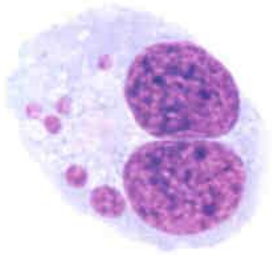


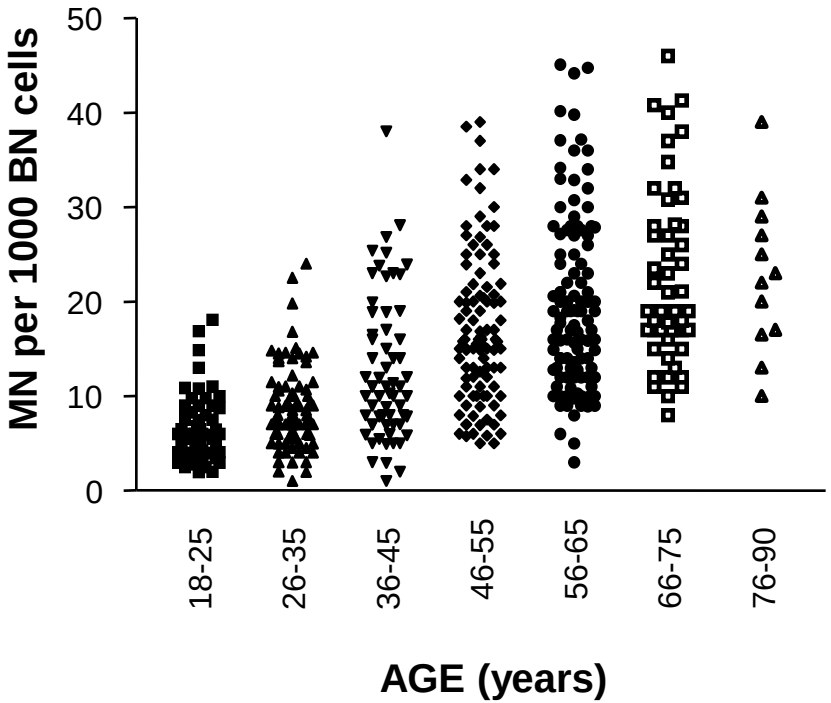
Finkel et al Nature 2007; DePinho Nature 2000

Genome damage increases with age

What are the nutrition, life-style and genetic variables that affect DNA damage?

Can we prevent the increase of DNA damage with age?





