



## III WORKSHOP APTITUDE PAMPLONA

# Healthy Human Ageing The Hole In the Doughnut

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ACTUAR PARA LA PREVENCIÓN  
TRANSPARENICA DE LA DEPENDENCIA  
DE LAS PERSONAS MAYORES

**Interreg**  
POCTEFA





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# Una discusión de las insuficiencias de los conceptos fisiológicos actuales del envejecimiento humano

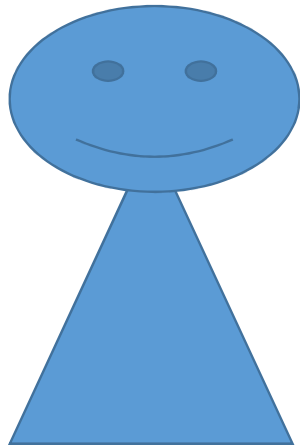


Healthy Human Ageing

The Hole In the Doughnut



## Current Disease Model of Ageing



Ageing



### Some of the twenty diseases of ageing

Hypertension

Type 2 Diabetes

Coronary heart Disease

Colon Cancer

Depression

Cardio – Respiratory Fitness ( VO<sub>2</sub>max)

etc.

Compr. Physiol 2: 1143 – 1211, 2012

## What fills the Hole





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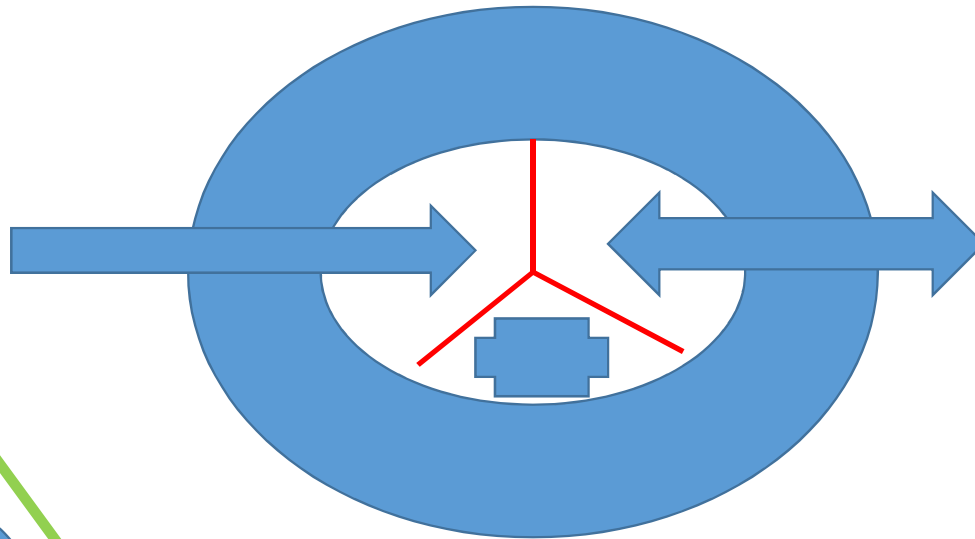
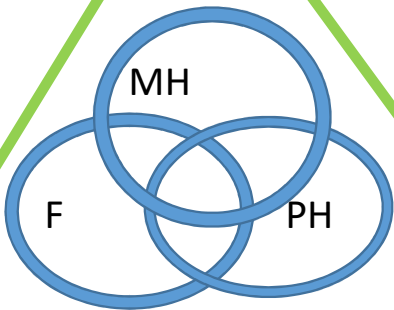
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# Trinity Necessary for Healthy Ageing

