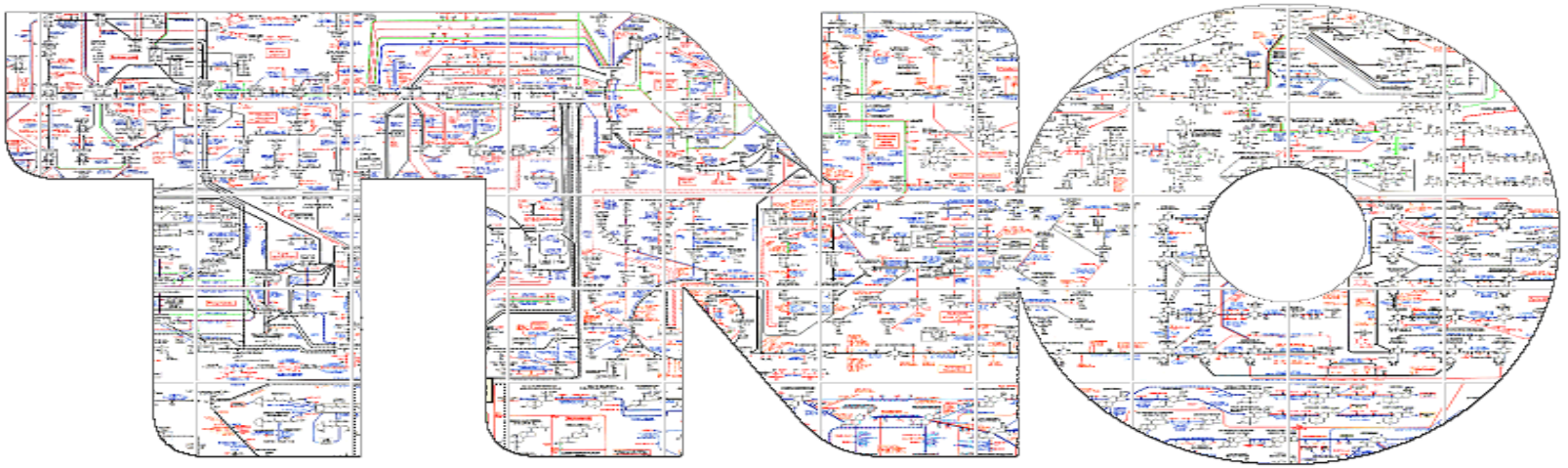
Nutrition of the future

Ben van Ommen



PubMed ▼ van Bladeren PJ[Author] van Ommen B[Author]

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1 - How to quantify the nutrition and health relationship (≃ biomarkers)

TABLE 12 Summary of key nutrient biomarkers[1]

Nutrient	Commonly used biomarker/indicators	Magnitude and direction of inflammation effect	Settings where used
Iron	Ferritin	+++	Clinical, research, population
	sTfR	+	Research, population
	Hemoglobin		Clinical
	Body iron	+	Research, population
	Ratio of TfR:ferritin	+	Research
	TfR index	+	Research, clinical
	ZPP	+	Clinical, population
	Hepcidin	0	Research
Vitamin A	Retinol	−	Clinical, research, population
	RBP	−	Research, population
	Breast-milk retinol		Research
	Retinol dose response test		Research
Zinc	Serum/plasma zinc	−	Clinical, population
Folate	Erythrocyte folate	+	Clinical, population
	Plasma or serum folate	−	Clinical, population
Vitamin B-12	Serum/plasma total cobalamin	0	Clinical, population
	Serum holotranscobalamin		Research
	Plasma/urine MMA	0	Clinical, population
	Plasma total homocysteine	+	Clinical
Iodine	Urinary iodine	0	Population
Vitamin D	25(OH)D	−	Clinical, population
Vitamin B-6	Plasma pyridoxal 5-phosphate	−	Research, population
Vitamin C	Serum ascorbic acid	−	Research, population

Raiten et al, J Nutr 2015 (INSPIRE)

Vitamin D genetics

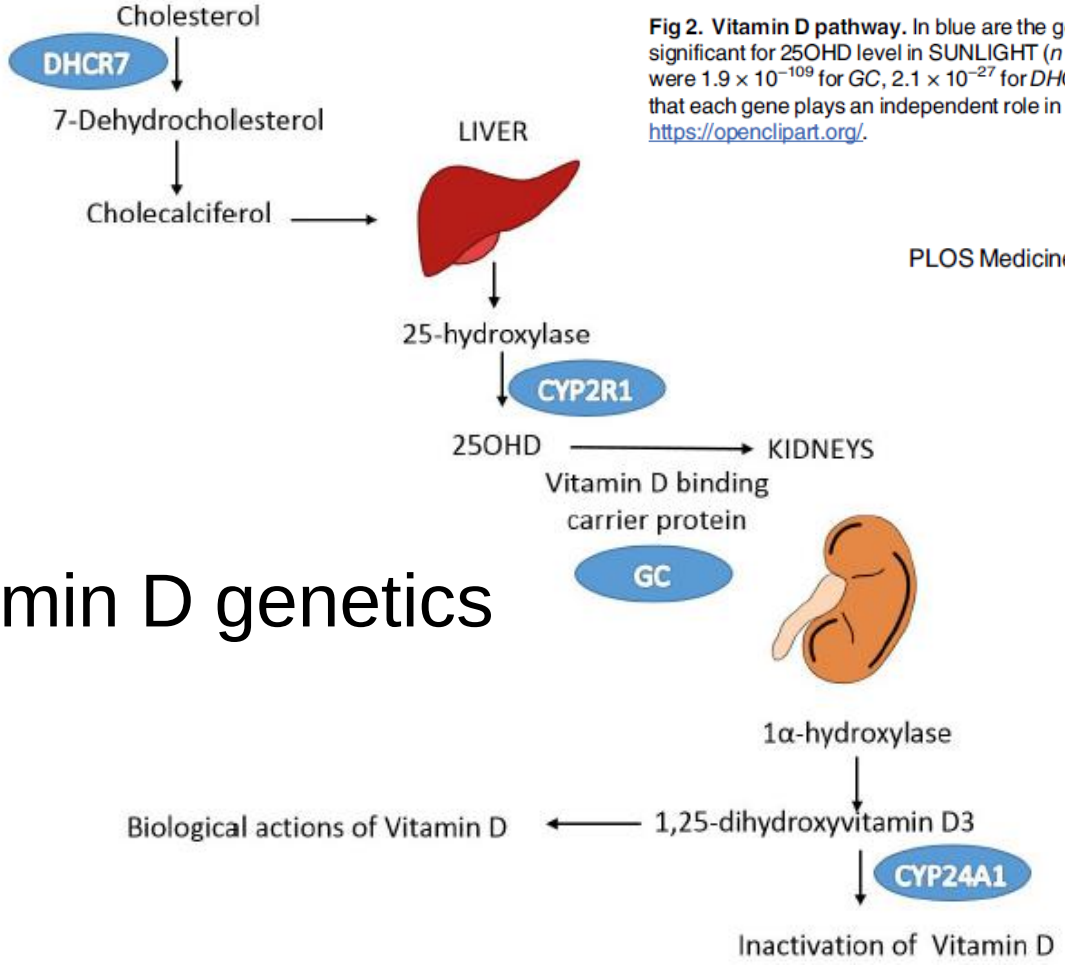


Fig 2. Vitamin D pathway. In blue are the genes containing, or in proximity to, SNPs that were genome-wide significant for 25OHD level in SUNLIGHT ($n = 33,996$). The p-values for the association with 25OHD level were 1.9×10^{-109} for *GC*, 2.1×10^{-27} for *DHCR7*, 3.3×10^{-20} for *CYP2R1*, and 6.0×10^{-10} for *CYP24A1*. Note that each gene plays an independent role in modulating the level of 25OHD. Kidney and liver images credit: https://openclipart.org/.

PLOS Medicine | DOI:10.1371/journal.pmed.1001866 August 25, 2015

Vitamin D genetics and 25OHD levels

PLOS Medicine | DOI:10.1371/journal.pmed.1001866

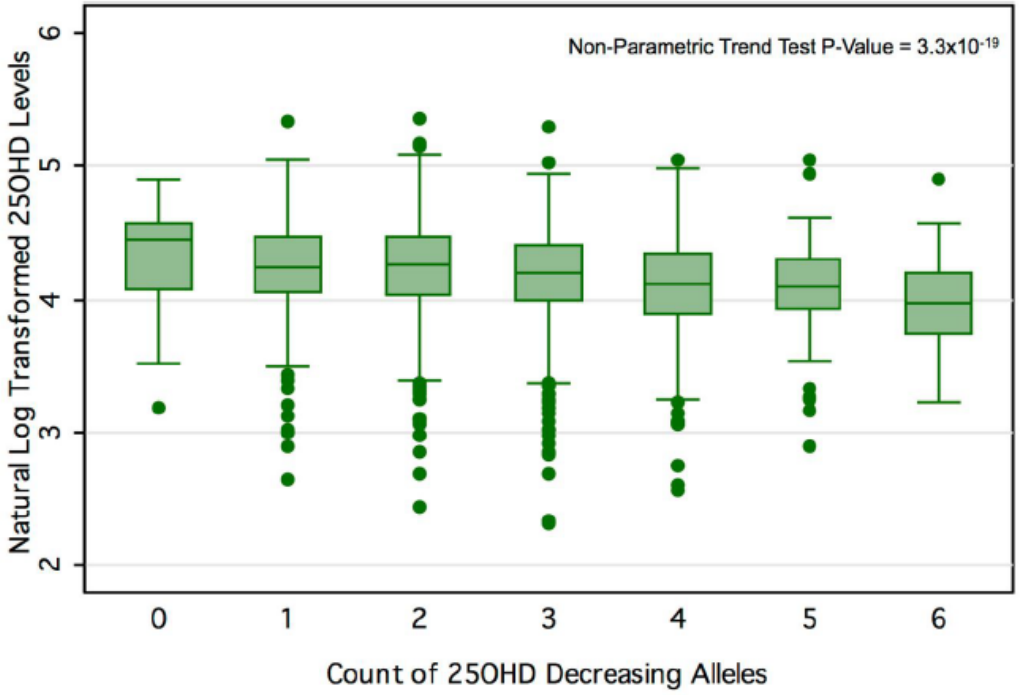
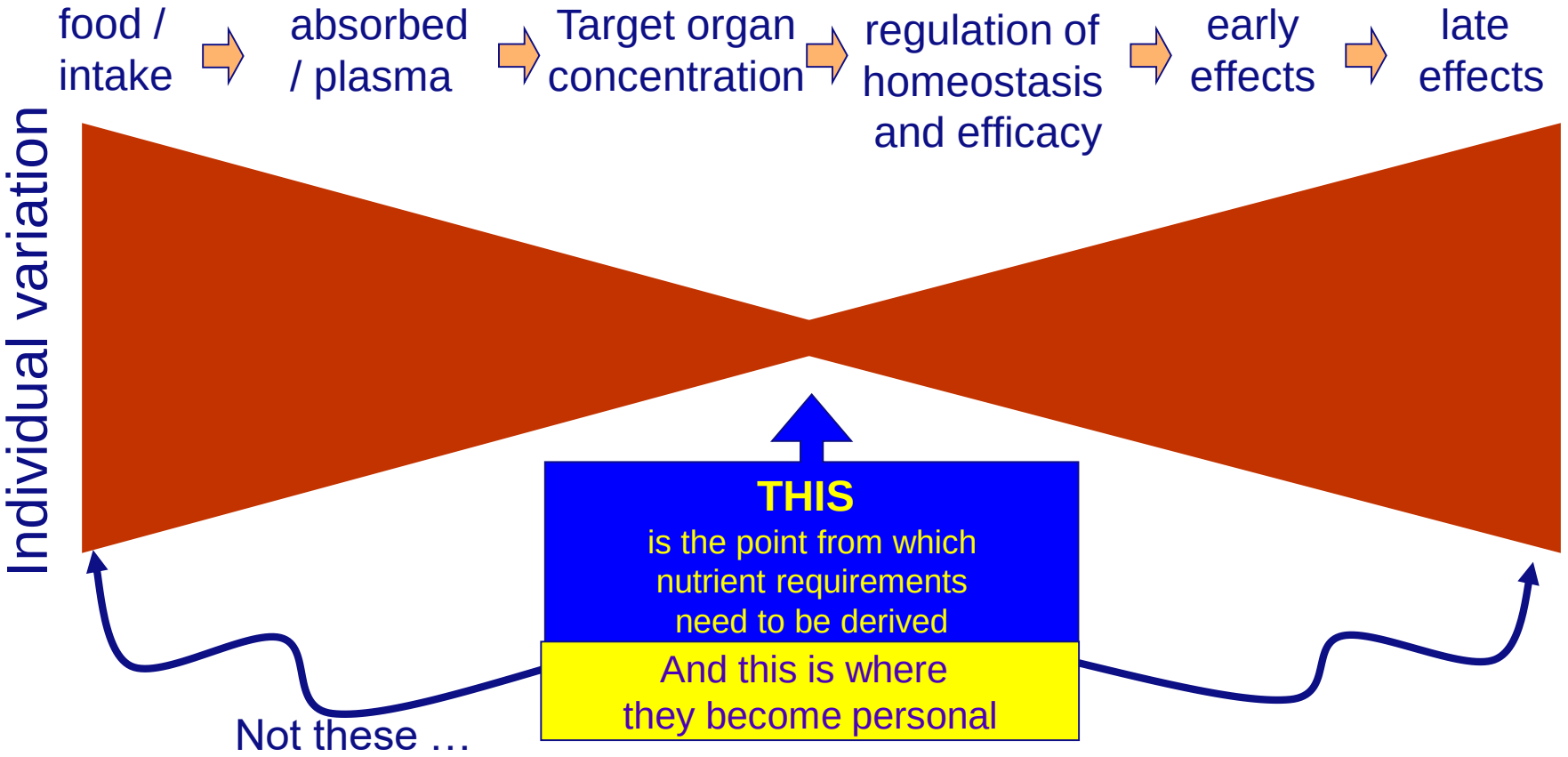


