

**Diet, Inflammation and Death**  
*Food Chemistry & Public Health*

*Paul Clayton*



# Health Trends since 1950

- Overweight, obesity, NIDDM doubling every 10-15 yrs
- NAFLD, ESRD – ‘out of control’
- Hypertension: >55% of US adults (USDA 2000)
- Dementias (AD = ‘Type 3 diabetes’) increased 250%
- Neurodegen. deaths > 75: increased 300-500% (Pritchard ‘15)
- ADD/ADHD/dysphasia/dyspraxia (U. Washington ‘06)
- Autism: up 78% in last 5 years (CDC ‘12, MMWR ‘12)
- Non-tobacco related cancers: 100% increases
- Cancers in teens and young adults: 100% increases
- Bowel cancer – quadrupled in 22-37 yr olds (Siegel et al ‘17)
- Osteoporosis: not demographic shift (Obrant et al ‘89, Agarwal Grynbas ‘96)
- Osteoarthritis: knee/hip replacement up 3/2 x from ‘93-’09 (JBJS ‘14)
- Asthma: up 250% in last 20 years (Upton et al 2000)
- Eosinophilic GI disorders: ‘explosive growth’ (Noel et al ‘04)
- Autoimmune diseases: increasing 3 - 4% p.a. (Eurodiab 2000)

# The Post-Modern Diet

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# Poor diet biggest cause of early death globally

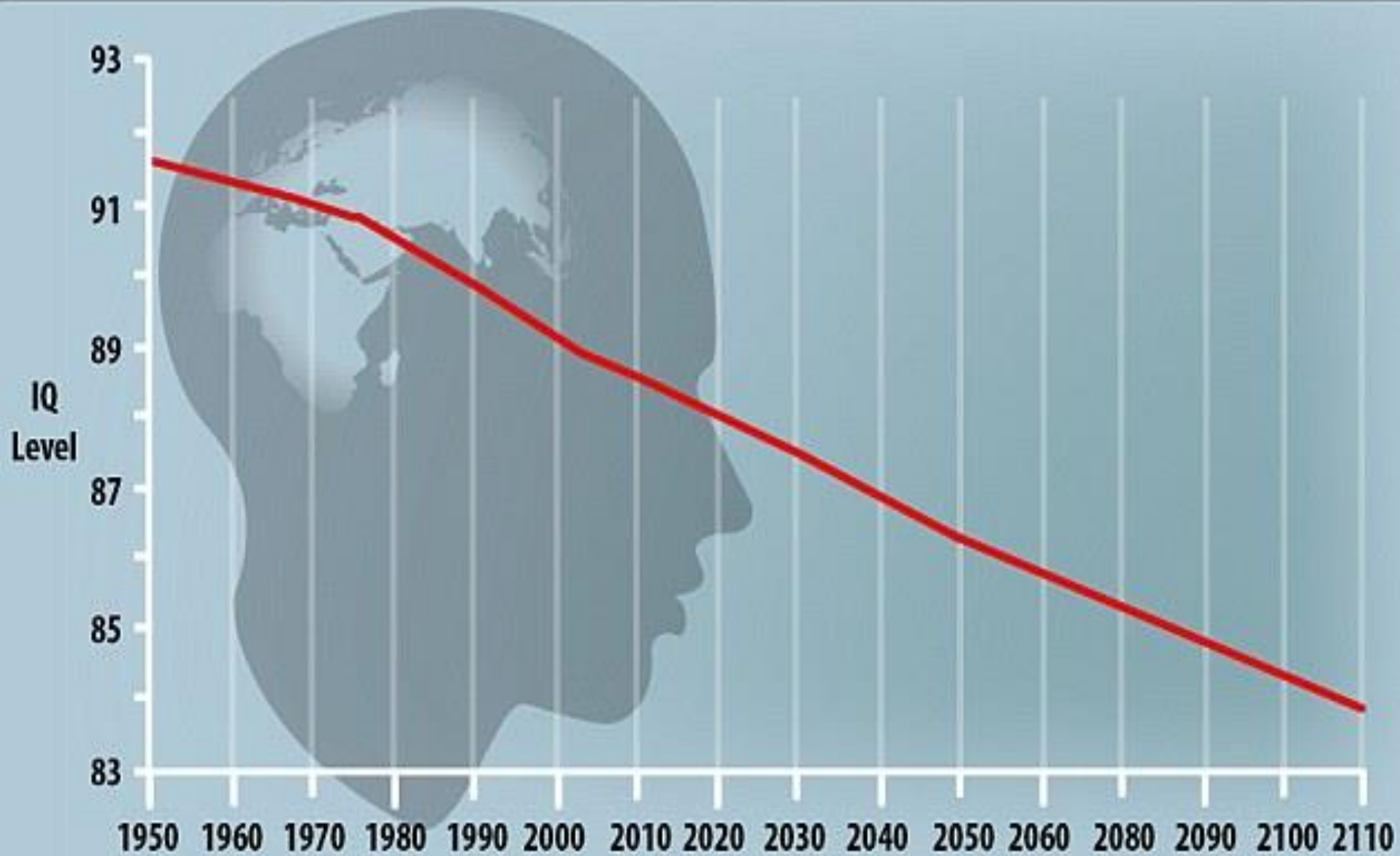
US Institute Health Metrics & Evaluation (IHME)

Lancet Sept 2015

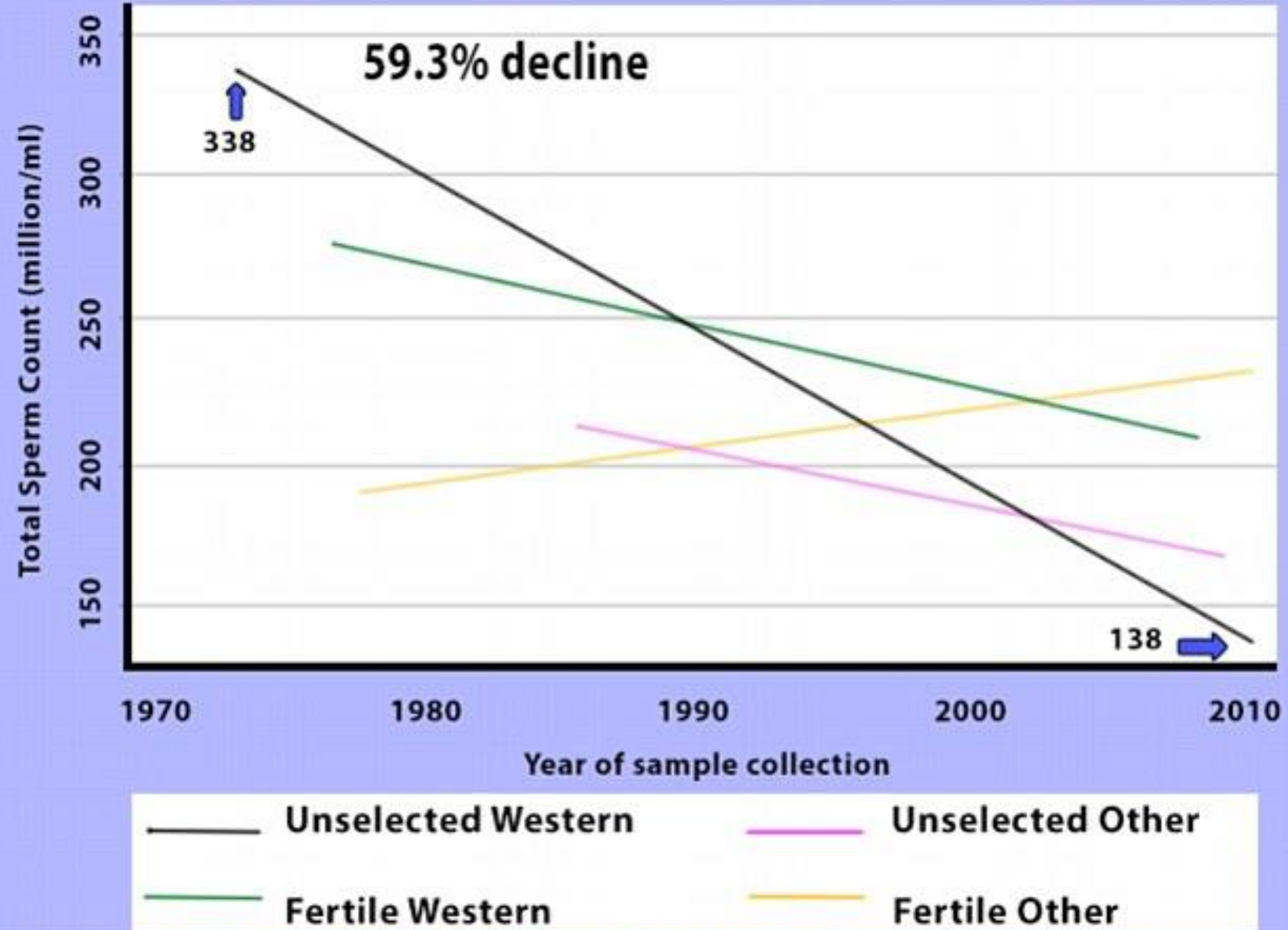
*'Global, regional, & national comparative risk assessment of 79 behavioural, environmental, occupational & metabolic risks or clusters of risks in 188 countries, 1990–2013: systematic analysis for Global Burden of Disease Study '13'*

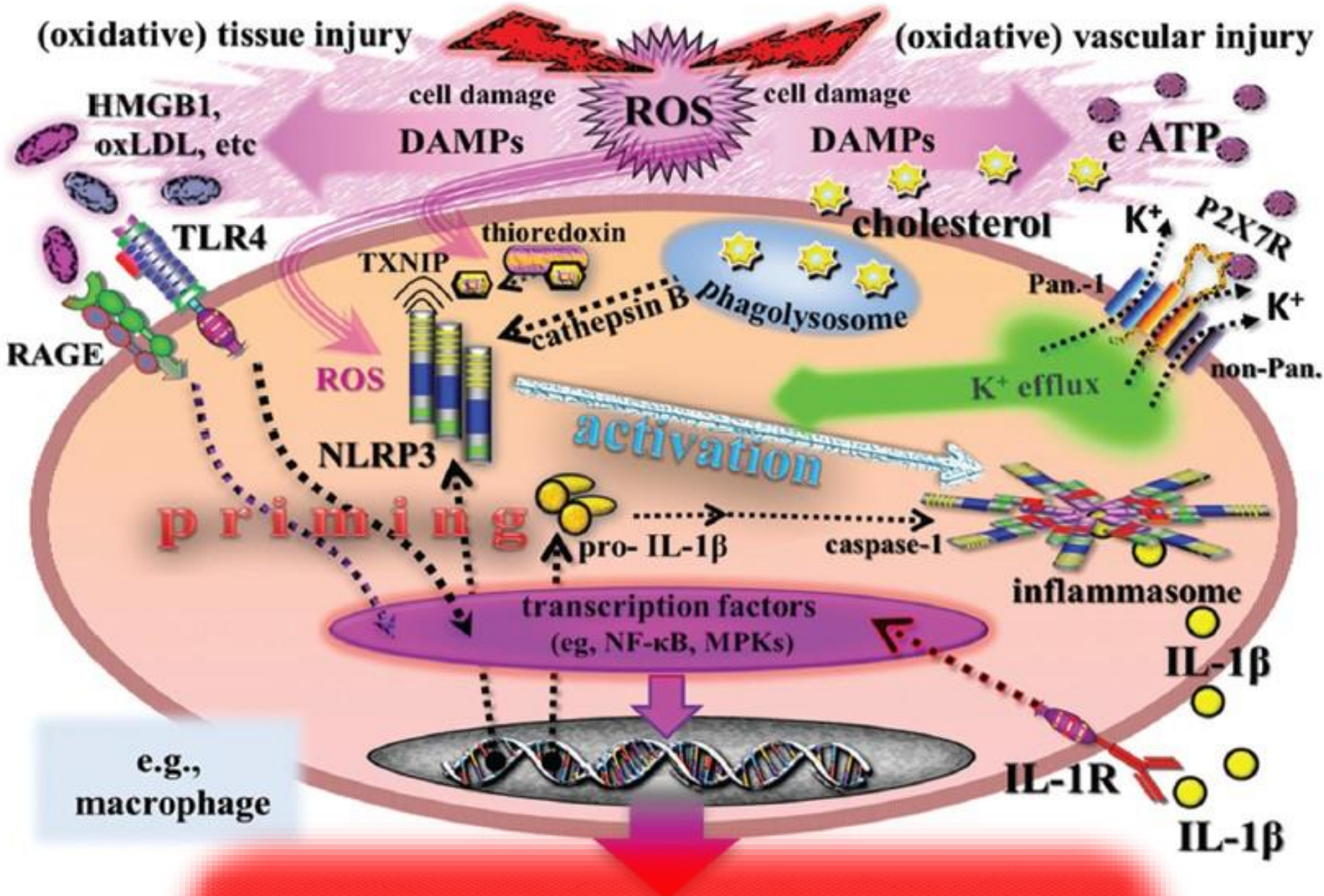
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# World IQ over time