**Food**  
**The fuel**



**Physical Activity**  
**The engine**

**Mental Health**  
**The driver**

Ageing Process operating on an optimal physiology

## Australopithecus africanus



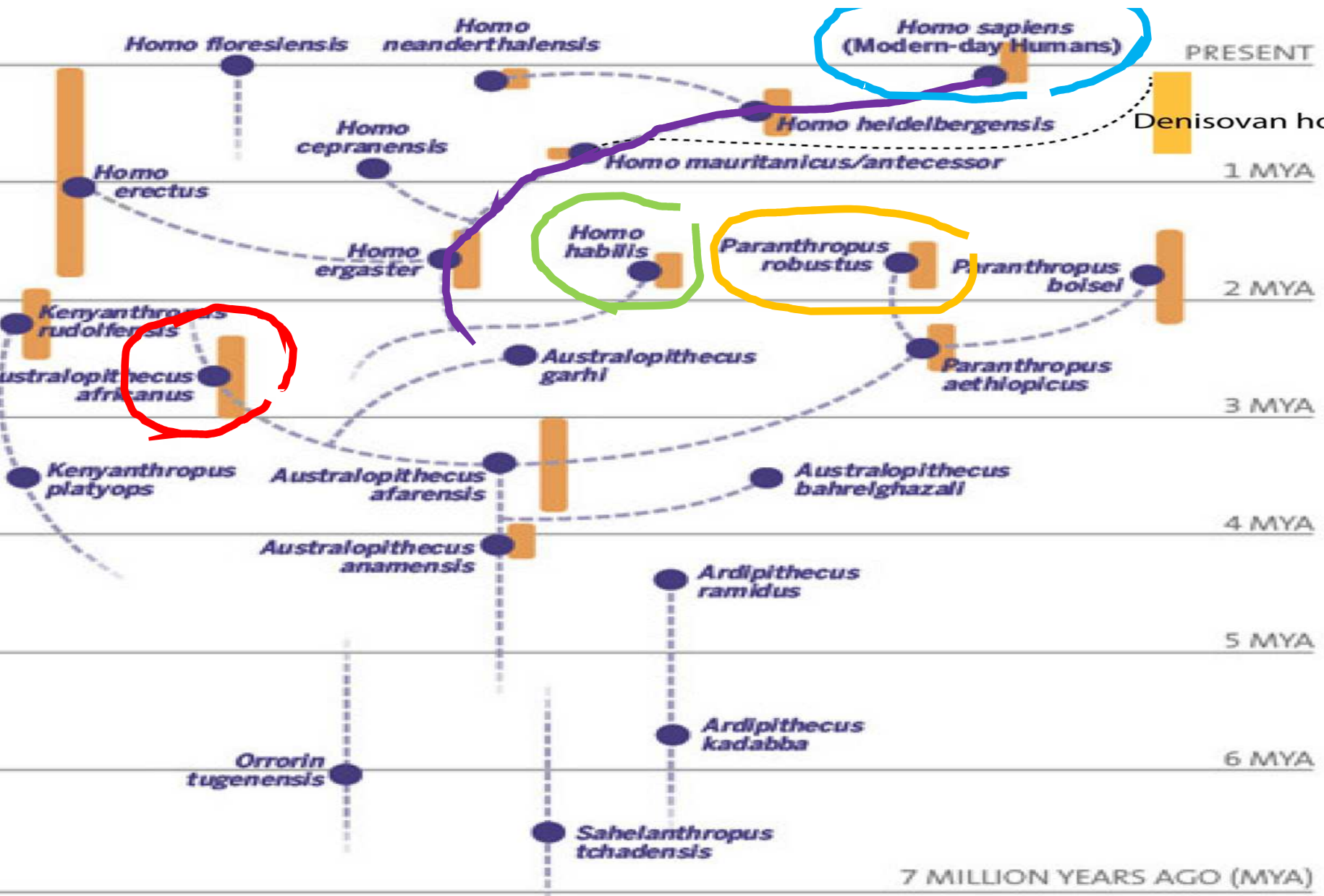
Taung's Skull Discovered 1924 by Raymond Dart

## Mrs Ples



Discovered 1947 by Robert Broom





Denisovan hominin

*Homo sapiens*  
(Modern-day Humans)

PRESENT

1 MYA

2 MYA

3 MYA

4 MYA

5 MYA

6 MYA

7 MILLION YEARS AGO (MYA)

*Homo floresiensis*

*Homo neanderthalensis*

*Homo sapiens*  
(Modern-day Humans)