Fig 3. 25OHD level by number of 25OHD-decreasing alleles in the CaMos cohort. Here we show the box-plot of natural-log-transformed 25OHD by the count of 25OHD-decreasing alleles in the CaMos population. A count of zero represents individuals with no 25OHD-decreasing alleles (or homozygous at each loci for the 25OHD-increasing allele), and a count of six represents an individual with six 25OHD-decreasing alleles. No individuals with a count of seven or more 25OHD-decreasing alleles were observed in this cohort.

the “bowtie” principle

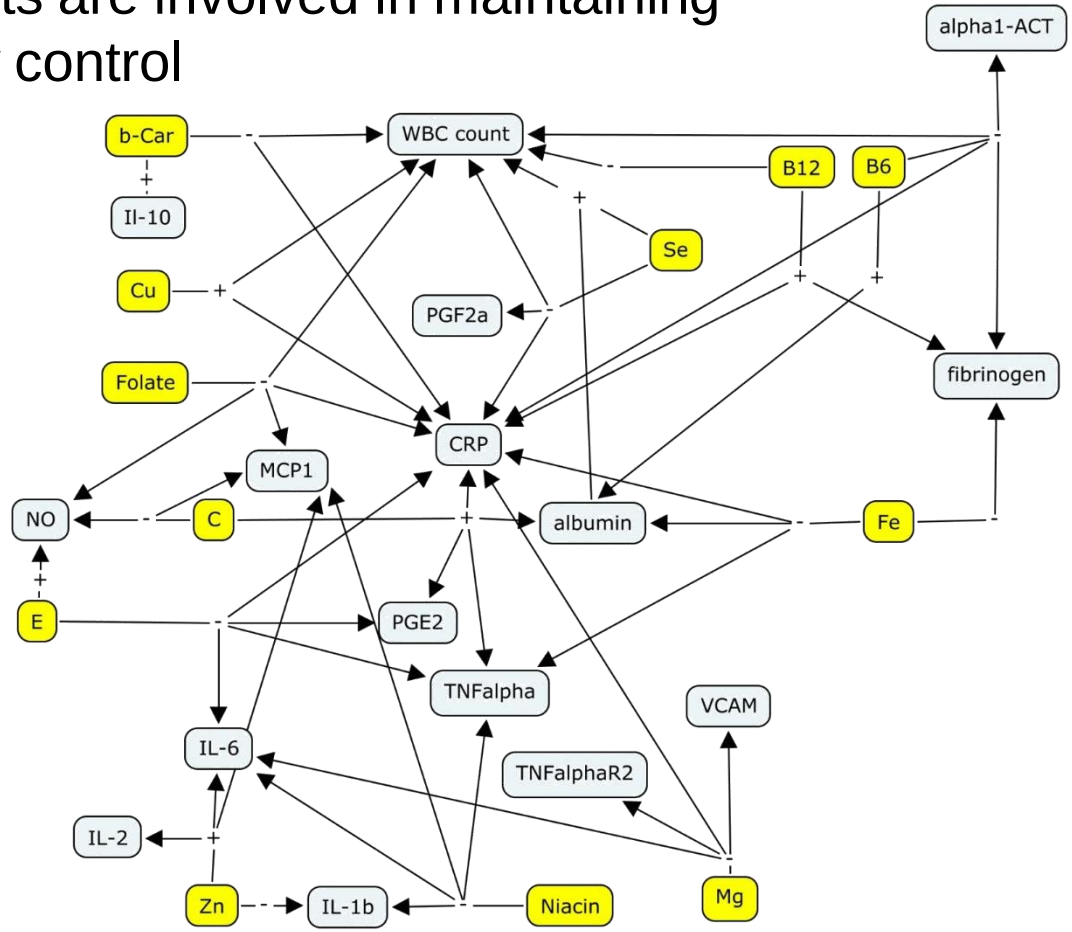


FOODBALL

The Food Biomarker Alliance

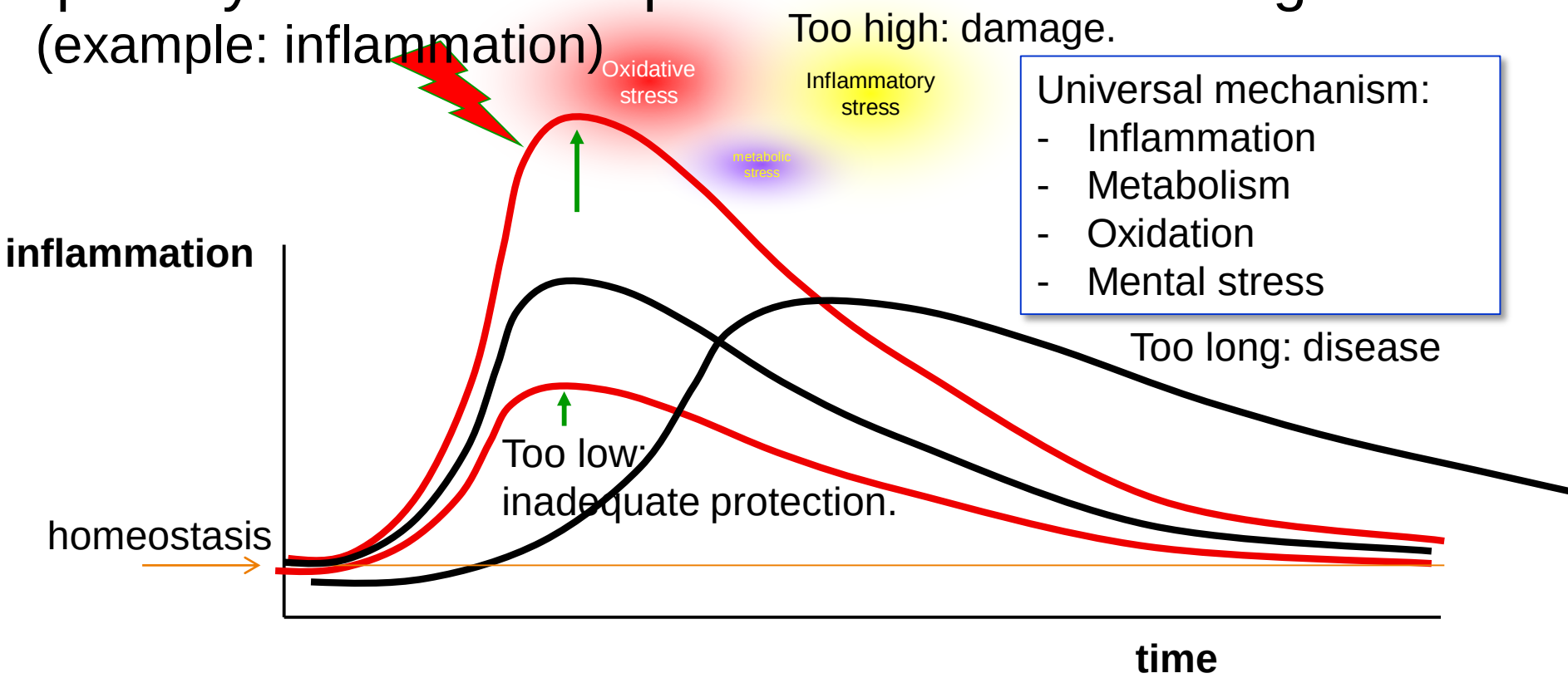
Multiple micronutrients are involved in maintaining optimal inflammatory control

Each arrow represents at least one reliable published human intervention study

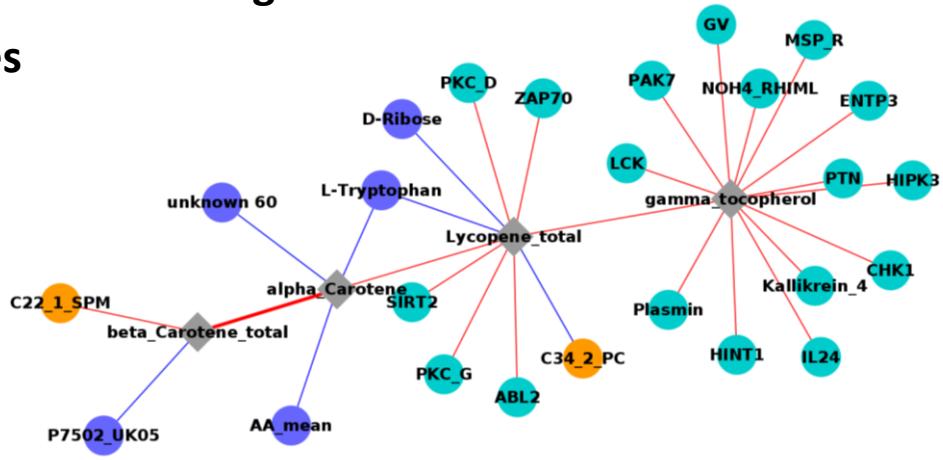


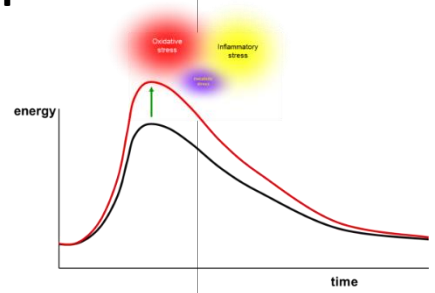
Health is not static but dynamic – Biomarkers should quantify the stress response to external changes.

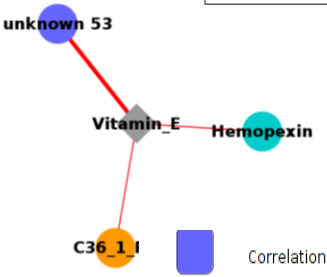
(example: inflammation)

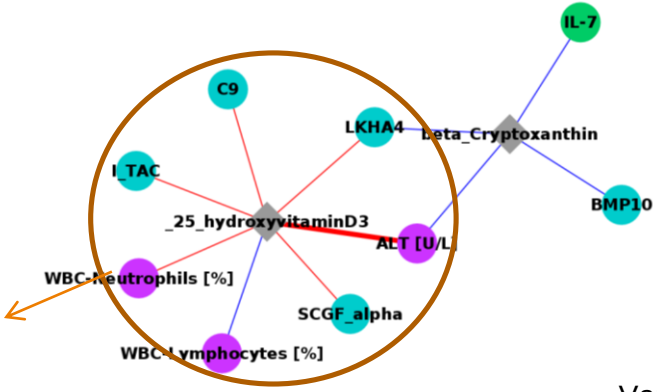


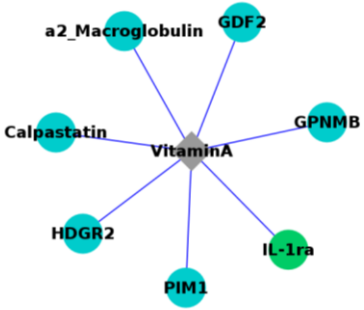
Correlations between fasting micronutrient concentrations and plasma protein stress response curves