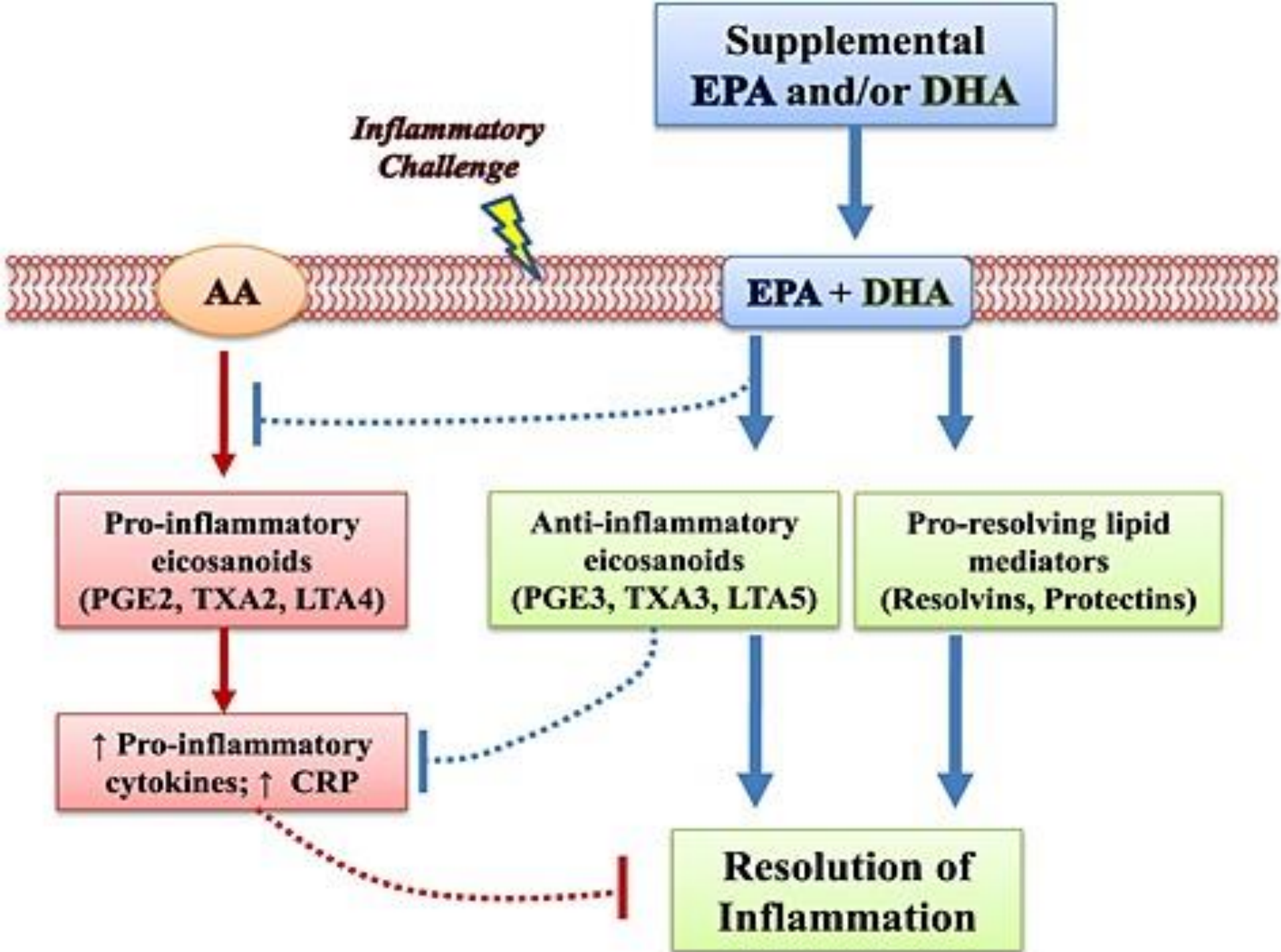






# The Inflammasome





# *The Inflammazone*

Lipid mediators  
cause oedema ...

6/3

... shed exosomes





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- # ....which release MMP's
- # ... causing tissue destruction

P-p

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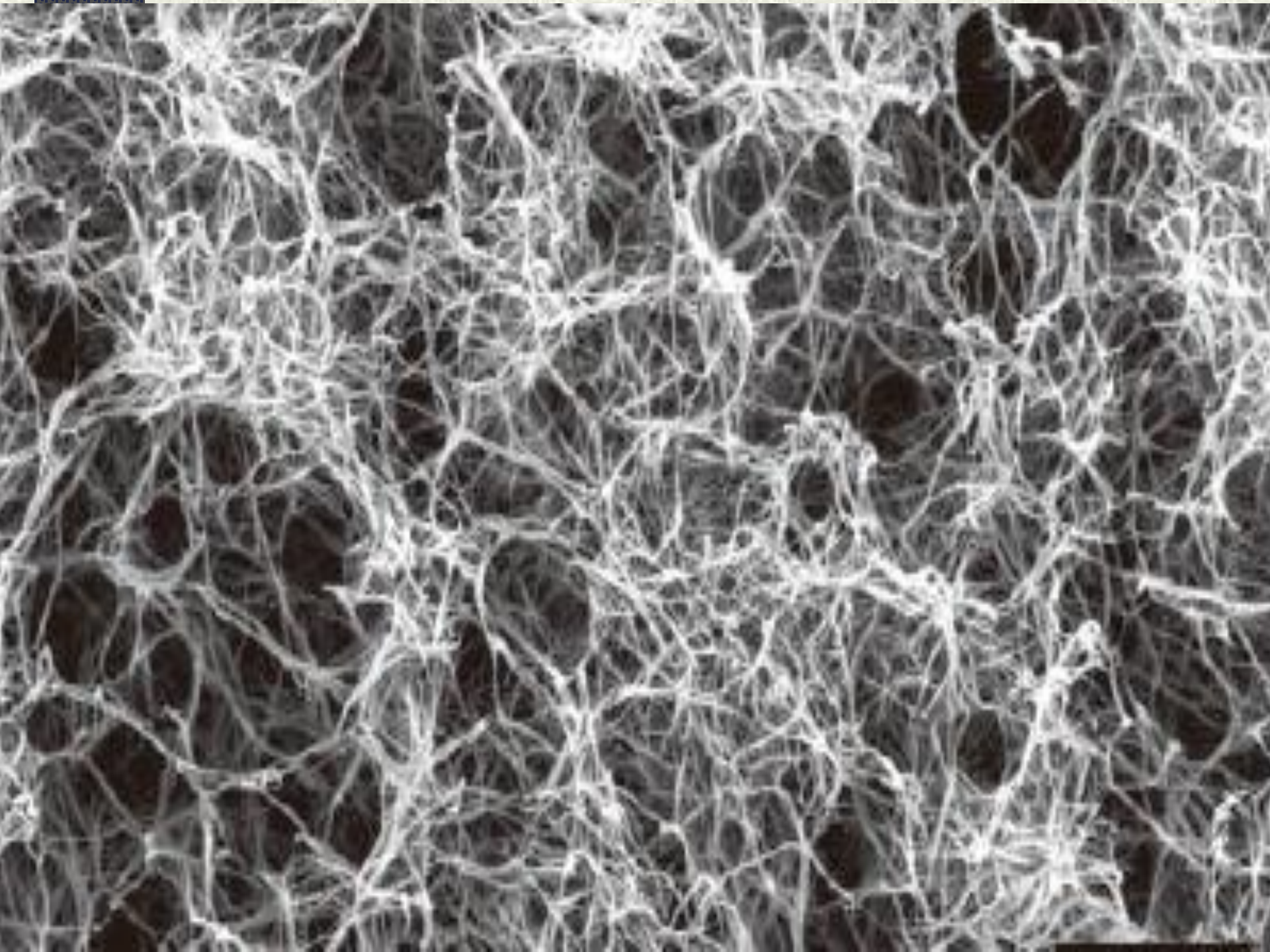
P-p

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n-6 / n-3 ratio

1:1

15:1 to 25:1

Hunter-Gatherer

Agricultural

Industrial



# *Polyphenol shift*

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- ❖ 5-a-day – but reality is 3
  - ❖ mid-Victorians ate 10 portions / day
  - ❖ Heritage fruits / veg contained 3 x polyphenols
  - ❖ Polyphenol intakes have fallen 90%
-



Pathological Omega 6:3 ratio



Pathological lack of polyphenols



Pathological lack of prebiotics



Pathological lack of 1-3, 1-6  $\beta$ -glucans



Pathological excess of AGE's & ALE's



Pathological electrolyte ratio







Pathological Omega 6:3 ratio



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# Ultra-processed foods and death

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10% increase in consumption associated with

- # 10% increased risk of cancer (Schnabel et al '19)
  - # 14% increased risk early death (Fiolet et al '19)
  - # Accelerated immunological ageing, increased inflammation, increased risk of sepsis (Napier et al '19)
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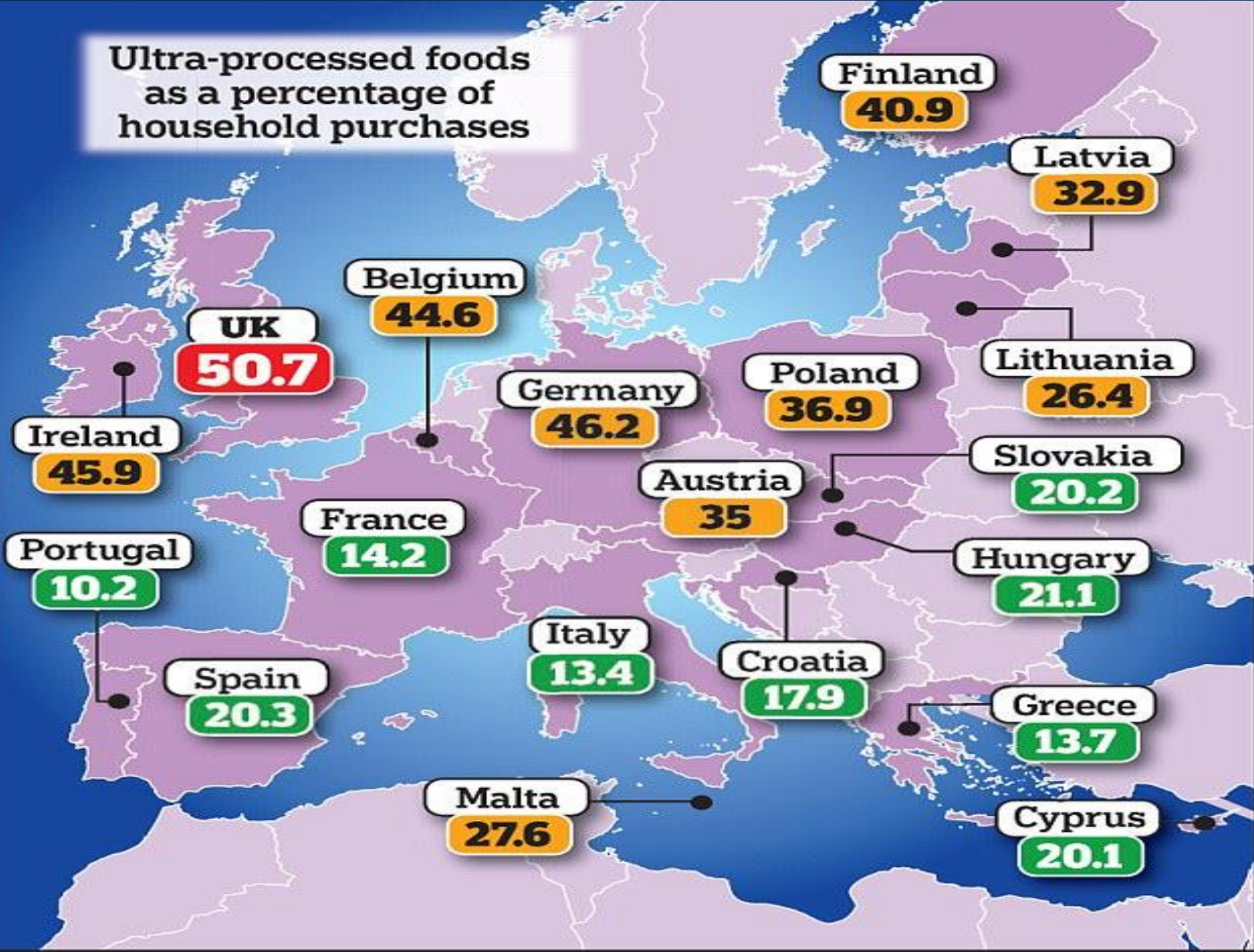
# Life Expectancy Falling