Fenech et al. 2000

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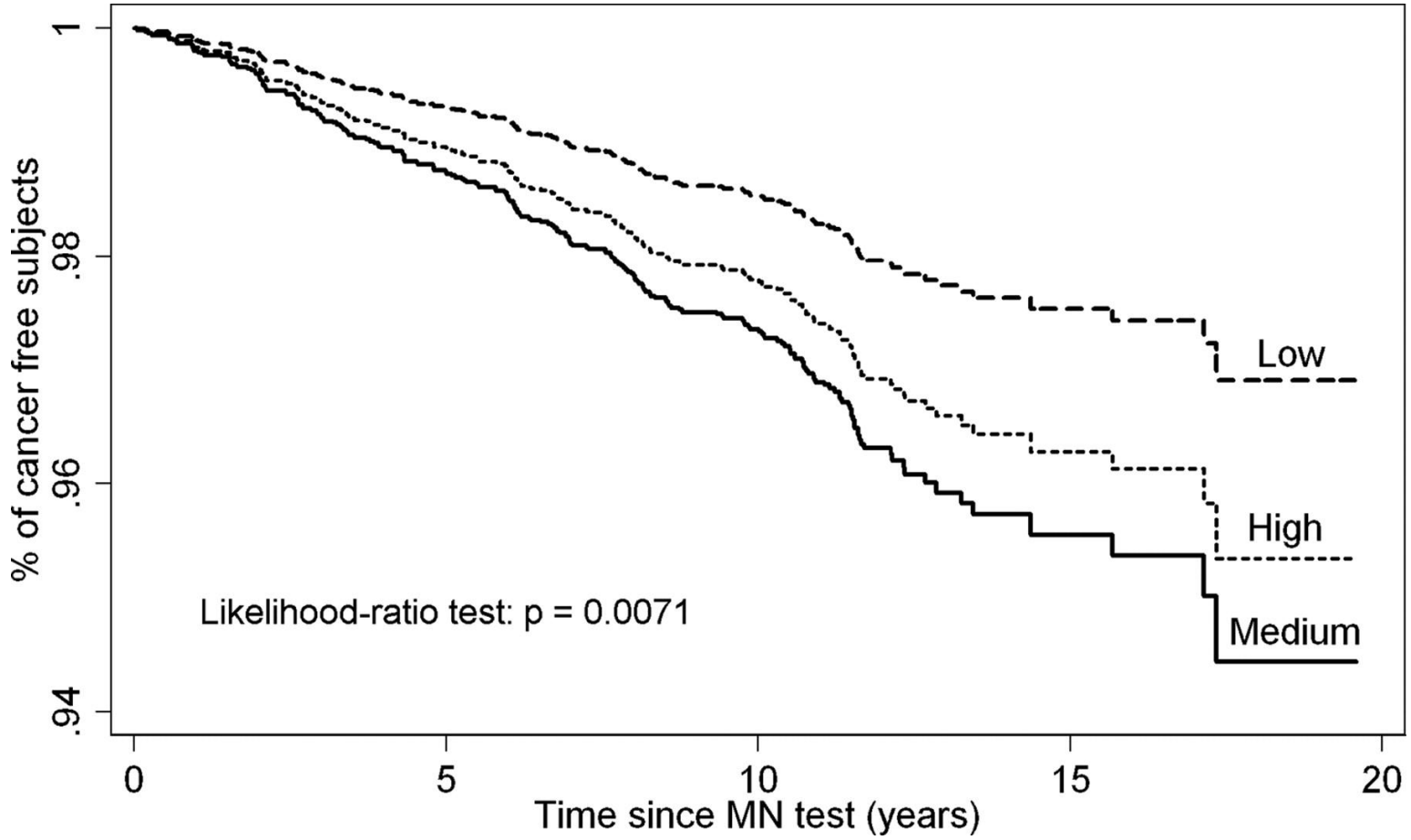
DNA damage index predicts cancer risk



Bonassi, S. et al. Carcinogenesis 2007 28:625-631; doi:10.1093/carcin/bgl177

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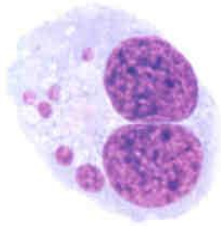
DNA damage index predicts cancer risk