Immune status/ inflammation

Correlations vitamins with GC data

Correlations vitamins with RBM data

Correlations vitamins with SomaLogic data

Correlations vitamins with clinical data

Correlations vitamins with lipids data

Correlations vitamins with vitamins

Van de Broek, Genes and Nutrition 2017

Wopereis et al, Genes and Nutrition, Sept 2017

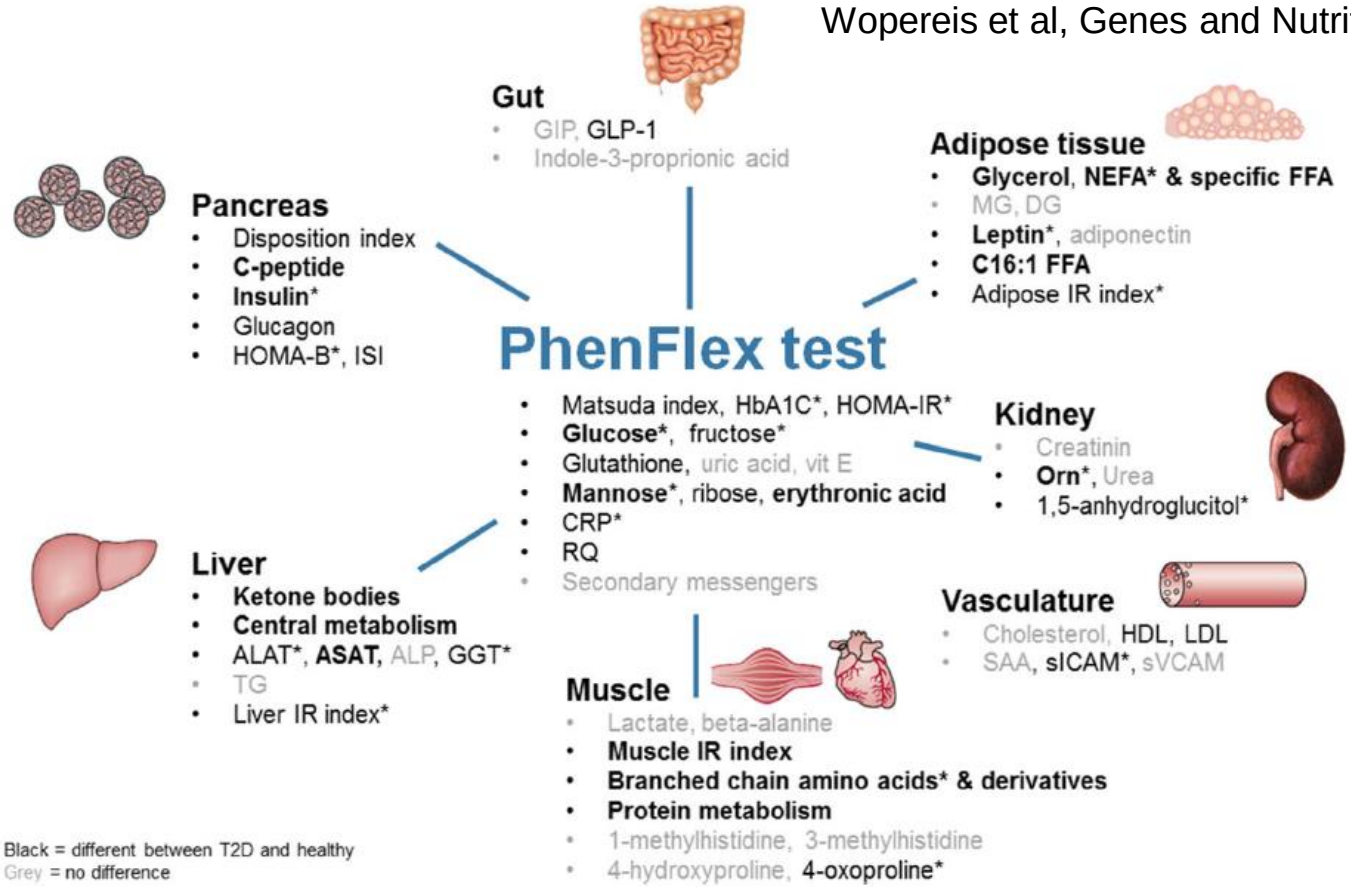
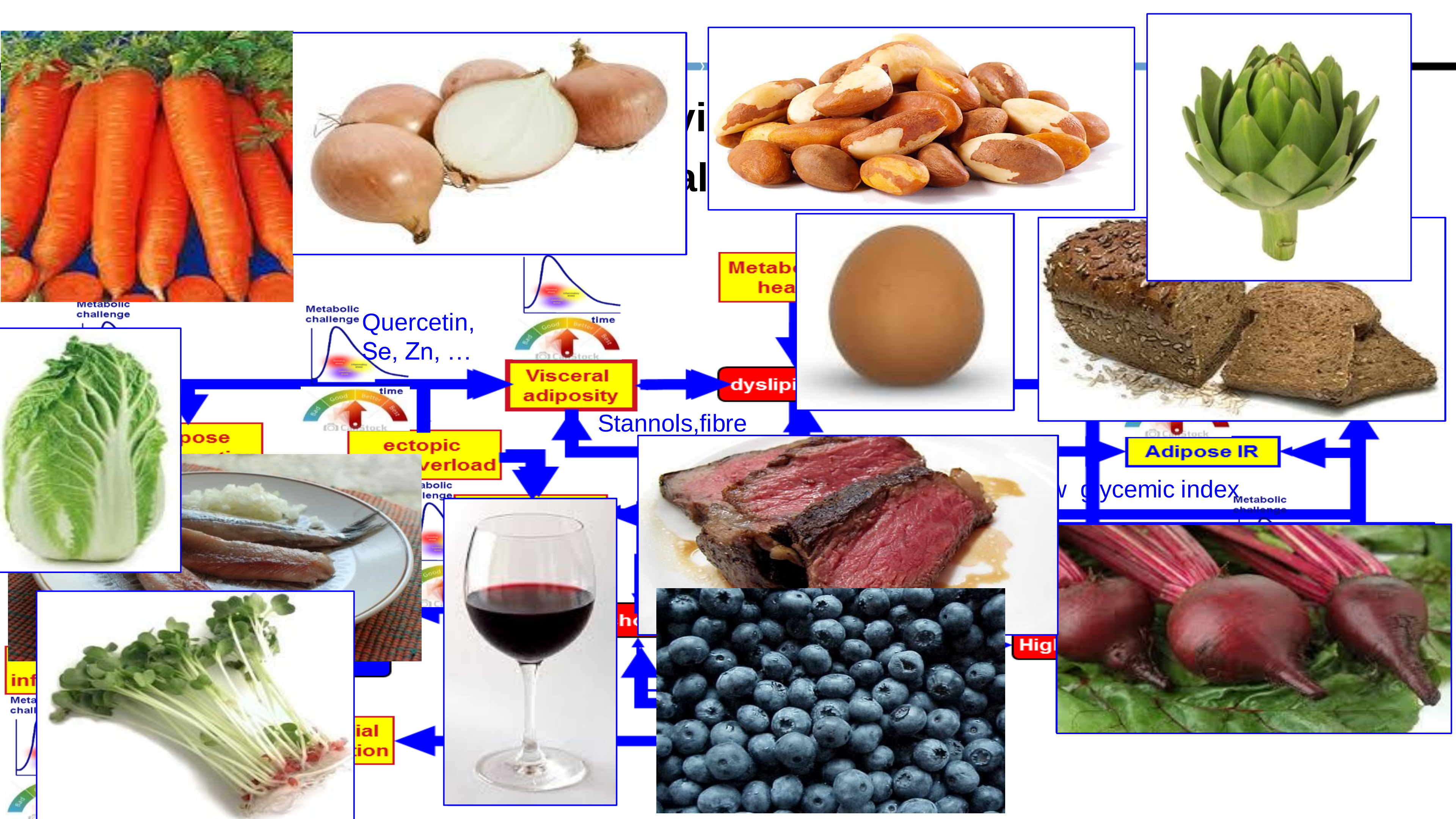


Fig. 4 Overview of markers that have a different PhenFlex test response between 20 healthy male and 20 male type 2 diabetic patients. Gray = no significant differences between T2D and healthy subjects; black = significant different postprandial levels between healthy and diabetic subjects; bold black = significantly different responses to PhenFlex challenge between healthy and type 2 diabetics; asterisk = significant different fasting levels



Metabolic challenge
Quercetin,
Se, Zn, …
time
Visceral adiposity
ectopic
Stannols,fibre
Adipose IR
Metabolic challenge

Personalized?

Type 2 diabetes subgroups react differently on different diets

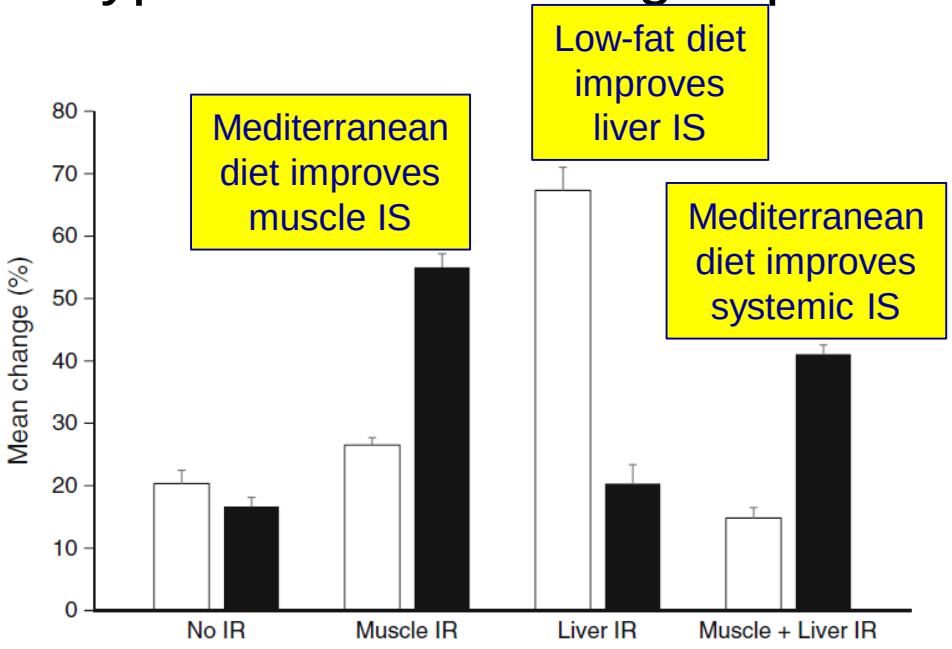
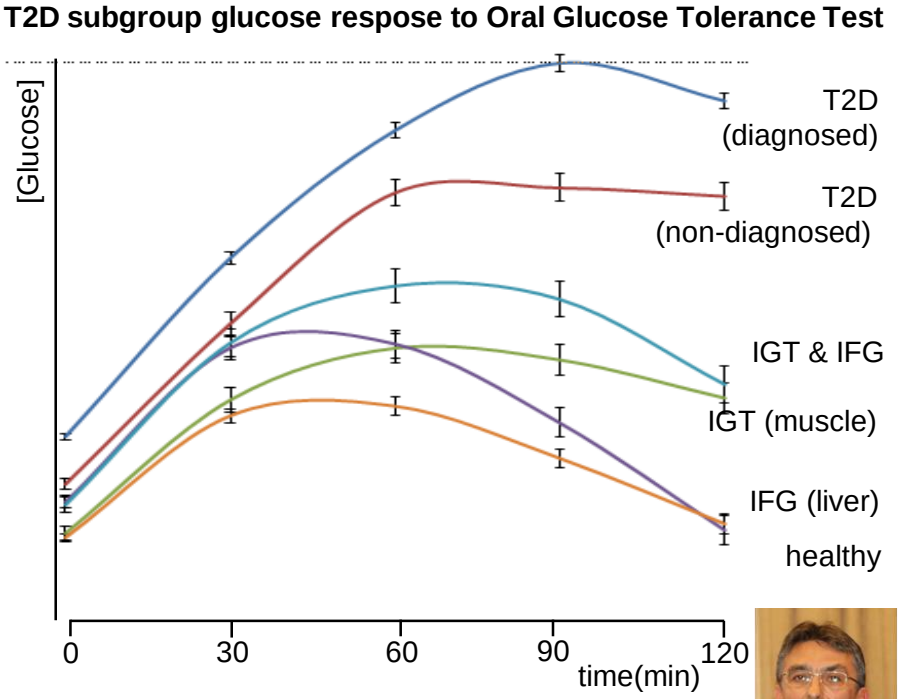
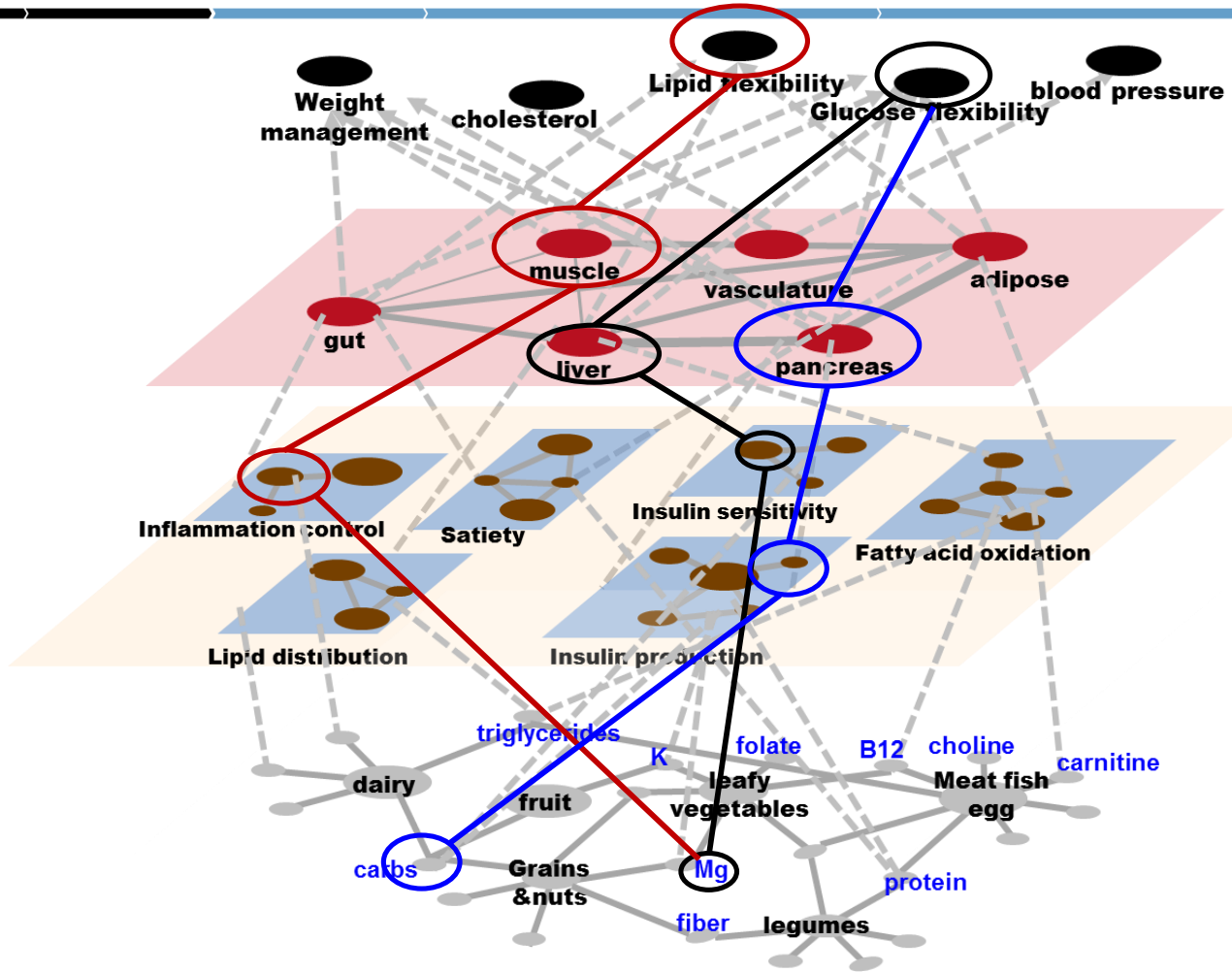