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- # USA: death rates from all major causes increasing since 2016 inc sepsis, diabetic complications, neurodegenerative (1)
  - # UK: death rates from all major causes increasing since 2017 (2)
  - # Coming soon: Germany, Ireland, Finland, Poland
-



Ultra-processed foods  
as a percentage of  
household purchases



# „Deutsche haben die geringste Lebenserwartung in Westeuropa“

*Woran liegt es?*

Im Vergleich zu Mittelmeerländern wie Spanien oder Frankreich seien Herz-Kreislauf-Erkrankungen hierzulande deutlich stärker verbreitet. Das liege insbesondere an der Ernährung.

Die Mittelmeerküche basiert nicht bloß auf vielen Fischgerichten, sie enthält auch deutlich mehr Gemüse, Salate, Hülsenfrüchte und Obst. In Deutschland dominieren dagegen kalorienreiche, fetthaltige Gerichte. Dazu kommen hoher Tabak- und Alkoholkonsum, Bewegungsmangel, Übergewicht.

*Info-Quelle: Max-Planck-Institut für demografische Forschung in Rostock*

ZEIT  ONLINE

22. November 2018



# Mediterranean diet better than medicine

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Halves the risk of ....

Metabolic Syndrome / diabetes

Secondary coronary artery disease

COPD

Alzheimer's

Parkinsonism

Several cancers

Premature death from all causes

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# 19<sup>th</sup> C diet better than Mediterranean diet

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## # The 'Agricultural Revolution'



# 19<sup>th</sup> C diet better than Mediterranean diet

## # The expansion of the railways



FIG. 55.—The "Rocket," 1829.



1880



# How the mid-Victorians worked

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- # Society mostly blue collar
- # 10 hrs / day, 5.5 - 6 days / week
- # 6 miles / day walking to & from work
- # Leisure 5-6 hours / week
- # 60 – 75 hours of physical activity / week

# How the mid-Victorians ate

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- # High physical activity (> 4000 cal/day)
- # Low intake: salt, tobacco, spirits, processed foods
- # High intake: omega 3
- # Low intake: omega 6
- # Fruit & veg: 10 or more portions / day
- # *A 'super-Mediterranean' diet*

# Life expectancy England & Wales

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- # Mid-Victorian women: 73 (Charlton 2004)
- # 21<sup>st</sup> C working class women: 76 (Joyce 2006)
- # Mid-Victorian men: 75
- # 21<sup>st</sup> C working class men: 72

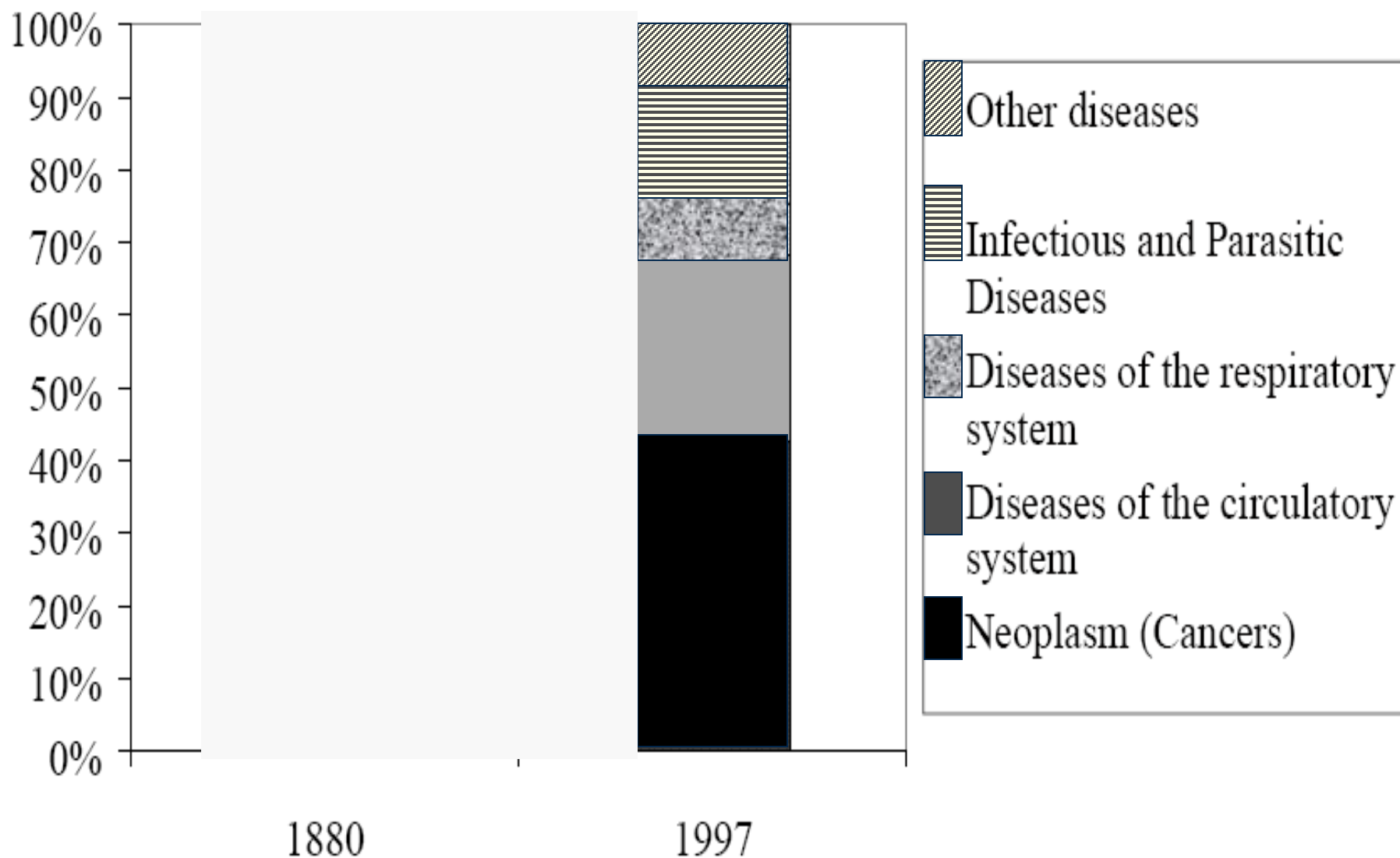
Mid-Victorian elderly generally healthy: work-houses

*90% less cancer, heart disease, diabetes .....*

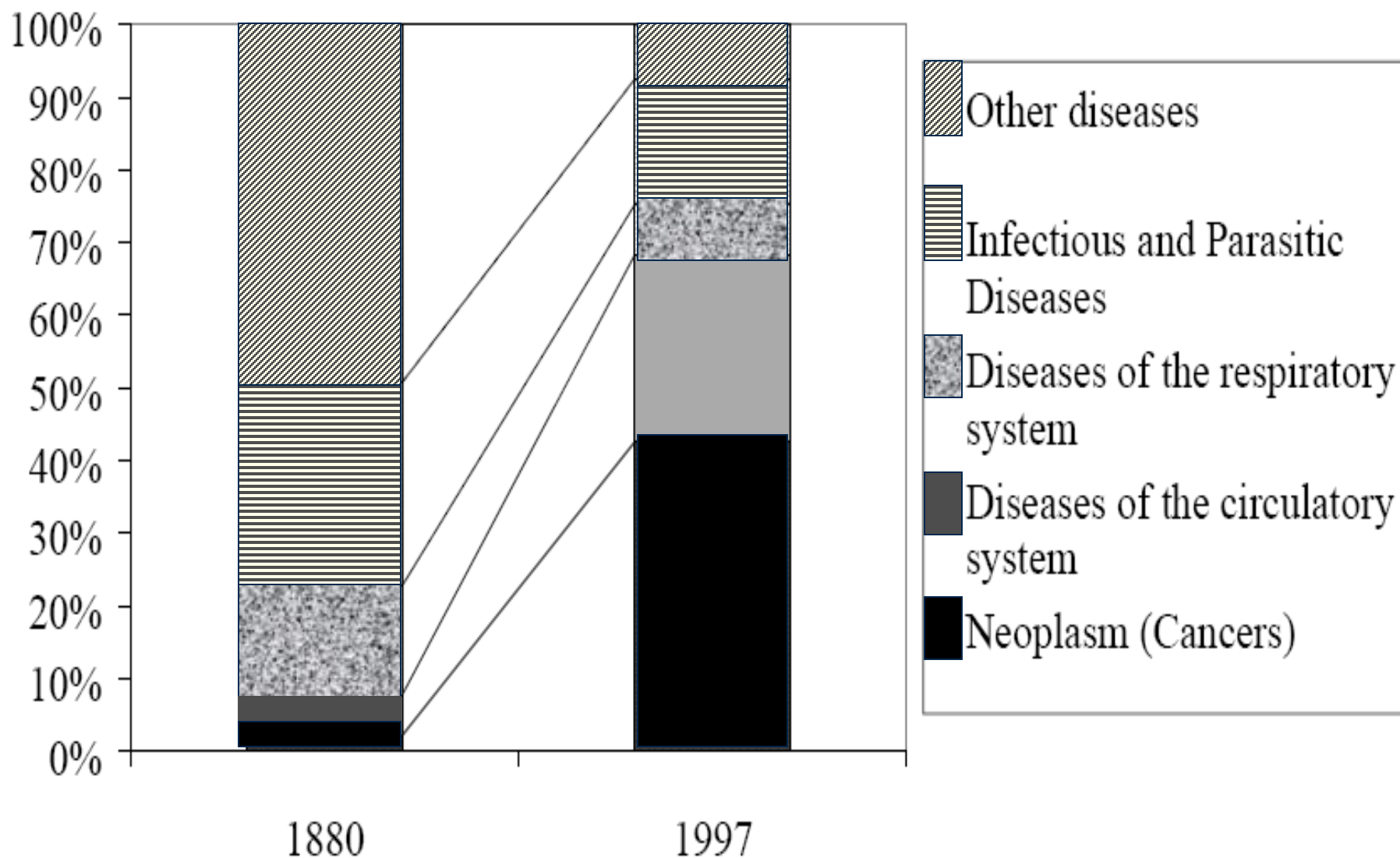
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## Cause of Death in England and Wales: 1880 and 1997