Mid/High DNA damage

Higher cancer risk

Low DNA damage

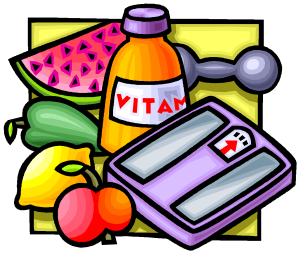
Lower cancer risk

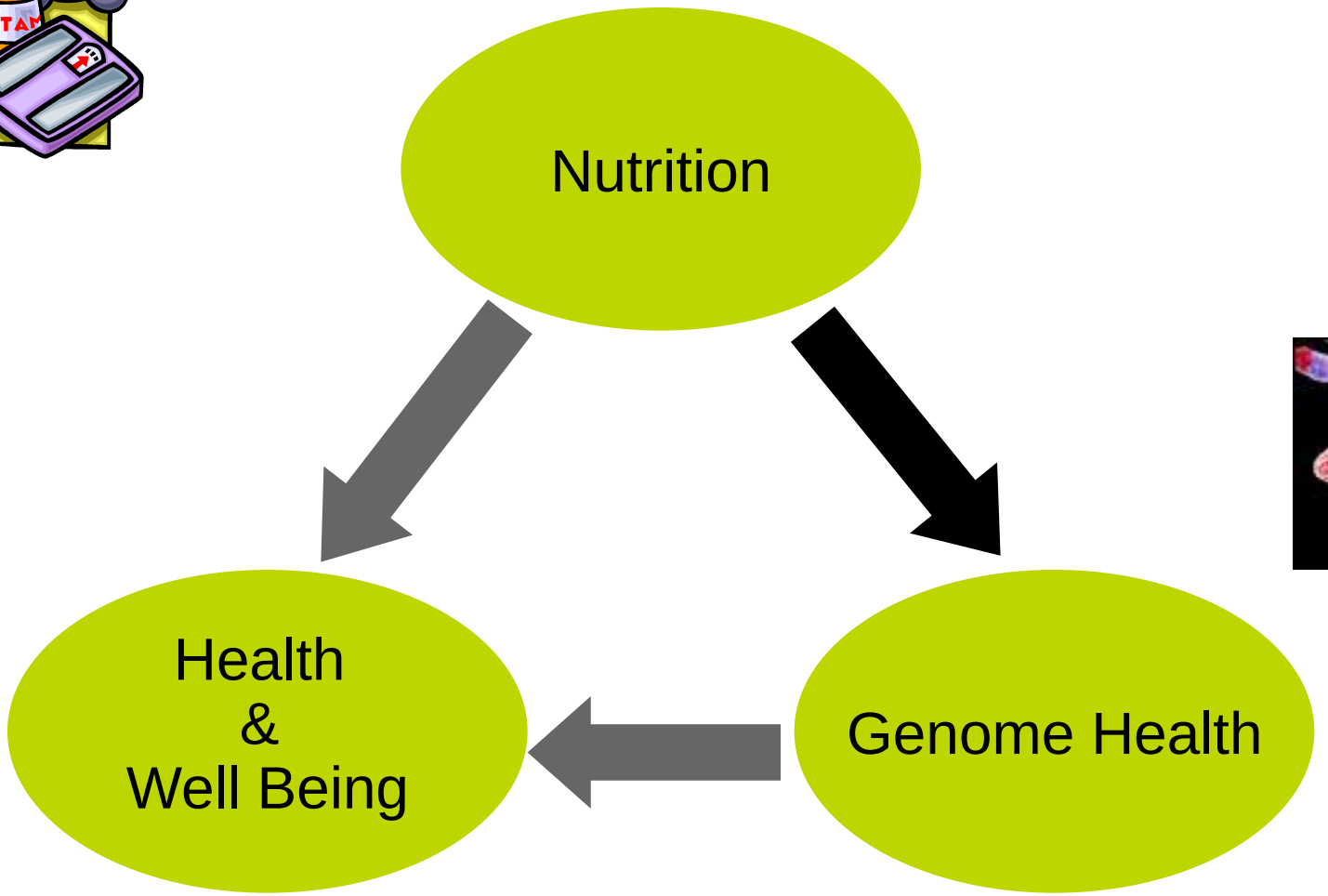
Genome health is modified by life-style factors

DNA damage accelerated by:

- Smoking
- Obesity and low physical activity
- Psychological stress
- Diet (inc. malnutrition)
- Environmental exposures
- Hours of sleep