Fig. 1 Mean percentage change in values of disposition index between baseline and after 2 years of follow-up by IR phenotype. *$p<0.05$ between low-fat diet (white bars) and Mediterranean diet (black bars) in each IR subgroup analysed using a univariate model adjusted for age, sex, baseline BMI and change in weight



Blanco-Rojo, Diabetologia, Oct 2015

José Lopez-Miranda



personalized nutrition based consumer goals

organs

flexibility processes and sub-processes

nutrients (connected in diets)

Van Ommen *et al*, Nutrition Reviews, 2017

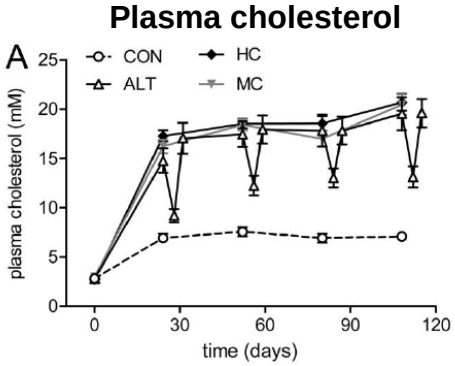
So:

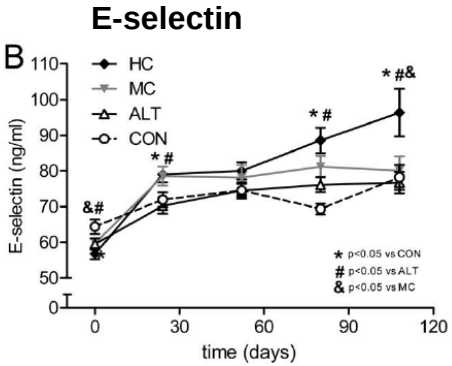
- We should quantify the dynamics (“systems flexibility”)

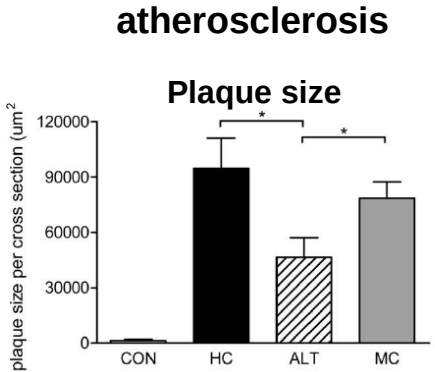
- We can optimize the dynamics by (dietary) interventions, i.e. provide the nutrients for the “flexibility machinery”

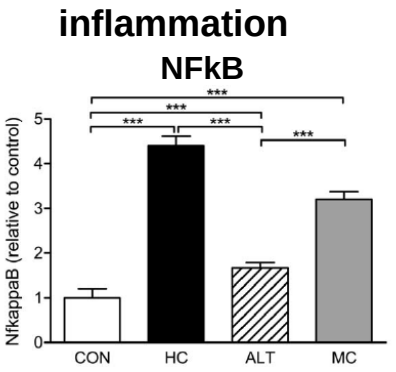
- Can we optimize system flexibility by introducing dynamics?

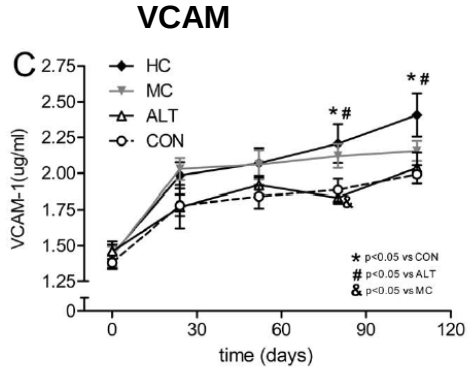
Beneficial effects of alternate dietary regimen on inflammation and atherosclerosis.

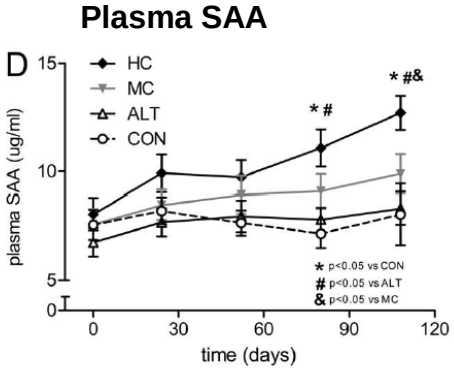


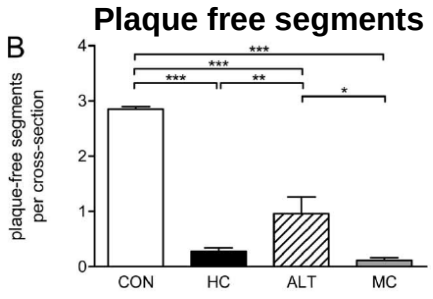


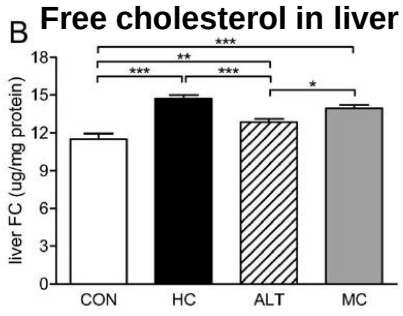






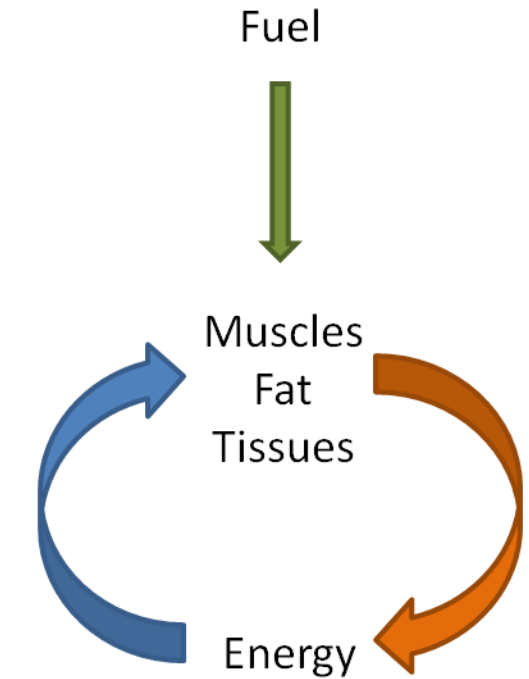






Wielinga, PLoSone 2011

carb – lipid switching



glucose overload →
beta cell failure

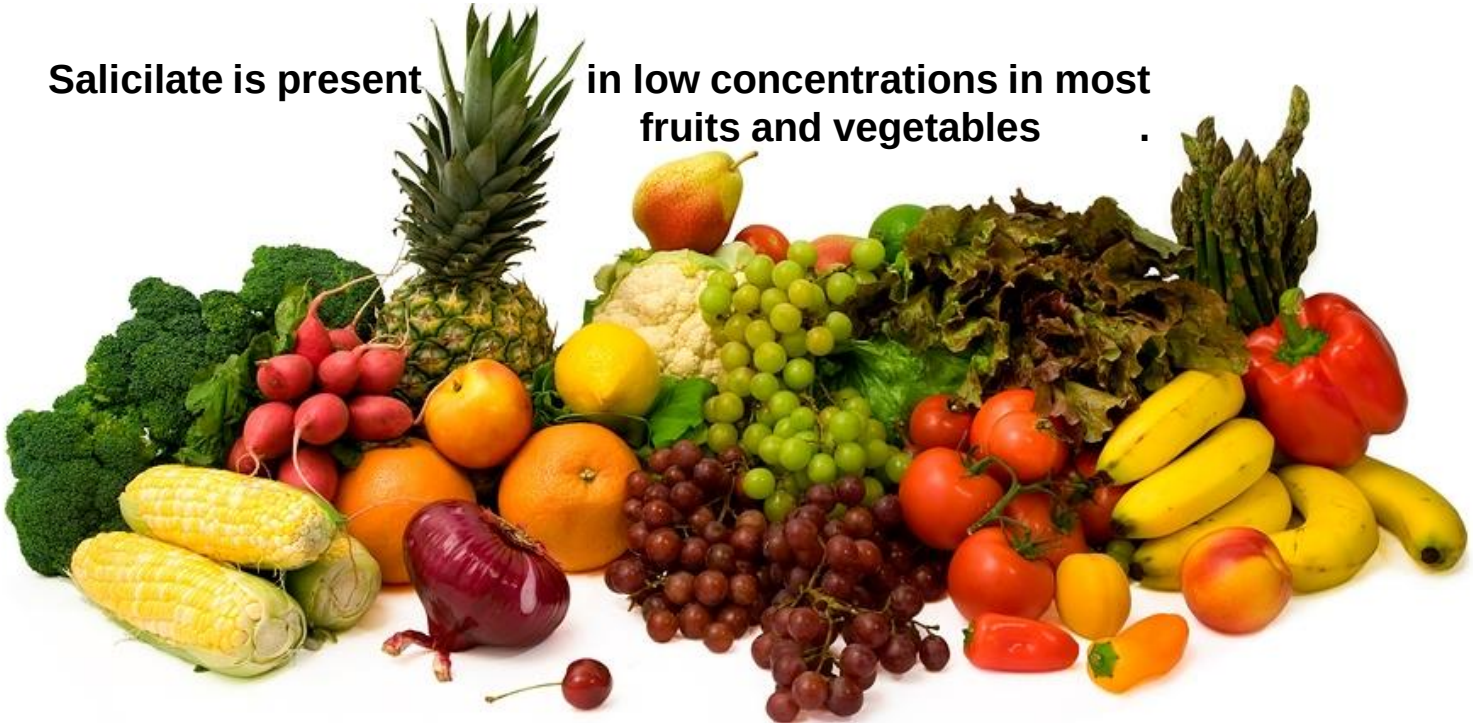
(intermittent) fasting
Ketogenic diets

Low dose or high dose?