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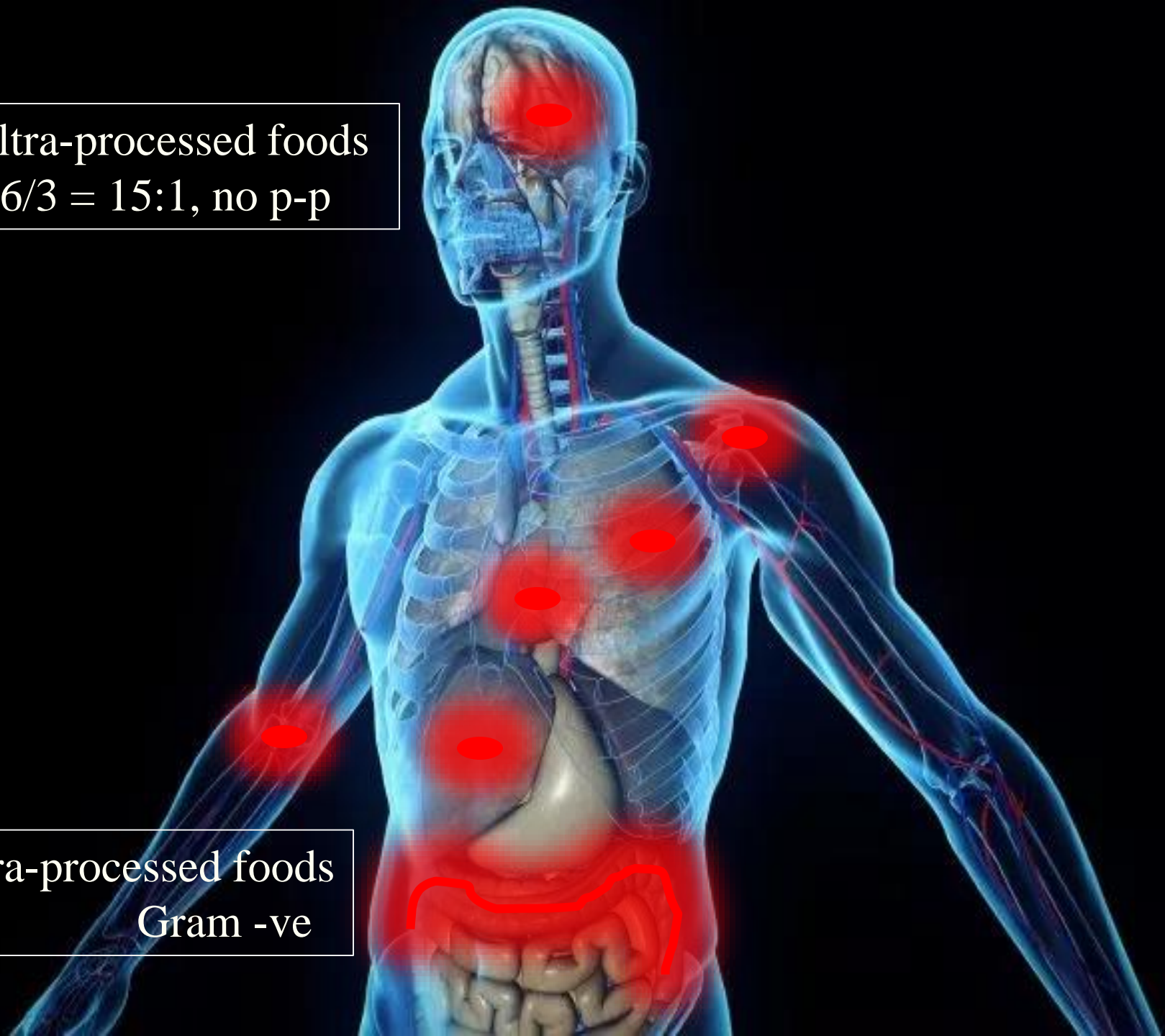
	Victorians	Today
Obesity	Rare	Prevalent
Adipocytokines	Neutral	Pro-inflammatory
NIDDM (hyper-glycaemia, insulinaemia, IGF-1)	Rare	Common
06/03	2:1	15:1 – 25:1
Polyphenols + other phytonutrients	10-15 g	0.5-1.0 g
1-3, 1-6 $\beta$ -glucans	+++++++	++
Tobacco, spirits	+/-	+++++++
Cooked meat carcinogens	+/-	+++++++
Phase 2 inducers	+++++++	+
AMP-K / MTOR	<b>ON / OFF</b>	<b>OFF / ON</b>



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Ultra-processed foods  
 $\Omega 6/3 = 15:1$ , no p-p