Nutrition, health and DNA

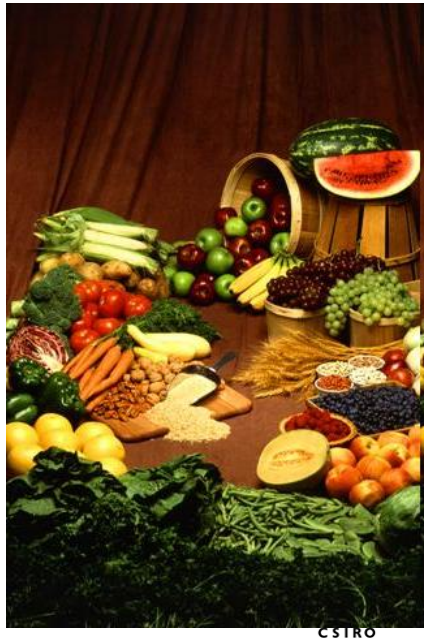




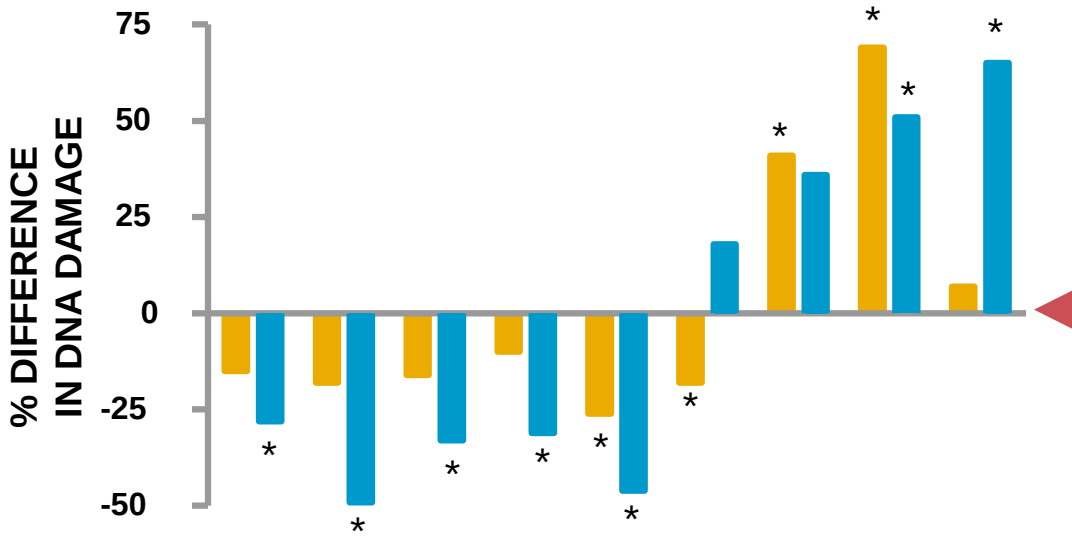
Dietary impacts on DNA

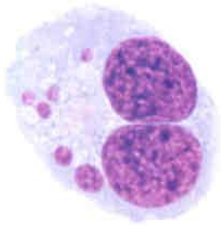
Increase DNA damage are associated with:
Increased homocysteine
low fruit & veg intake
Increased alcohol intake
Increased processed meat intake

Genome health is positively associated with:
plasma folate
Multi-vitamin use
Vitamins E, D
Fish intake
Dietary fibre (cereals)
Selenium



Micronutrient intake is a determinant of DNA Damage





Nutrition and DNA damage

DNA oxidation prevention	Vit C, Cu, Zn, Vit E, polyphenols
DNA synthesis	folate, B12, Zn, Mg
DNA repair	niacin, Zn, folate
Gene expression	folate, Vit D, Vit A
Chromosome segregation	folate, Vit A, Mg
Telomere length	niacin? via PARP, folate
Necrosis/Apoptosis	niacin, Zn, Vit E, Vit D, Vit C Vit A, Vit K2.