Salicilate stimulates the inflammatory response at low concentration

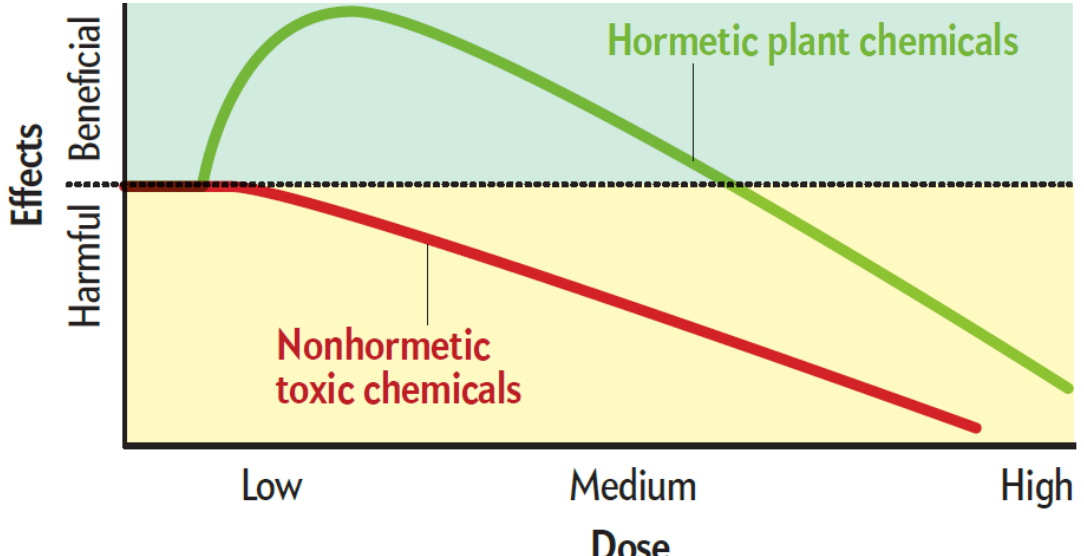
Salicilate inhibits the inflammatory response at high concentration

Salicilate is present in low concentrations in most fruits and vegetables .



First Good, Then Bad

Fruits and vegetables often contain low levels of toxic chemicals that provide health benefits when consumed in modest amounts but become increasingly noxious at high levels, a process called hormesis. The disparity in effects—traced on a biphasic response curve—contrasts with mercury and other nonhormetic toxic substances that are harmful at even low amounts.



Mattson, Scientific American 2015

Are flexibility, resilience and optimal immune system related?


Nature's Best Antibiotics ...
and how
to use
them!

CHALLENGING ONESELF INTERMITTENTLY TO IMPROVE HEALTH

Mark P. Mattson □ Laboratory of Neurosciences, National Institute on Aging
Intramural Research Program, Baltimore, MD. 21224.

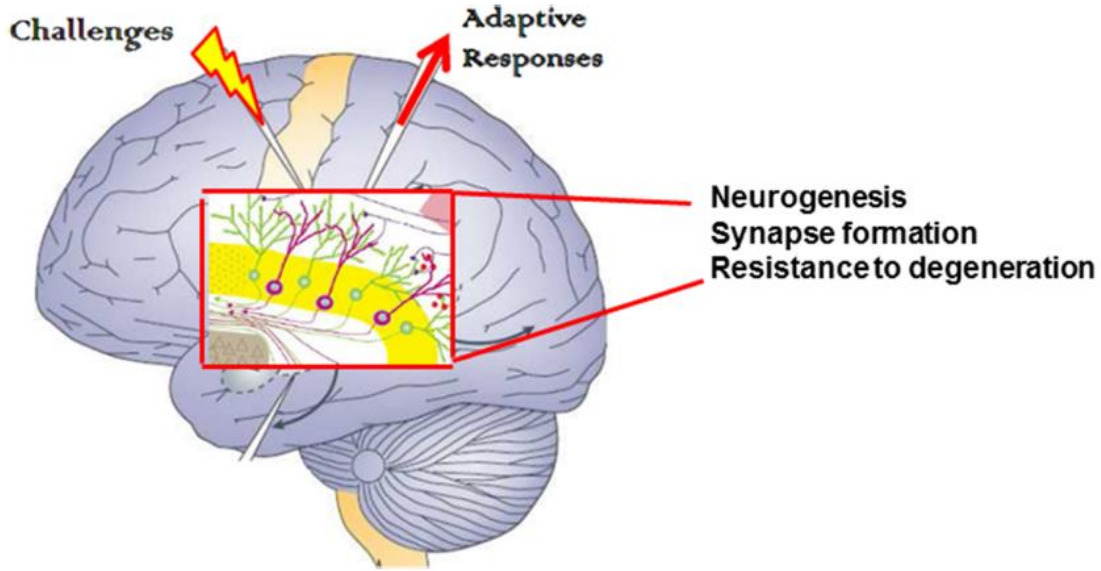


FIGURE 1. Illustration of the simple fundamental concept that optimal health is promoted by intermittent challenges (mild stressors). Cells in the organ, in this case the brain, respond adaptively by enhancing their ability to function and resist disease.

Matson, Dose-Response 2014

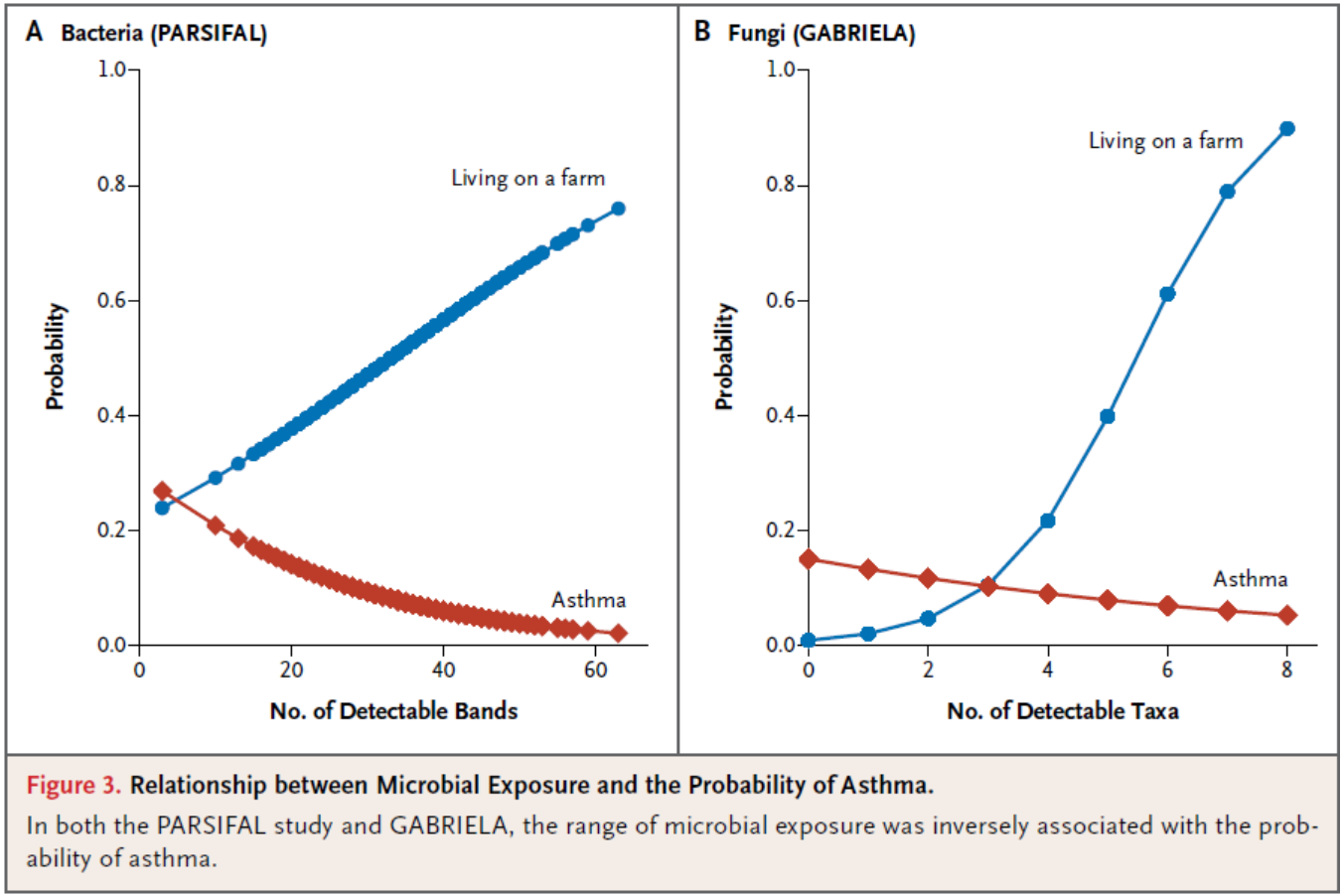


Figure 3. Relationship between Microbial Exposure and the Probability of Asthma.

In both the PARSIFAL study and GABRIELA, the range of microbial exposure was inversely associated with the probability of asthma.

Ege et al, NEJM 364 (2011) 701-9

P. CLERGUE / PHOTOTAKE LTD / ALAMY

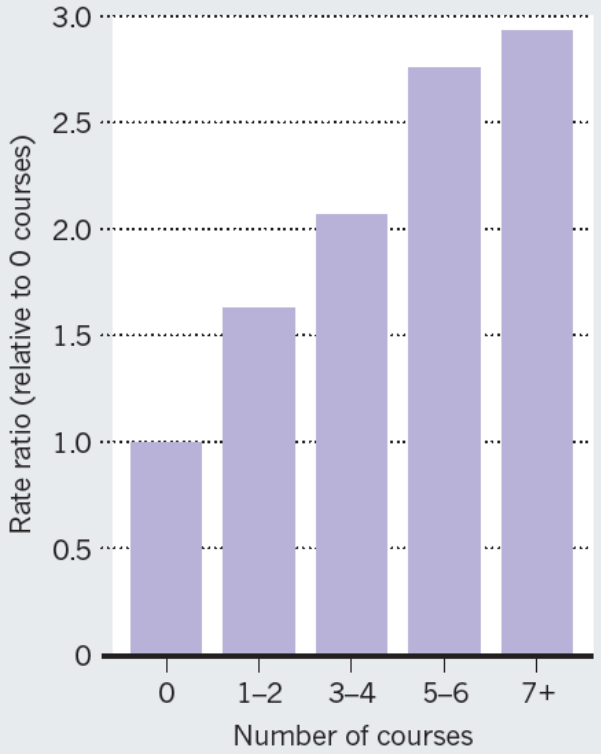
Dosed up: could excessive prescription of antibiotics be hampering children's ability to fight disease?

Stop the killing of beneficial bacteria

Concerns about antibiotics focus on bacterial resistance — but permanent changes to our protective flora could have more serious consequences, says **Martin Blaser**.

TROUBLING CORRELATION

The risk of inflammatory bowel diseases in children rises with the number of courses of antibiotics taken.



SOURCE: A. HVIID, H. SVANSTRÖM & M. FRISCH *GUT* **60**, 49–54; 20

Serious (Early) Life Events and Type 1 Diabetes

Se

Child

Death and

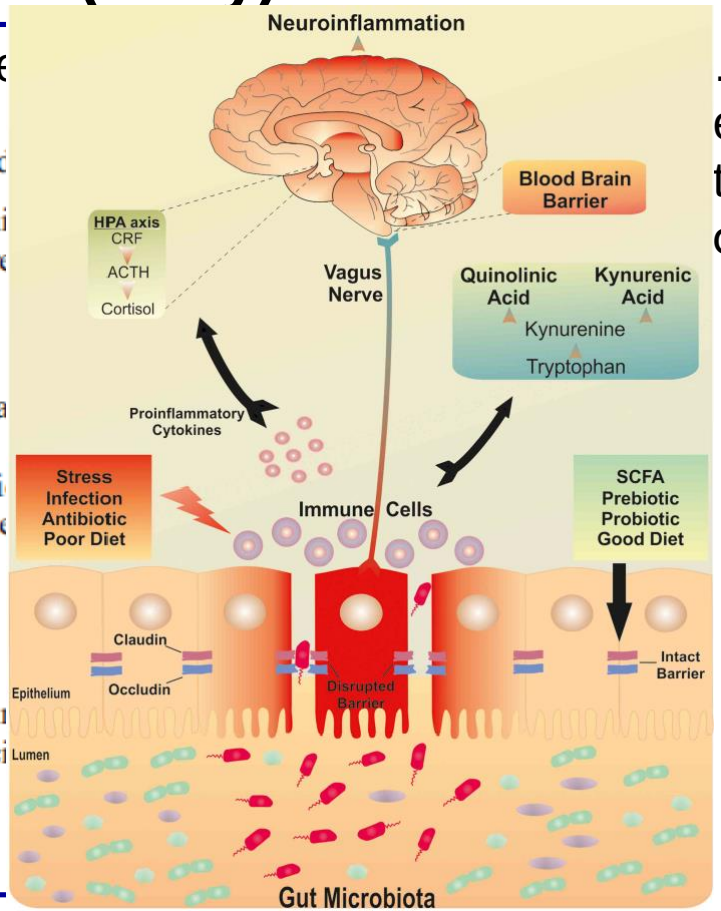
New fami
structure

Conflict a

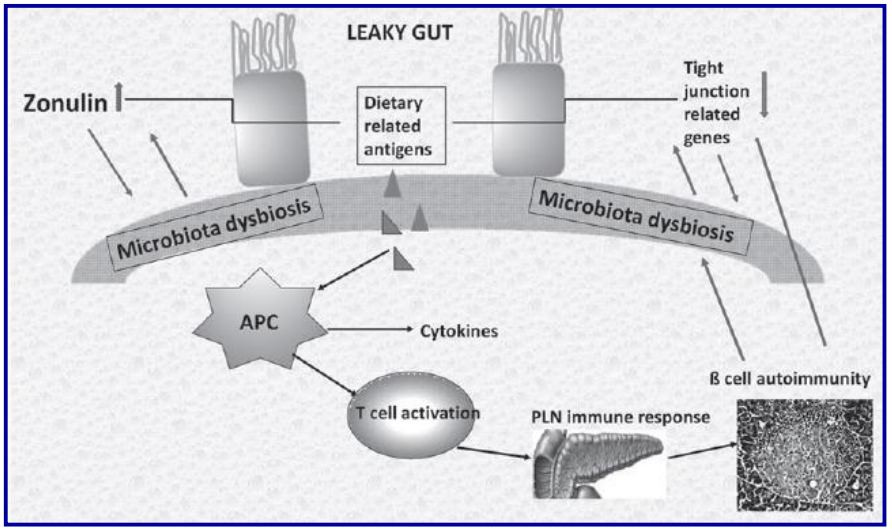
Interventi
social se

Parent

Death, illn
and acci



… we found that a Serious Life Event experienced by the child at any time during the first 14 years of life increased the risk of diagnosis of type 1 diabetes …