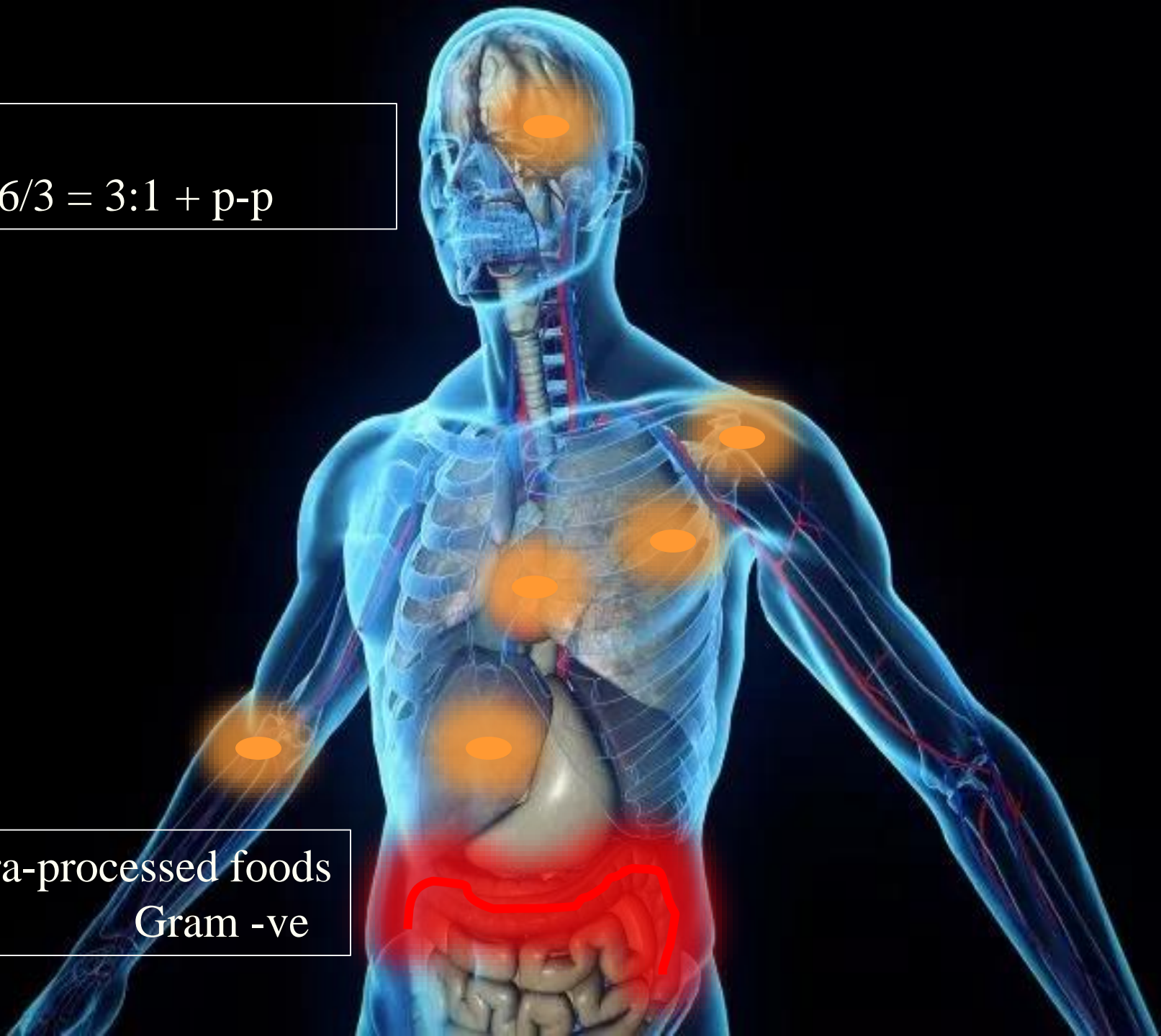
Ultra-processed foods  
Gram -ve



*l*

$$\Omega 6/3 = 3:1 + p-p$$

Ultra-processed foods  
Gram -ve

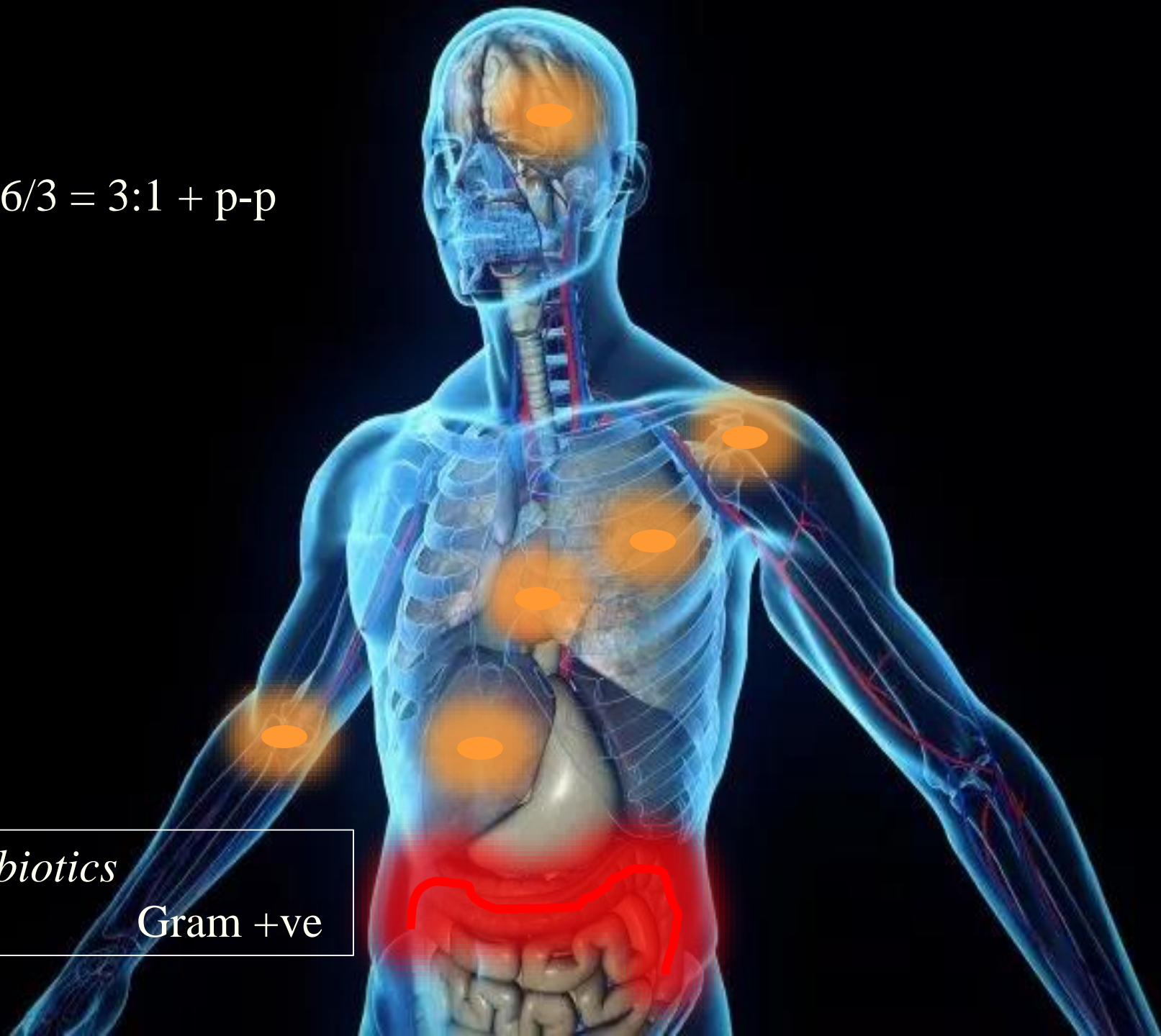




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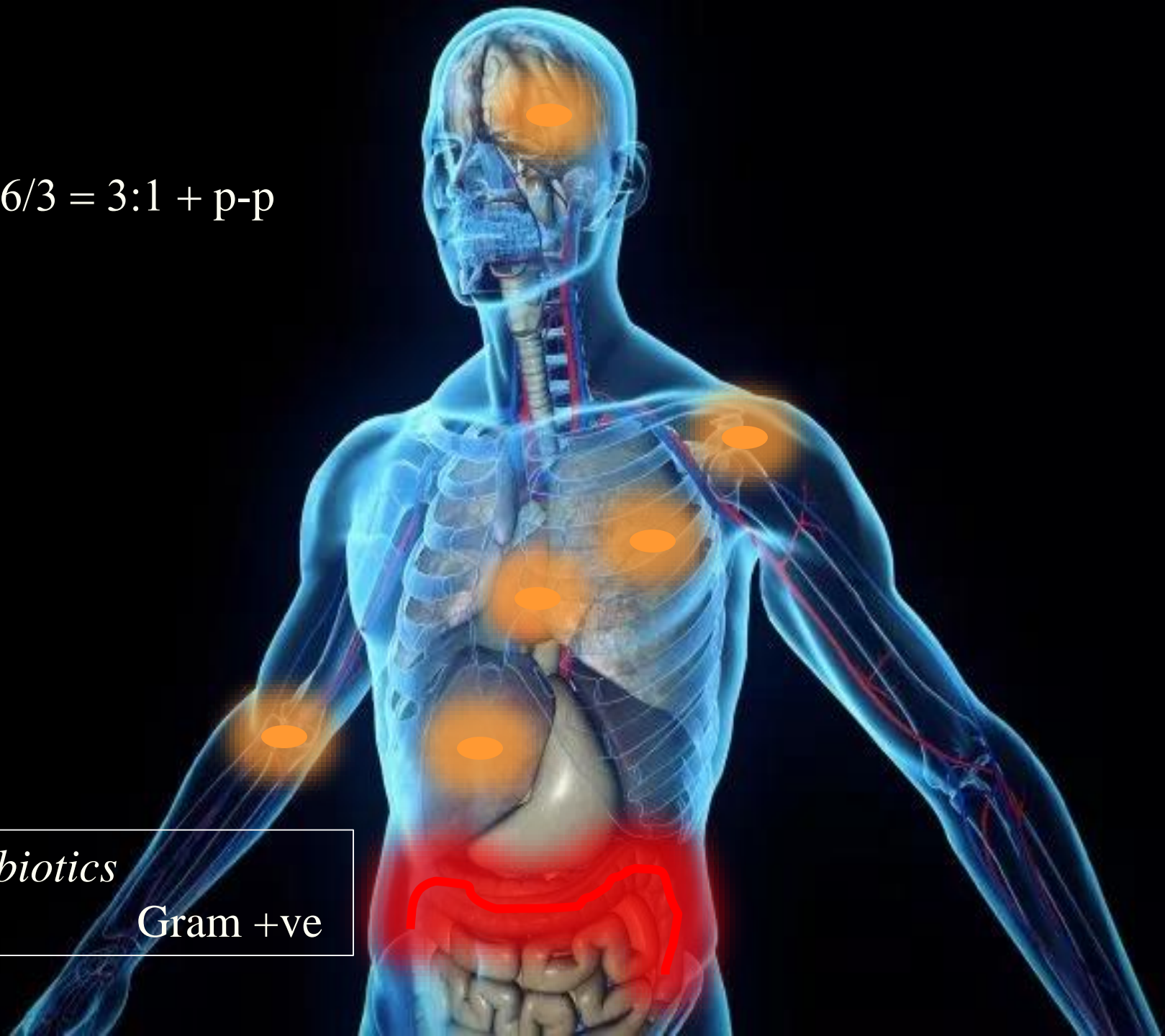
*Prebiotics*  
Gram +ve



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*Prebiotics*

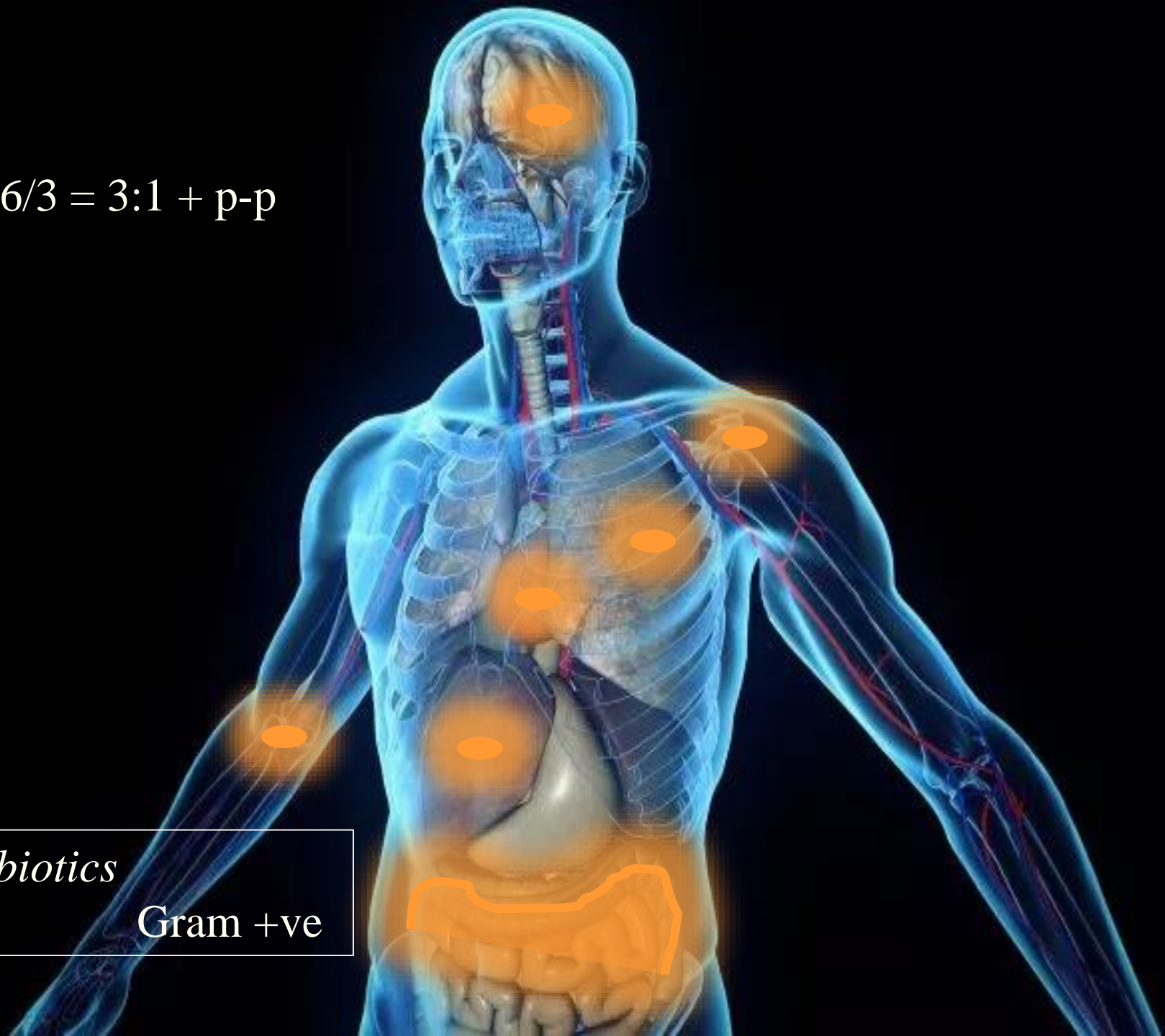
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*Prebiotics*