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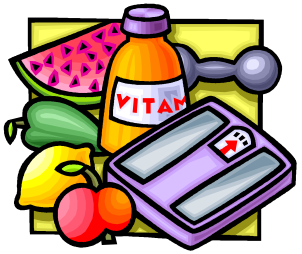
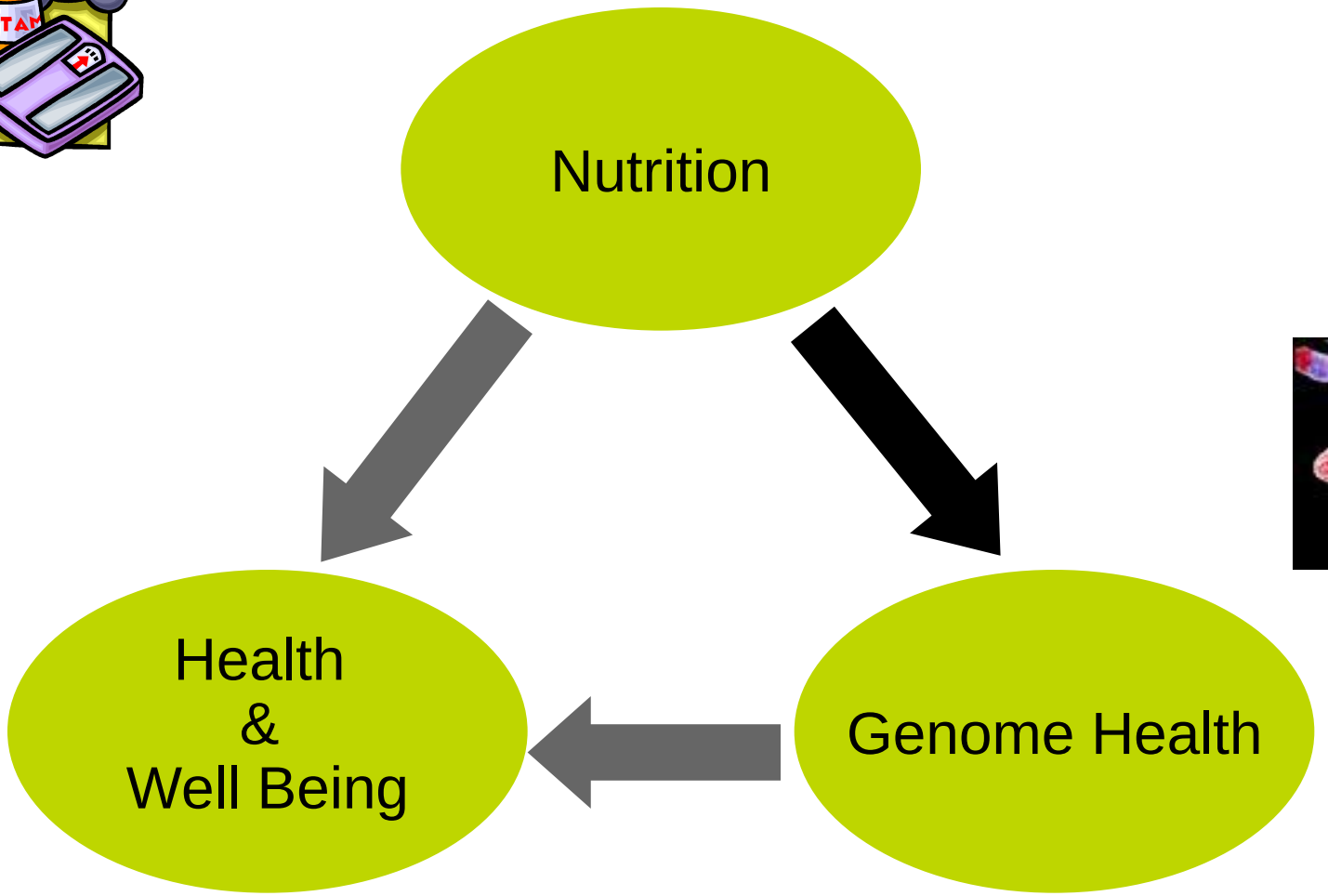