Nygren, Diabetologia 2015
Li, Pediatric Diabetes 2015
Kelly, Frontiers Cellular Neuroscience 2015

U.S. Food and Drug Administration
Protecting and Promoting *Your* Health

efsa
European Food Safety Authority

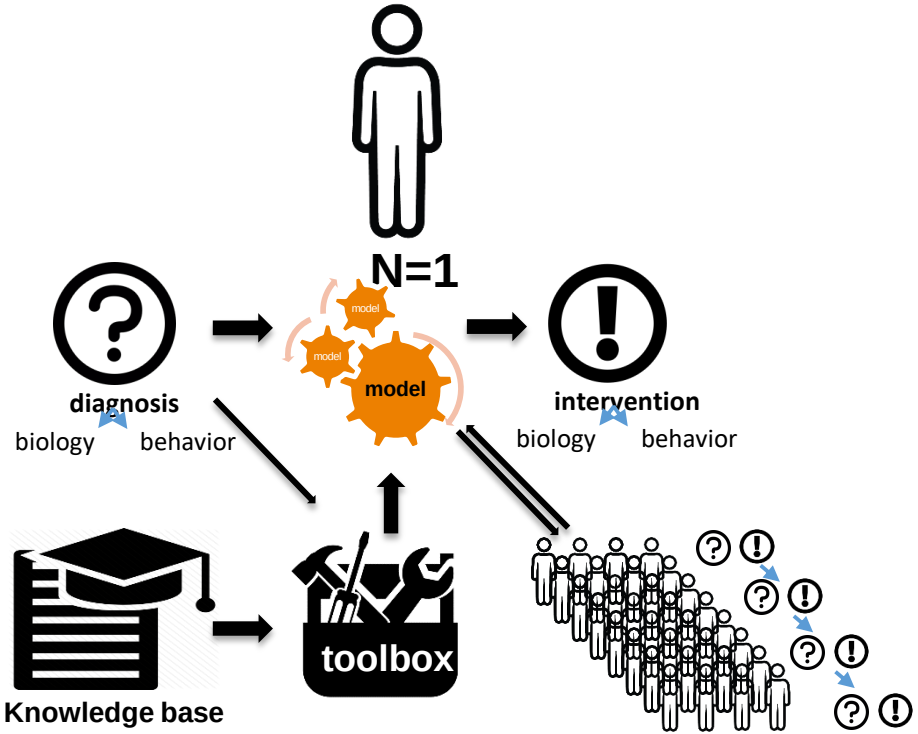
I scan a product and the App tells me if this is the right product for me, based on my preferences:
Cheap / Healthy / Biological / Sustainable
AND IT MAY SUGGEST AN ATERNATIVE ….

I don`t need to look to the advertisements, health claims, suggestions, package,

I don`t need consumer protection, I am empowered

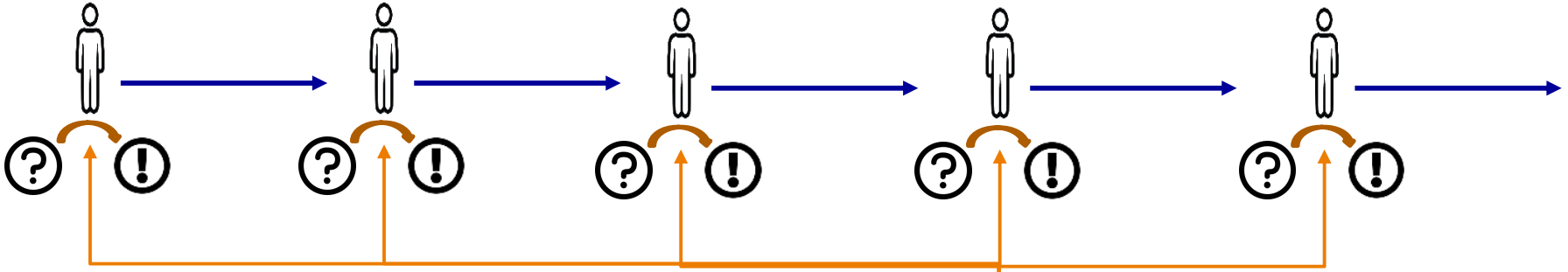
Consumer empowerment

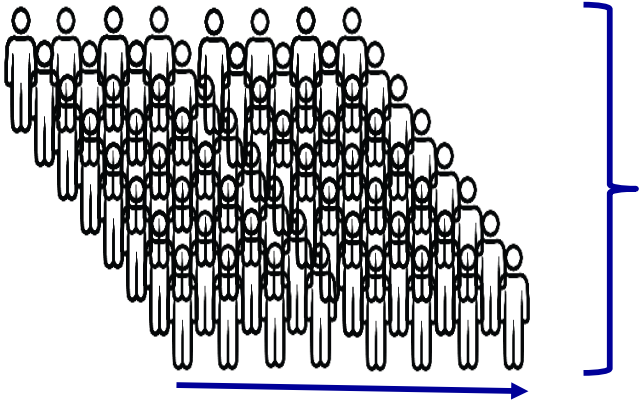
So how will nutrition look like in 10 years?



1. It is personal
2. The intervention or advice is based on a diagnosis, i.e. my personal health data.
3. A (science based) model is used to translate diagnosis into advice
4. The model is tailored to specific conditions and goals from a large toolbox
5. The toolbox is continuously and systematically updated with all relevant scientific knowledge
6. Exploit/use information from large numbers of personal health data

I make regular adjustments to my diet and behavior in order to stay on track





Can we make use of thousands of other personal health timelines to optimize every decision I make for my personal health ?

Bayesian networks
Artificial Intelligence

Child Health Passport

Use this passport to record important health information. Keep it in a safe place for future reference.

Parent/Guardian Name _____ Phone Number _____

_____ _____

Health Care Providers

Public Health Office _____ Phone Number _____

Public Health Nurse _____ Phone Number _____

Doctor _____ Phone Number _____

_____ _____

BRITISH COLUMBIA | ImmunizeBC

SMOCK

Naam kind

Donor bron

SMOCK (n: 1933)

Bezoeknummer

Matches

10

- [x] Zelfde geslacht
- [x] Zelfde zwangerschapsduur
- [ ] Kijk in toekomst
- [ ] Gerealiseerde groei

Diagram | Gegevens | Matches | Model | Toelichting | Over TNO

Datum | Gewicht | Lengte | Hoofd

GROEIDIAGRAM 0-15 MAANDEN MEISJES NL 2010

Naam

Vader (a/g) cm Moeder (a/g) cm TH cm

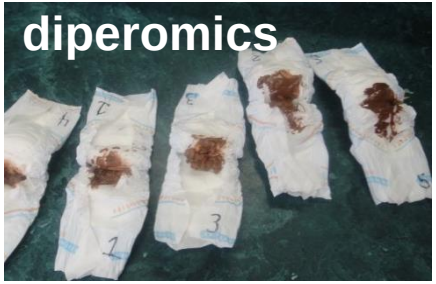
Predictor of head circumference

Growth diagram 0-15 months – girls NL

Nice – but what can a parent do with this information?

FREDRIKS 2000

LEEFTIJD IN MAANDEN



What data do we really have / need and what should we do with it?

Personal ownership of your (child`s) health data

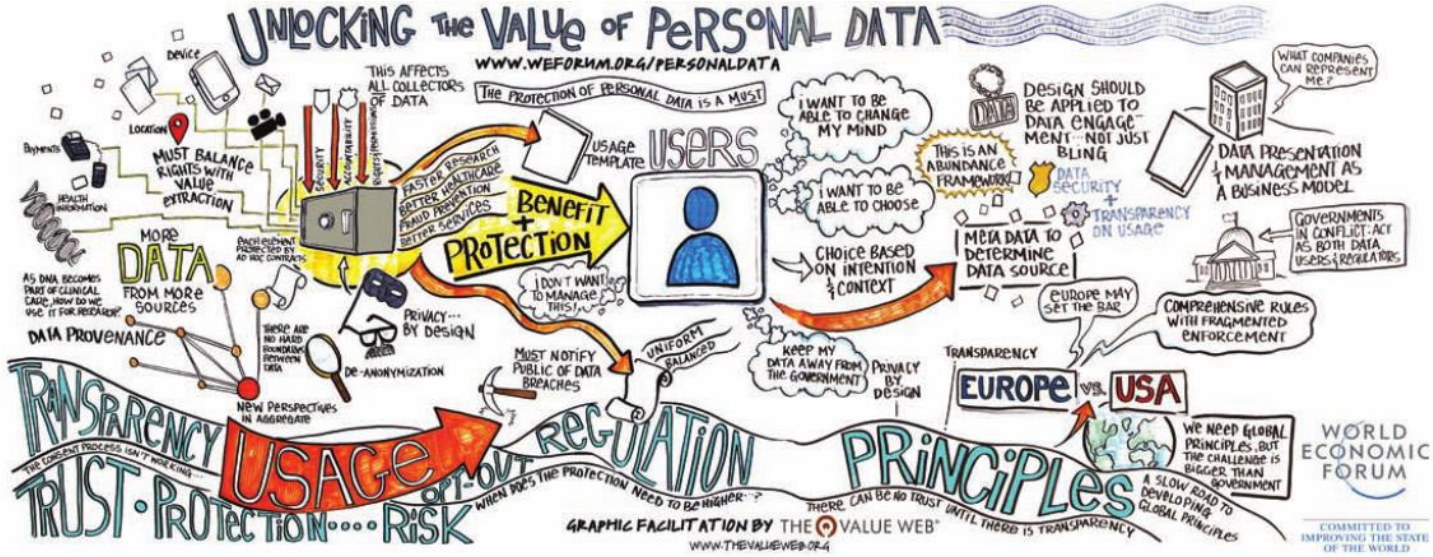
Where is our health data and how is it really useful to us?