Gram +ve

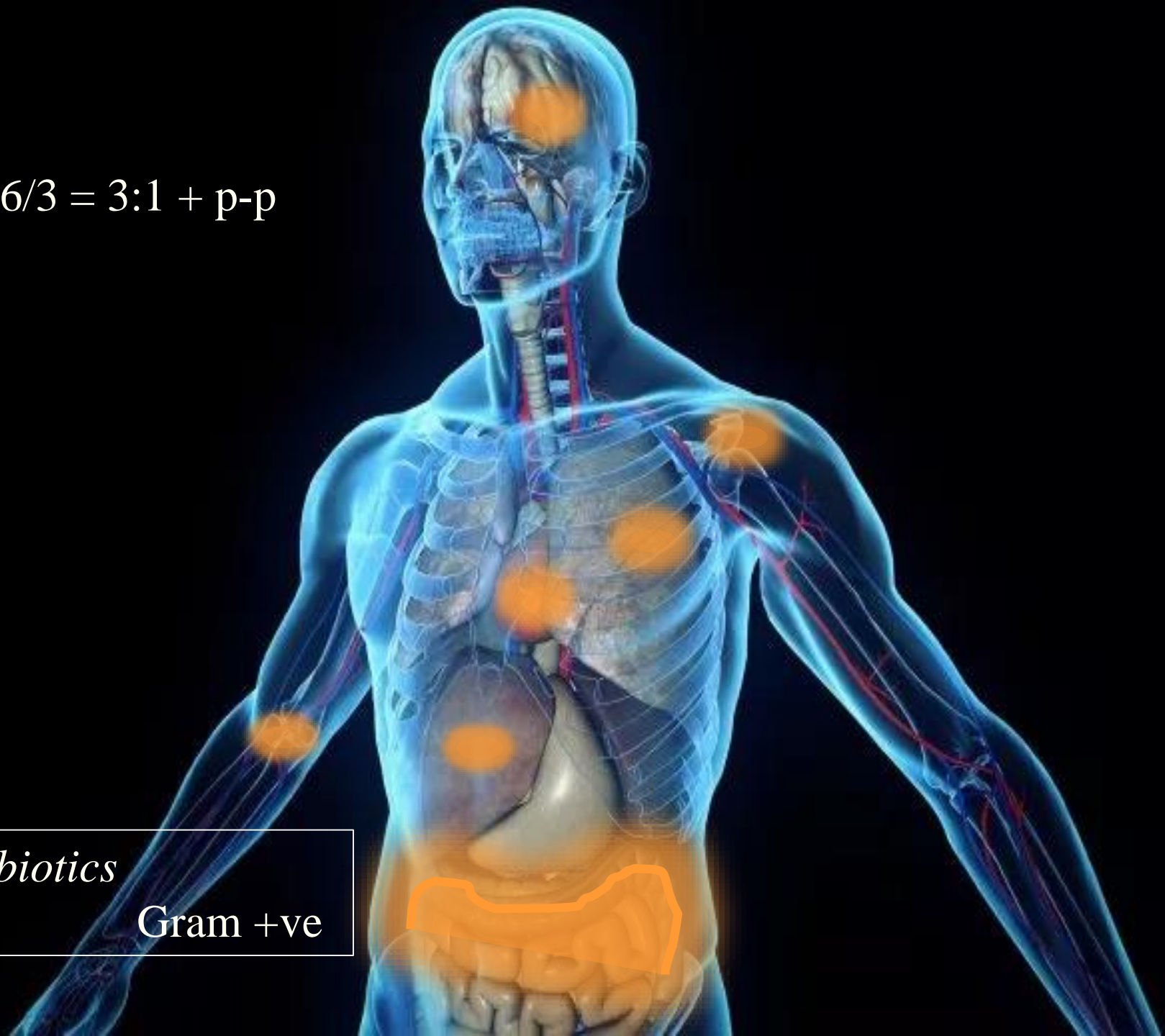




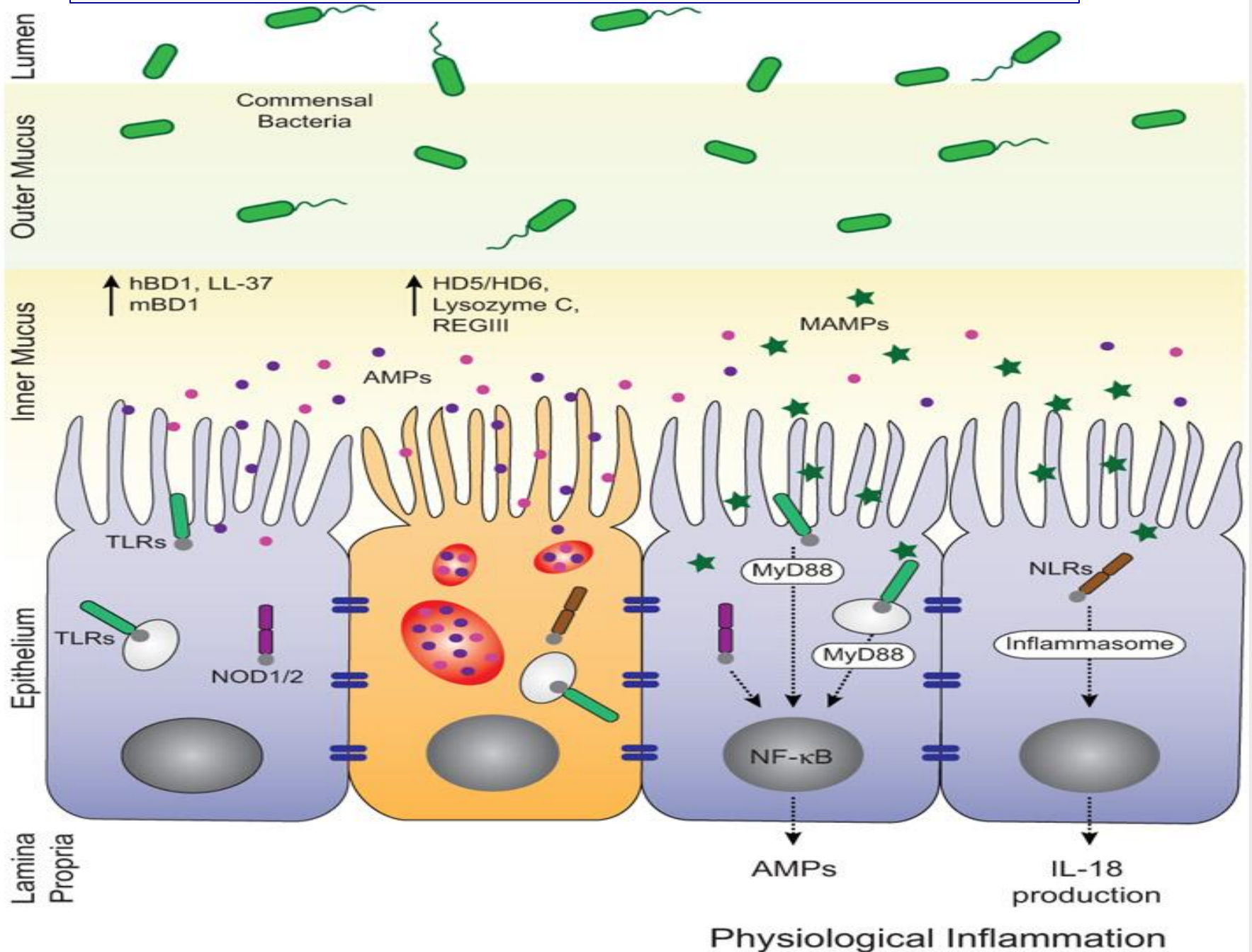
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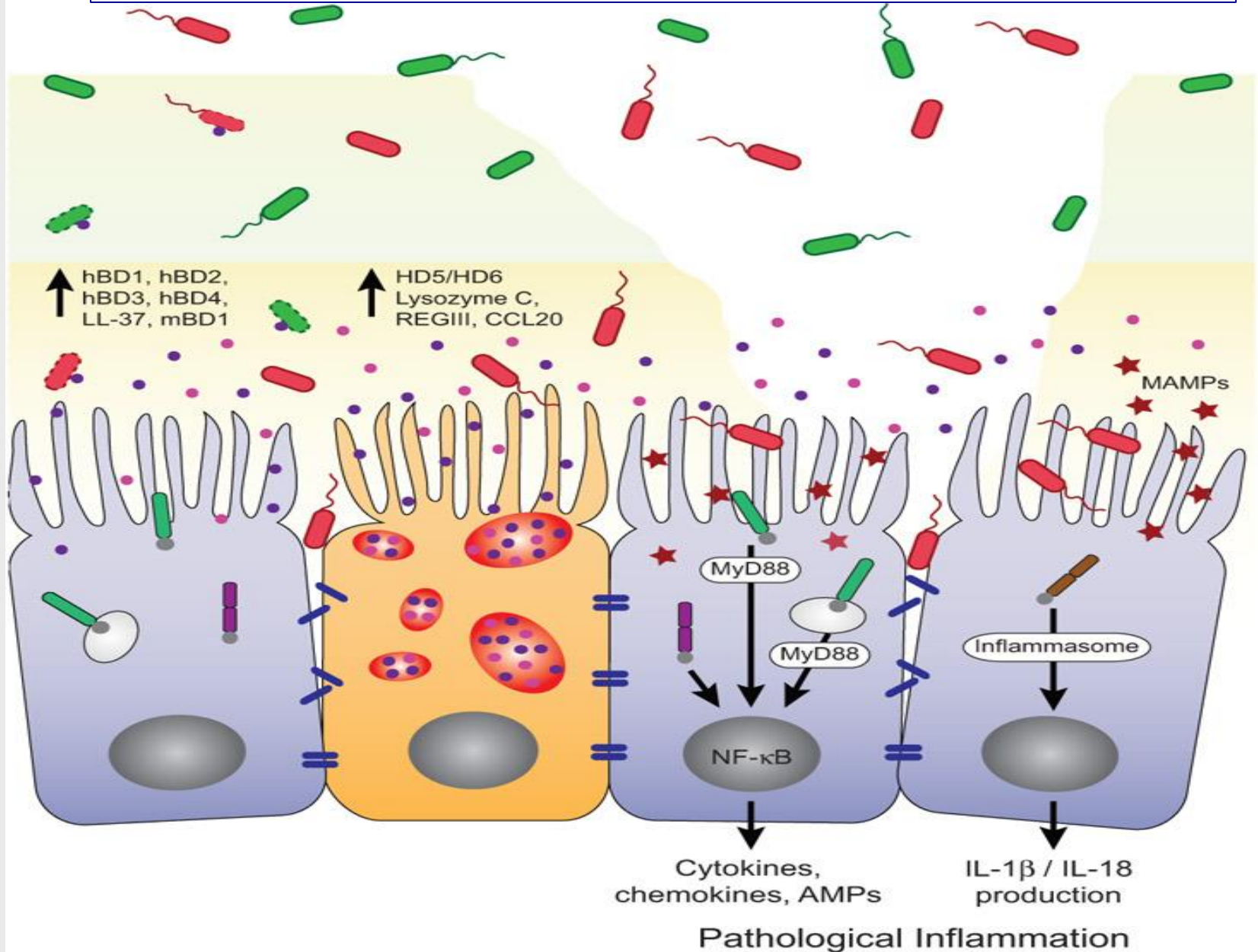
Gram +ve