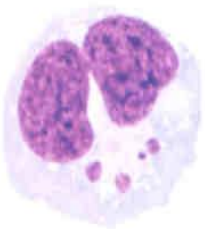
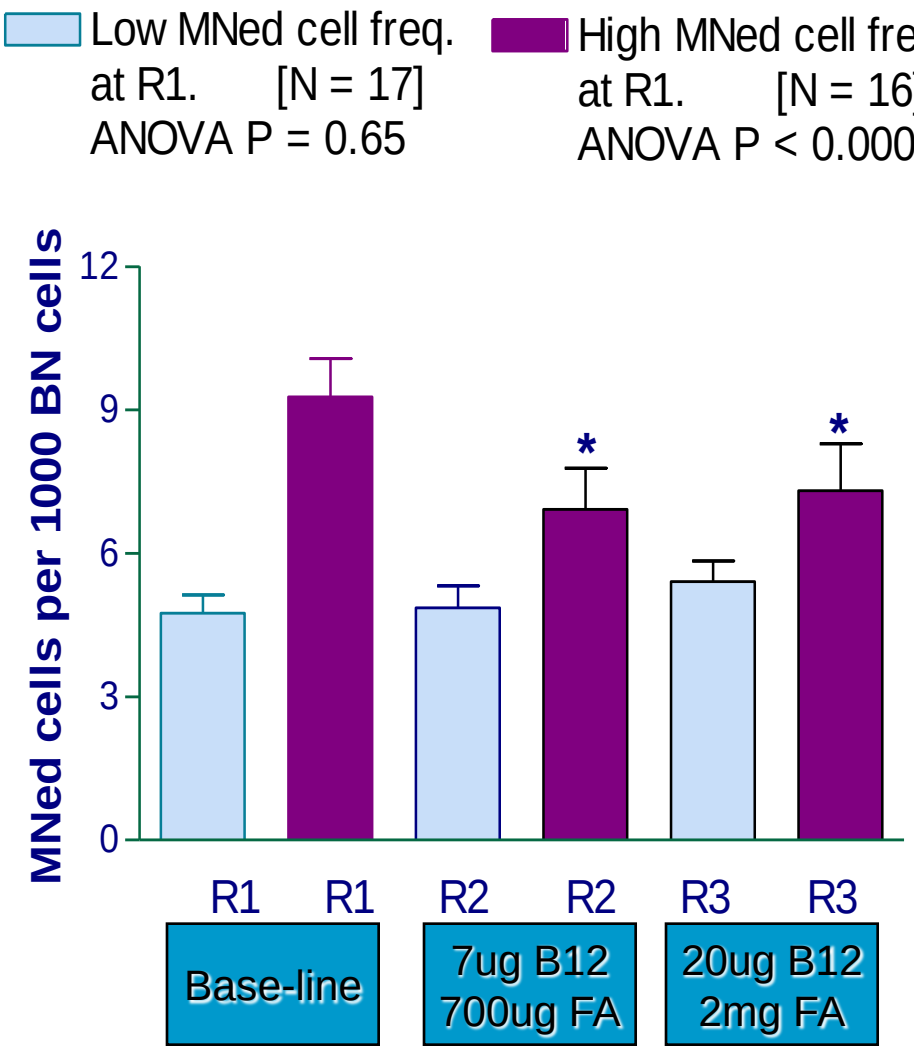
Nutrition, health and DNA