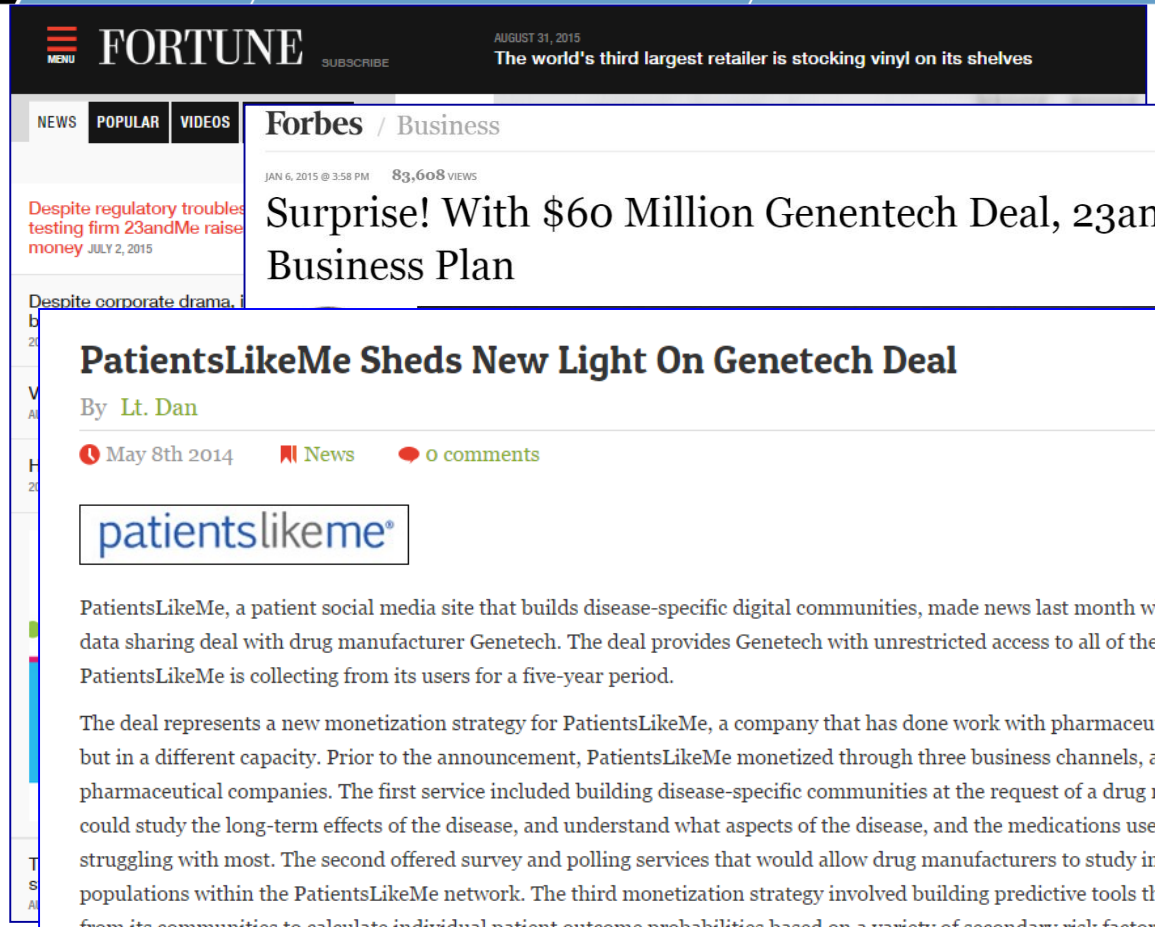
TNO innovation for life

Unlocking the Value of Personal Data:
From Collection to Usage

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD





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Despite corporate drama, i

Forbes / Business

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Surprise! With $60 Million Genentech Deal, 23andMe Has A Business Plan

PatientsLikeMe Sheds New Light On Genetech Deal

By Lt. Dan

May 8th 2014 News 0 comments

Tweet 2

patientslikeme®

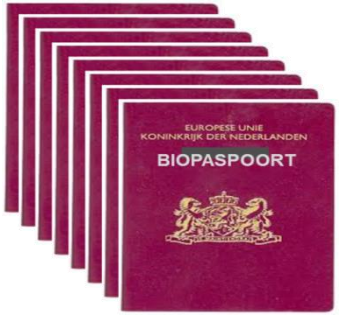
PatientsLikeMe, a patient social media site that builds disease-specific digital communities, made news last month when it announced a new data sharing deal with drug manufacturer Genetech. The deal provides Genetech with unrestricted access to all of the de-identified data PatientsLikeMe is collecting from its users for a five-year period.

The deal represents a new monetization strategy for PatientsLikeMe, a company that has done work with pharmaceutical companies in the past, but in a different capacity. Prior to the announcement, PatientsLikeMe monetized through three business channels, all marketed to pharmaceutical companies. The first service included building disease-specific communities at the request of a drug manufacturer, so that they could study the long-term effects of the disease, and understand what aspects of the disease, and the medications used to treat it, patients were struggling with most. The second offered survey and polling services that would allow drug manufacturers to study individual patient populations within the PatientsLikeMe network. The third monetization strategy involved building predictive tools that used aggregated data from its communities to calculate individual patient outcome probabilities based on a variety of secondary risk factors.

TNO innovation for life

The real value of MY health data: how can this data work for me?

Health Data Cooperative as legal entity that valorizes my own health data.