# Blue Zone diet: prebiotics → healthy homeostasis

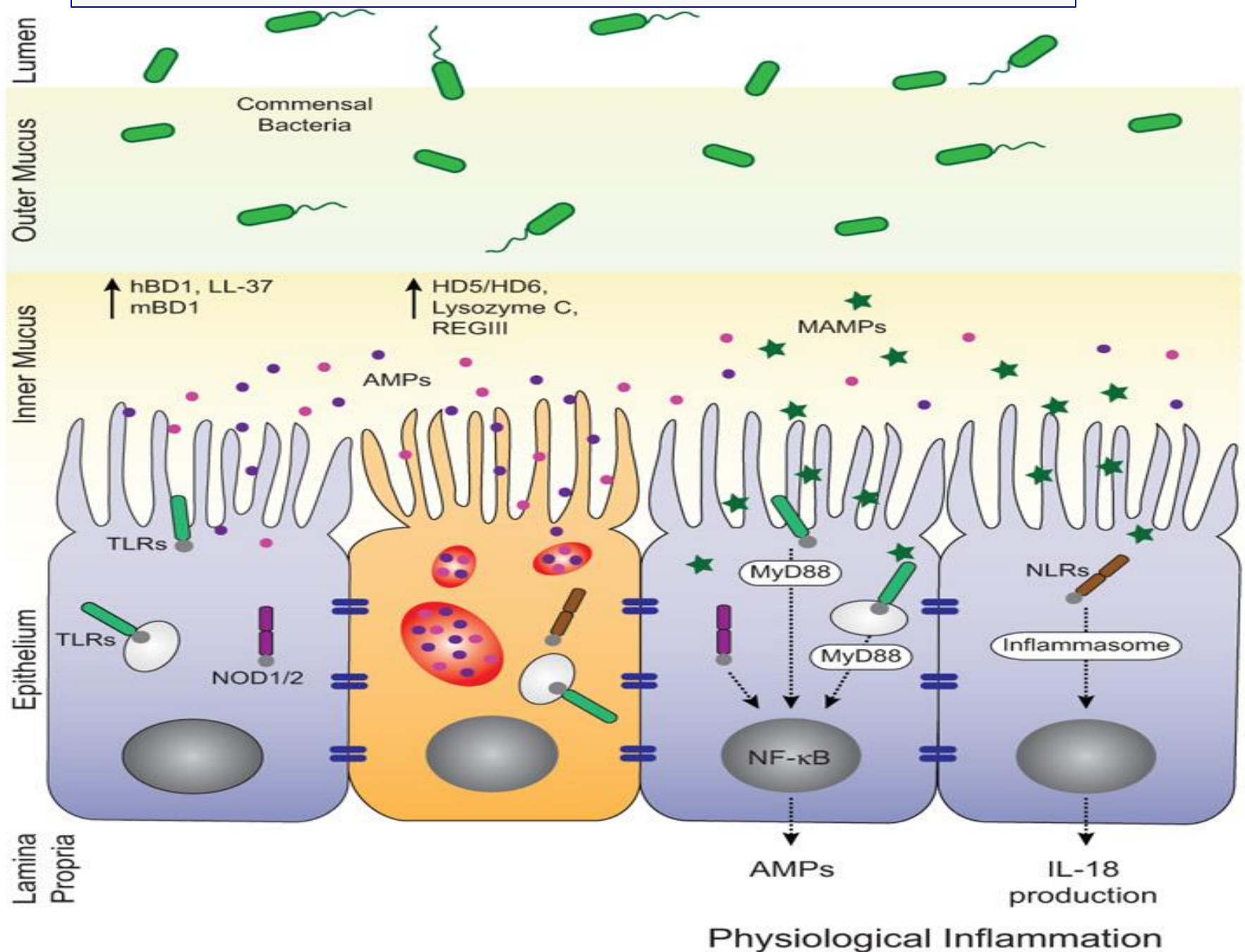


# Modern diet: depleted prebiotics → dysbiosis

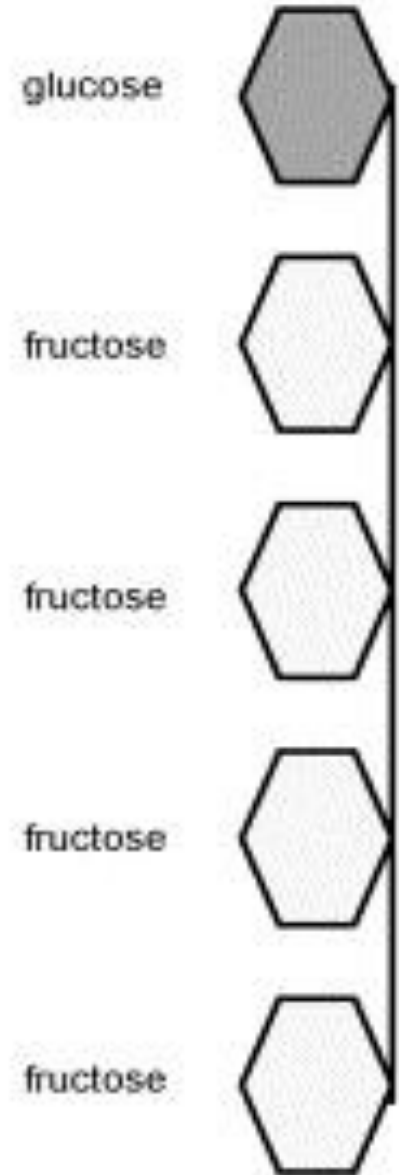
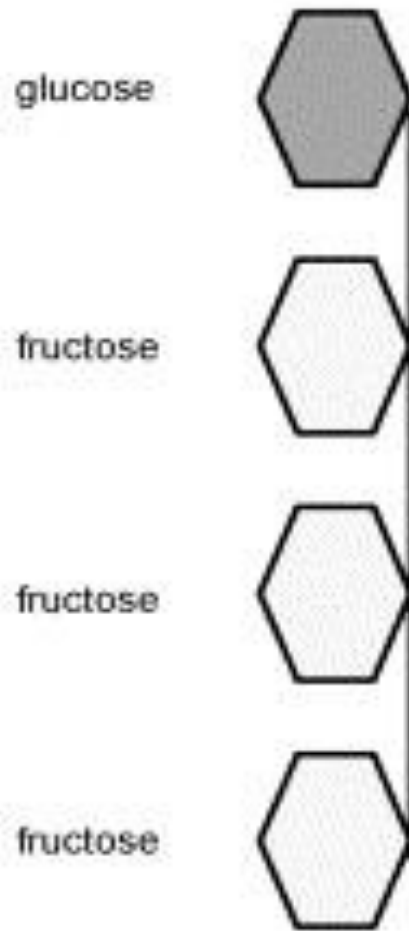
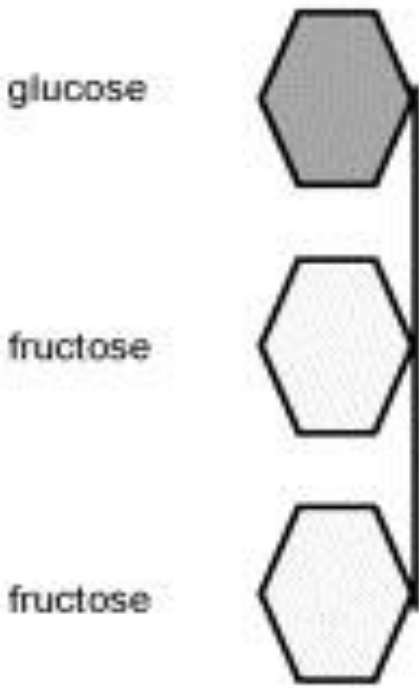




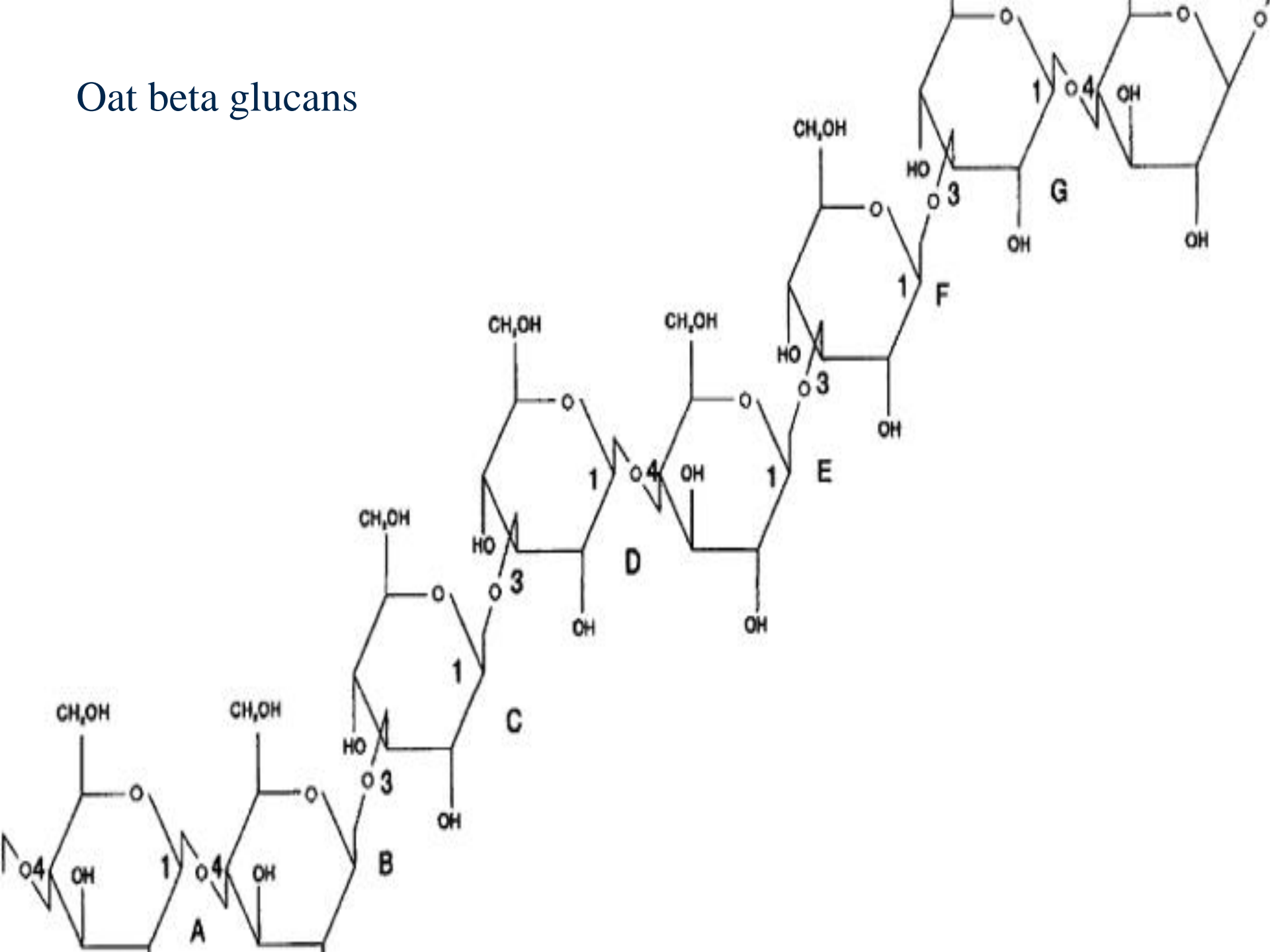
# Modern diet + prebiotics → healthy homeostasis