DNA Damage can be modified by diet





Fenech et al. 1998 Carcinogenesis

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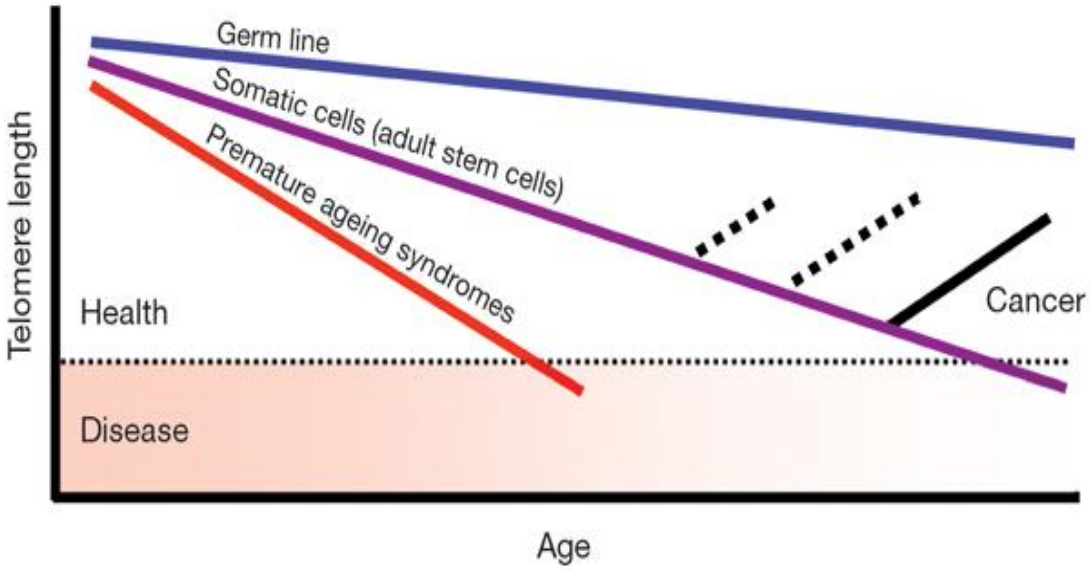
Genome damage in children

- Heritable premature ageing syndromes
  - Ataxia telangiectasia, Werner Syndrome, Bloom Syndrome, Dyskeratosis congenita, Fanconi anaemia.

- Early childhood cancers
  - Leukaemia and lymphomas



Nutritional factors associated with genome damage in children

AIMS:

1. Describe the nature of the interaction between nutritional factors in determining level of DNA damage in children.
2. Identify the key nutritional factors associated with DNA damage in children.

- 3, 6 and 9 year olds
- Dietary questionnaire
- DNA damage and nutrient profile

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Nutritional factors associated with genome damage in children

- DNA Damage markers
  - CBMN-Cyt assay
  - Telomere length

  CSIRO – Food and Nutritional Sciences
- Vitamins
  - Folate, Vitamin B12, Vitamin D

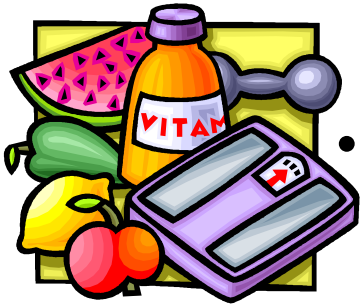
  SA Pathology
- Carotenoids
  - Carotenes (α and β), α-tocopherol, lycopene, luetin, retinol

  CSIRO – Food and Nutritional Sciences
- Minerals
  - zinc, magnesium, calcium, selenium

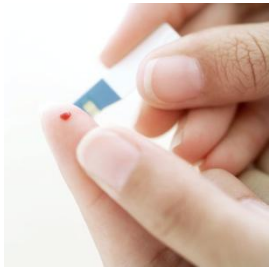
  Waite Analytical Services

What next?

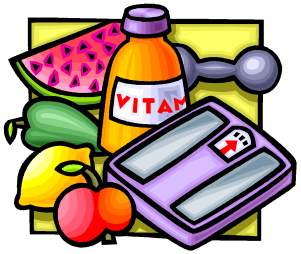
- Determine the nutritional and genomic factors that significantly affect telomere maintenance and function in children.
  - Define nutrient levels for optimal genome functioning