mijn data onze gezondheid **Holland Health Data Coöperatie**

Developers

Doctors

Schools & daycare

Hospitals

Research

food industry

Infant formula producers

Education

Retail

Farmers market

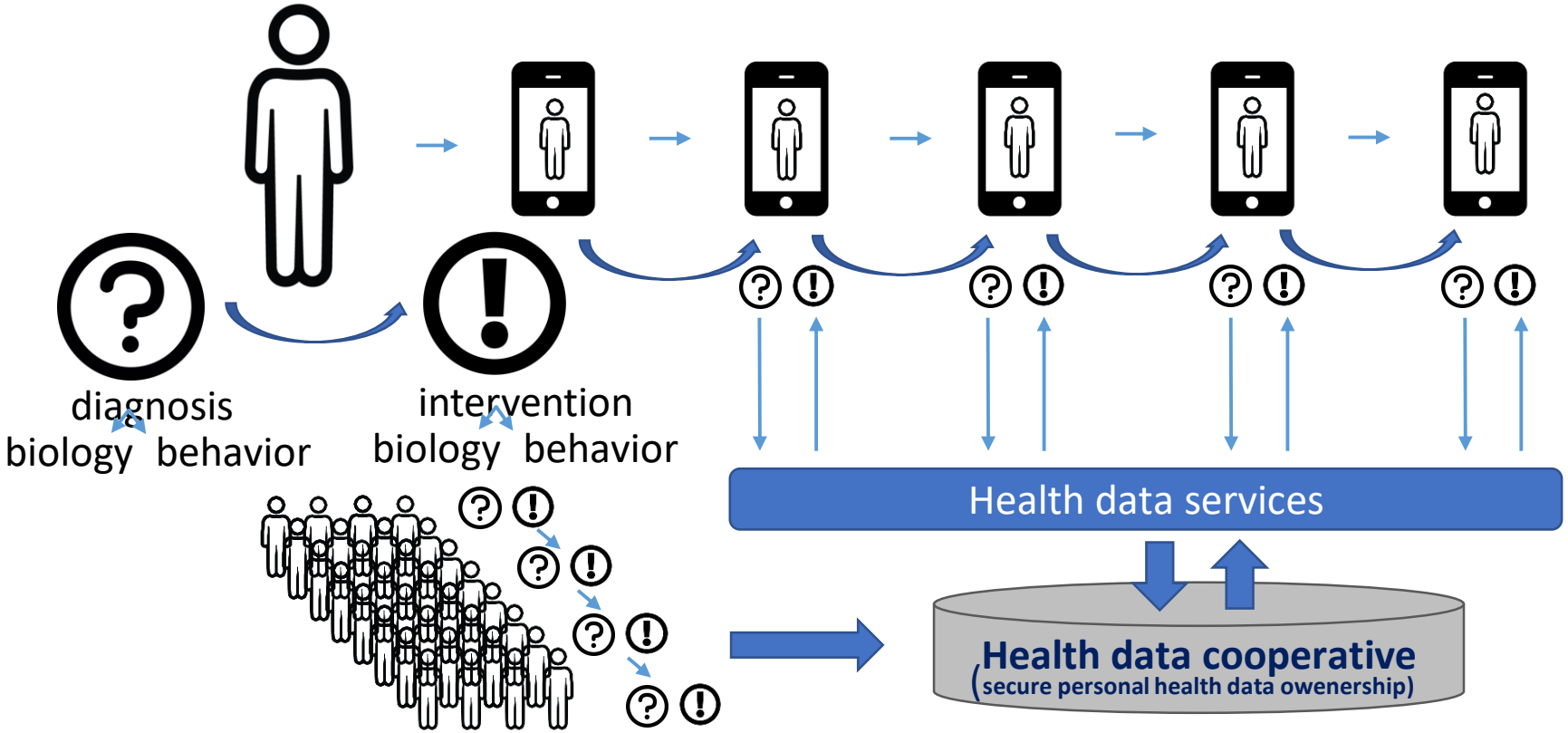
Government

Health Service Providers

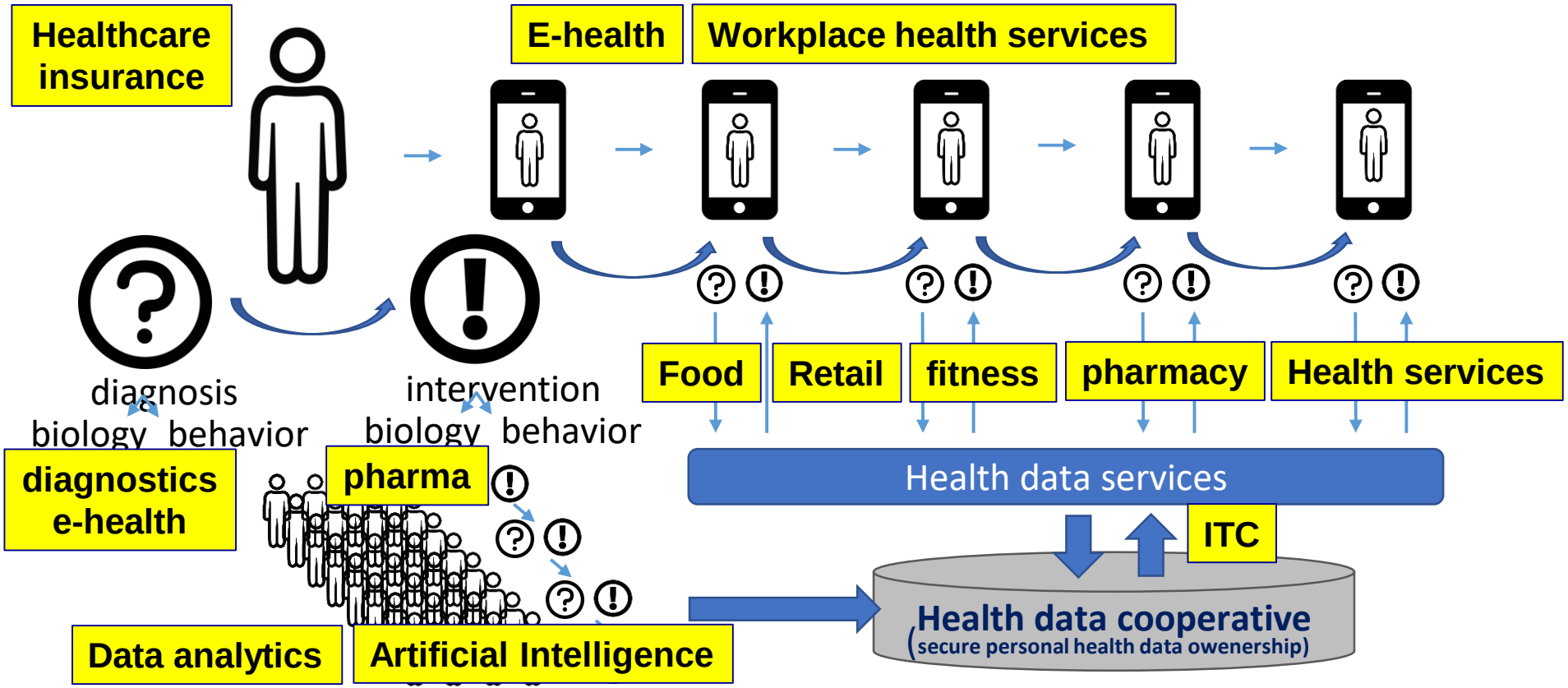
www.mdog.nl

The TNO life companion

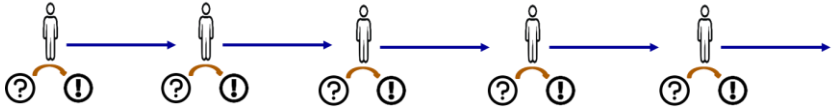
personalized advice timeline

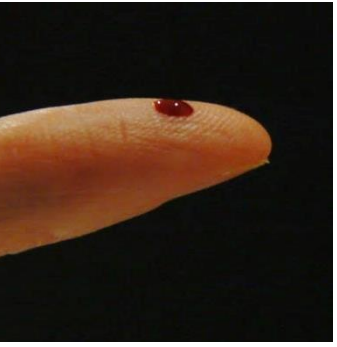


The TNO life companion and the new health economy



Citizen based research provides evidence on lifestyle related treatments



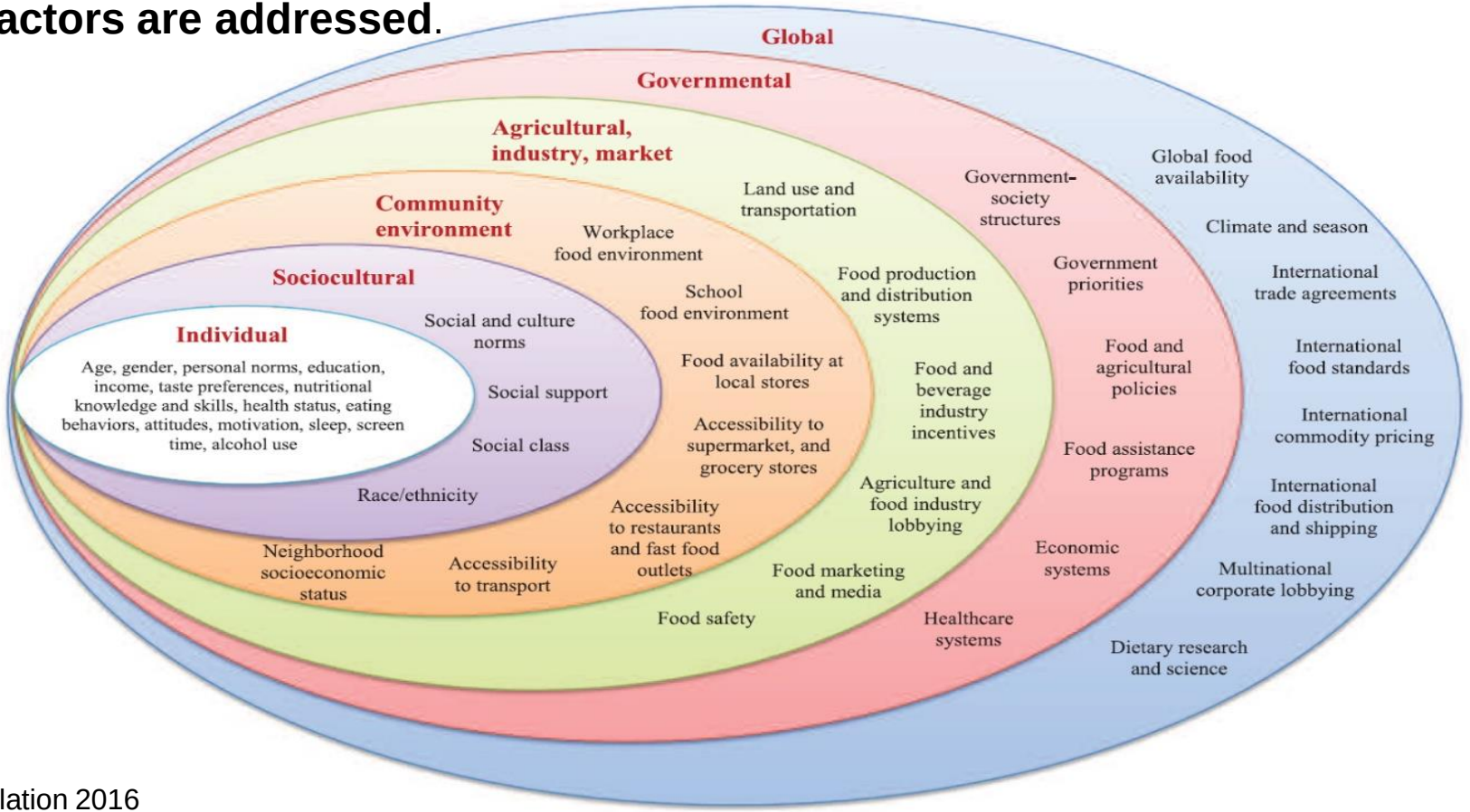


(Do-it-Yourself) diagnosis

Full health data ownership

A new health economy provides SERVICES that I want to use

Lifestyle related health can only be optimized in a systems approach where all relevant factors are addressed.

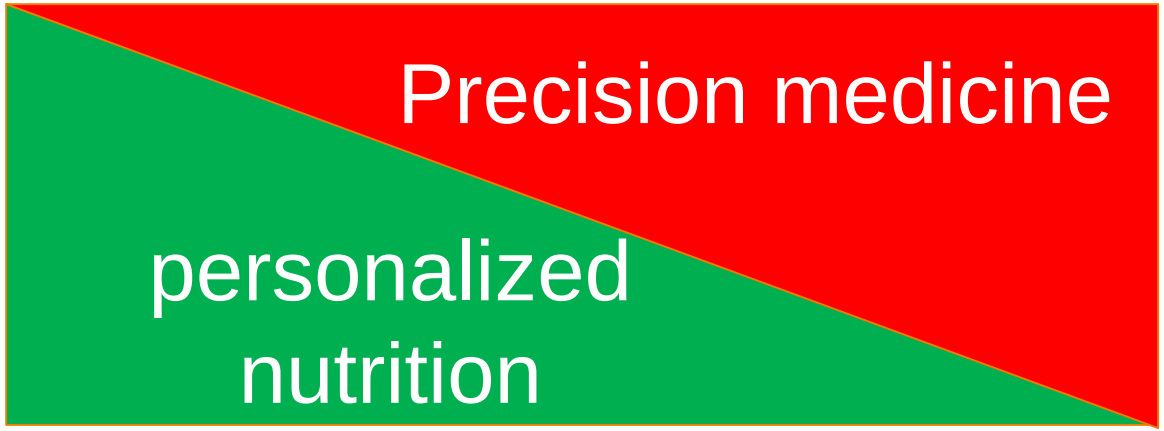


Mozaffarian, Circulation 2016

Strategy : First implement a systems change in a regional setting

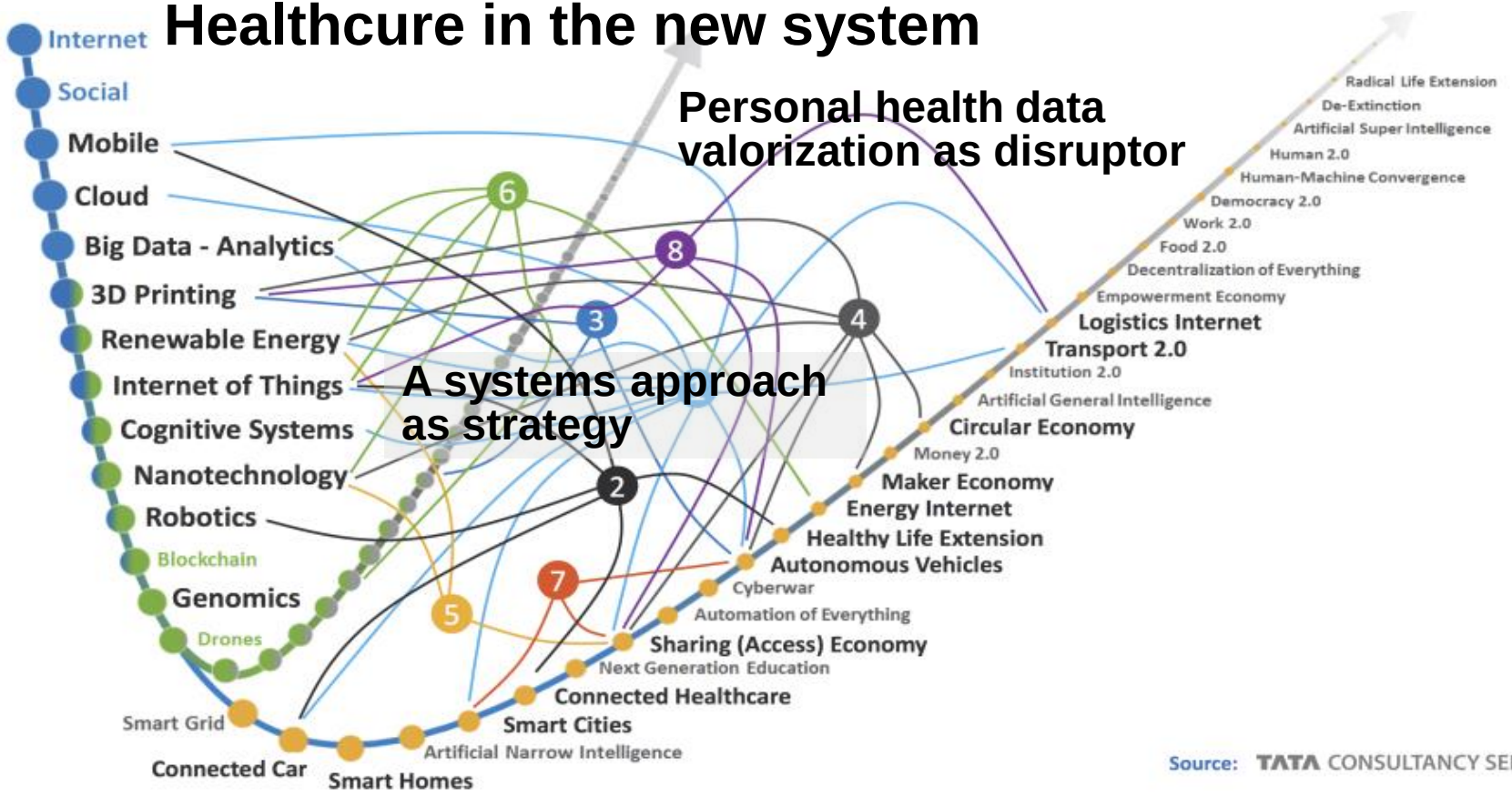
The Netherlands

and the rest …

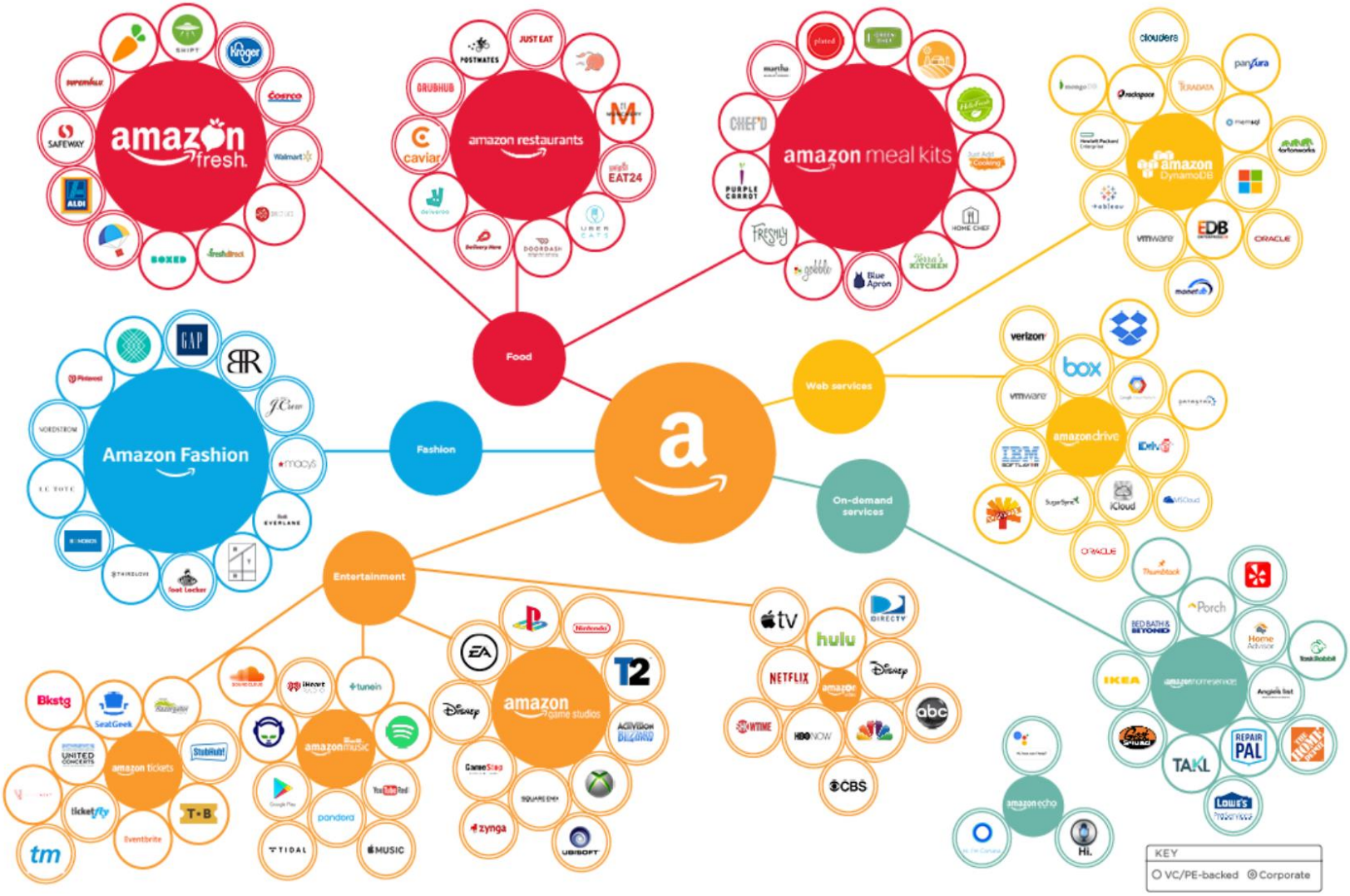

Precision medicine
personalized
nutrition


Health (care)
Research

Healthcure in the new system



Source: TATA CONSULTANCY SERVICES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amazon meal kits
amazon DynamoDB
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Amazon Fashion
Fashion
Web services
amazon drive
On-demand services
Entertainment
amazon tickets
amazon music
amazon game studios
amazon echo
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Corporate


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