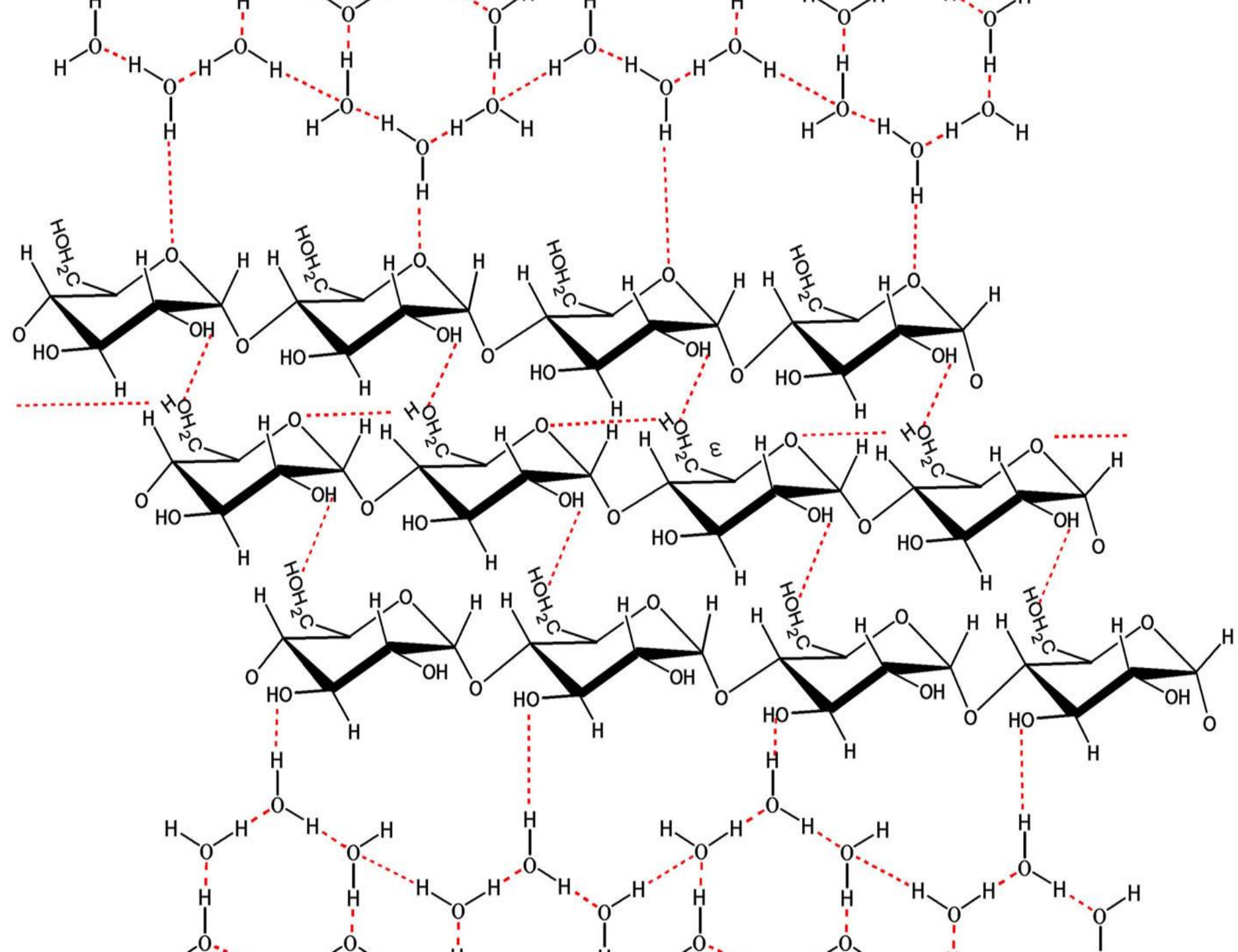
# FructoOligoSaccharides



# Oat beta glucans





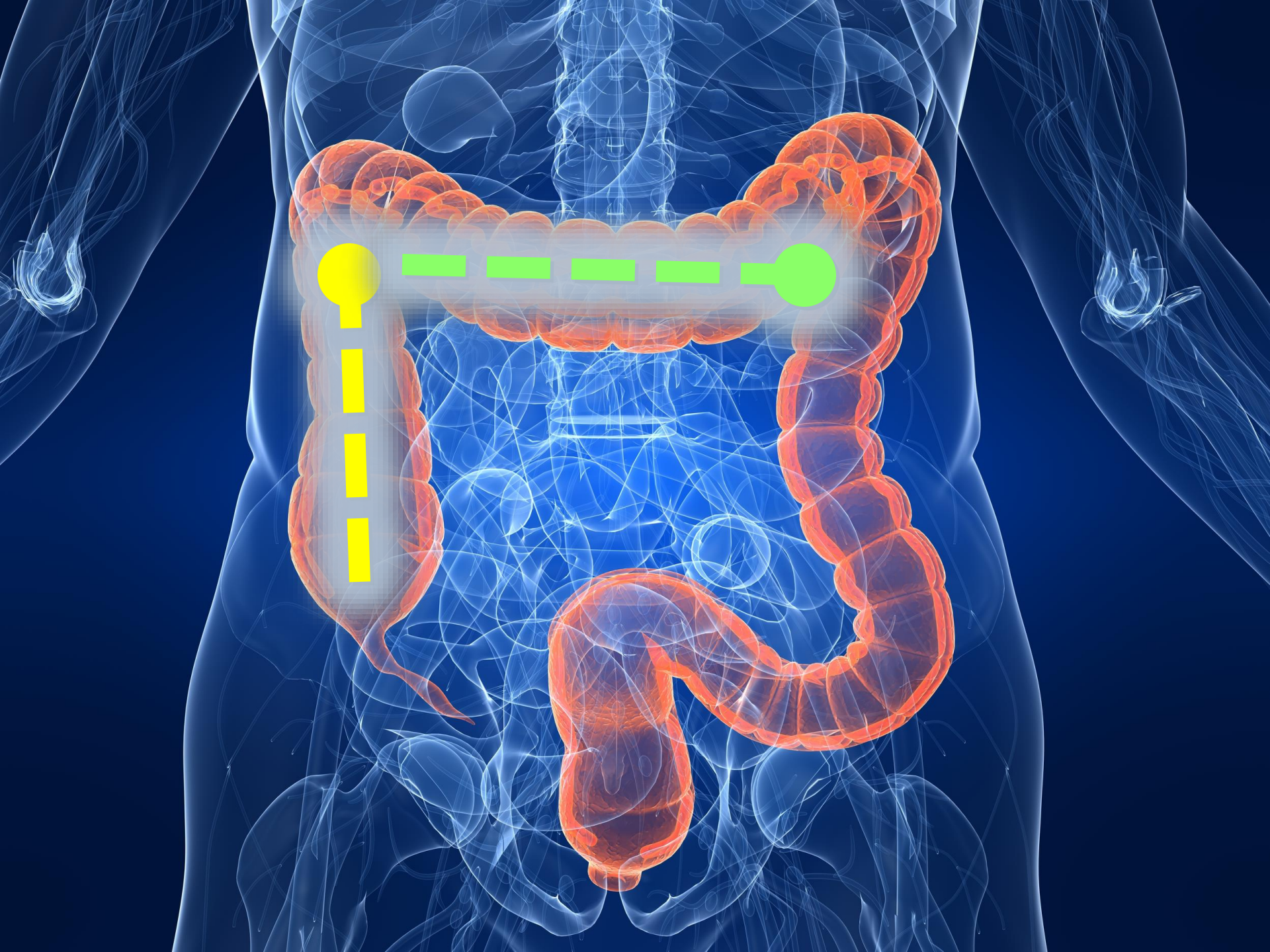
























# W.H.O. study 2019

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- # Higher fiber intakes reduce early death by 30%
  - # Bowel cancer - 25%
  - # Breast cancer - 20%
  - # Heart attack – 25%
  - # Stroke - 25%
-



# W.H.O. study 2019

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- ◆ 25g - 29g fibre day 'adequate'
  - ◆ > 30g gives greater protection
  
  - ◆ Every additional 8g fibre per day reduces early deaths by 5 – 27%
  
  - ◆ 9 out of 10 do not eat enough fiber
-



# W.H.O. recommends 30 g fiber

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- # 'Wholemeal breads & cereals, jacket potatoes, fruits and vegetables.'
  - # Starch = sugar, cellulose & lignins are inert
  - # Prebiotic fibers re-balance the microbiome
  - # Prebiotic fibers produce butyrate
  - # Butyrate producers → well-being (1)
-

# W.H.O. recommend 30 g fiber

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- # Average diet contains 15 g total fiber (2)
  - # Average diet contains 3.5 g prebiotic fiber (3)
  - # W.H.O. imply 7 g prebiotic fiber
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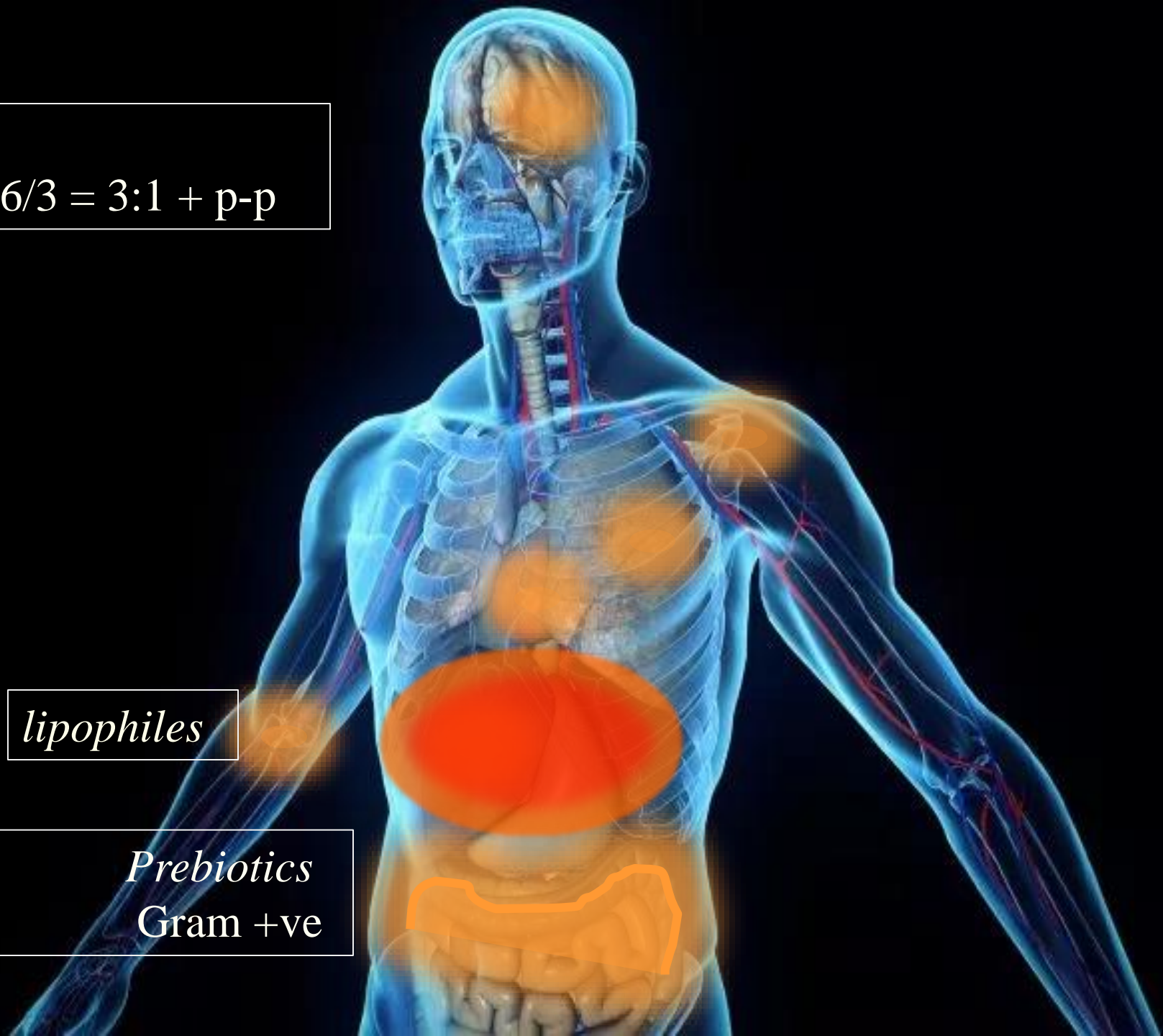




$\Omega 6/3 = 3:1 + p-p$

*lipophiles*

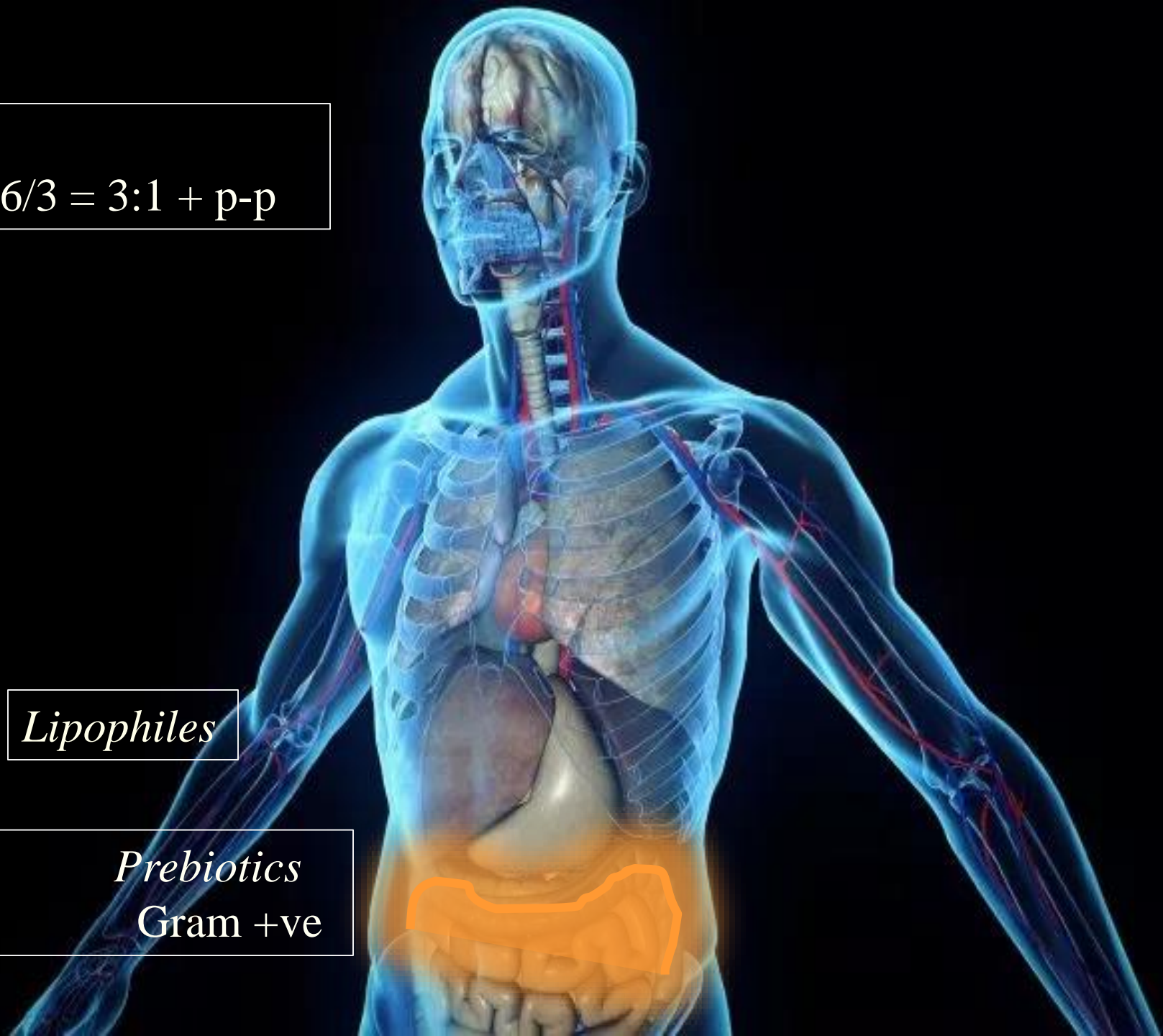
*Prebiotics*  
Gram +ve



$\Omega 6/3 = 3:1 + p-p$

*Lipophiles*

*Prebiotics*  
Gram +ve









# Ascophyllum nodosum

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- # Marine algae contain fucoidans
  - # When eaten, secreted in saliva
  - # Coat roots of teeth in 'bio-teflon'
  
  - # Plaque and tartar fall away
  - # Inflammation stops
  - # Gums stop bleeding
-



**Fucoidans**