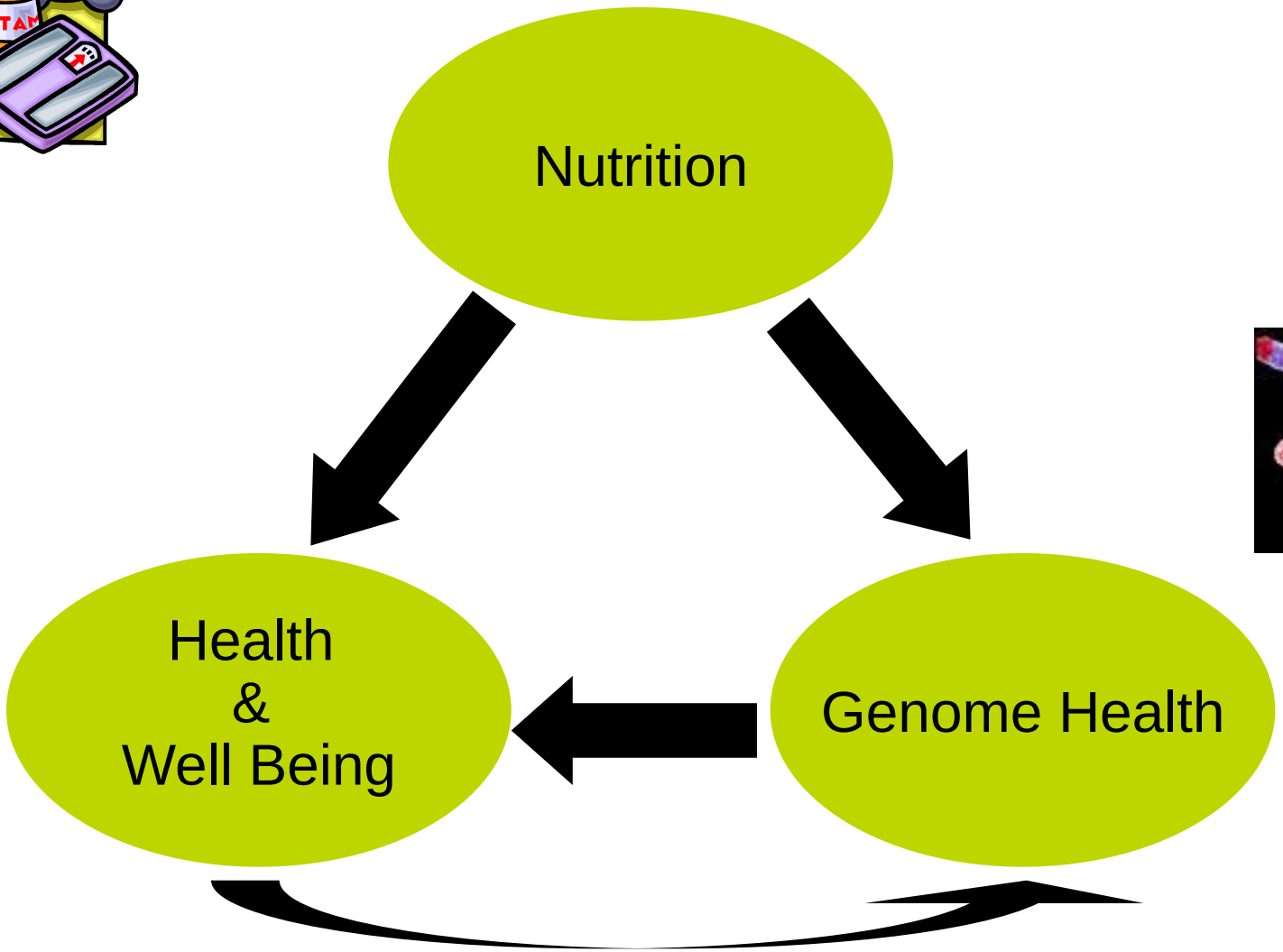


- Does improved nutrition in early life reduce disease?



Nutrition, health and DNA





Acknowledgements

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Michael Fenech

Carolyn Salisbury, Theodora Almond, Maryam Hor, Bianca Benassi-Evans, Sasja Beetstra-Hill

TICHR

Liz Milne

Sandy Costanzo, Lisa Miller, Meg McHugh

NHMRC Kids project CIs

Liz Milne, Michael Fenech, Bruce Armstrong, Nick de Clerk, Marg Miller

Australian Government
National Health and Medical Research Council
NHMRC

The Cancer Council

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Reference list

- Images are sited on slide they appear
- Others images:
  - Life be in it
  - Gearfuse.com
  - Futurama.com