*Homo cepranensis*

*Homo mauritanicus/antecessor*

Denisovan hominin

*Homo erectus*

*Homo ergaster*

*Homo habilis*

*Paranthropus robustus*

*Paranthropus boisei*

*Kenyanthropus rudolfensis*

*Australopithecus africanus*

*Australopithecus garhi*

*Paranthropus aethiopicus*

*Kenyanthropus platyops*

*Australopithecus afarensis*

*Australopithecus bahrelghazali*

*Australopithecus anamensis*

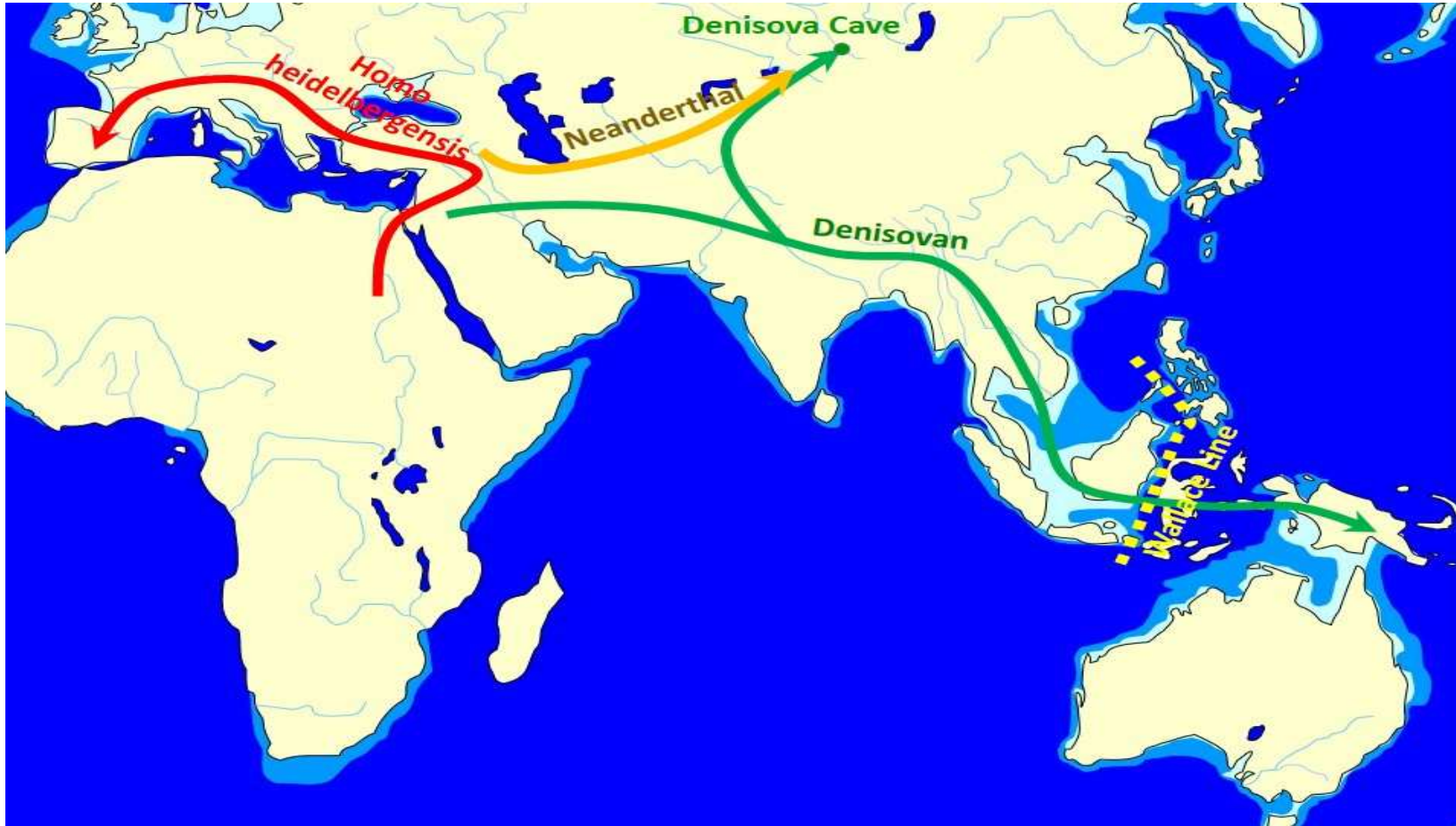
*Ardipithecus ramidus*

*Orrorin tugenensis*

*Ardipithecus kadabba*

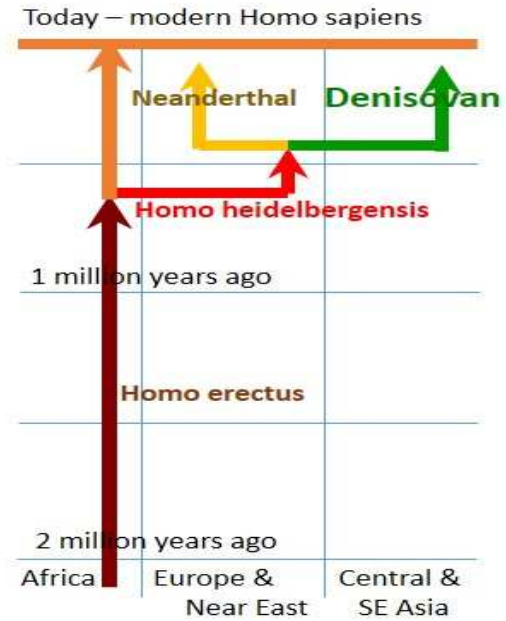
*Sahelanthropus tchadensis*

7 MILLION YEARS AGO (MYA)

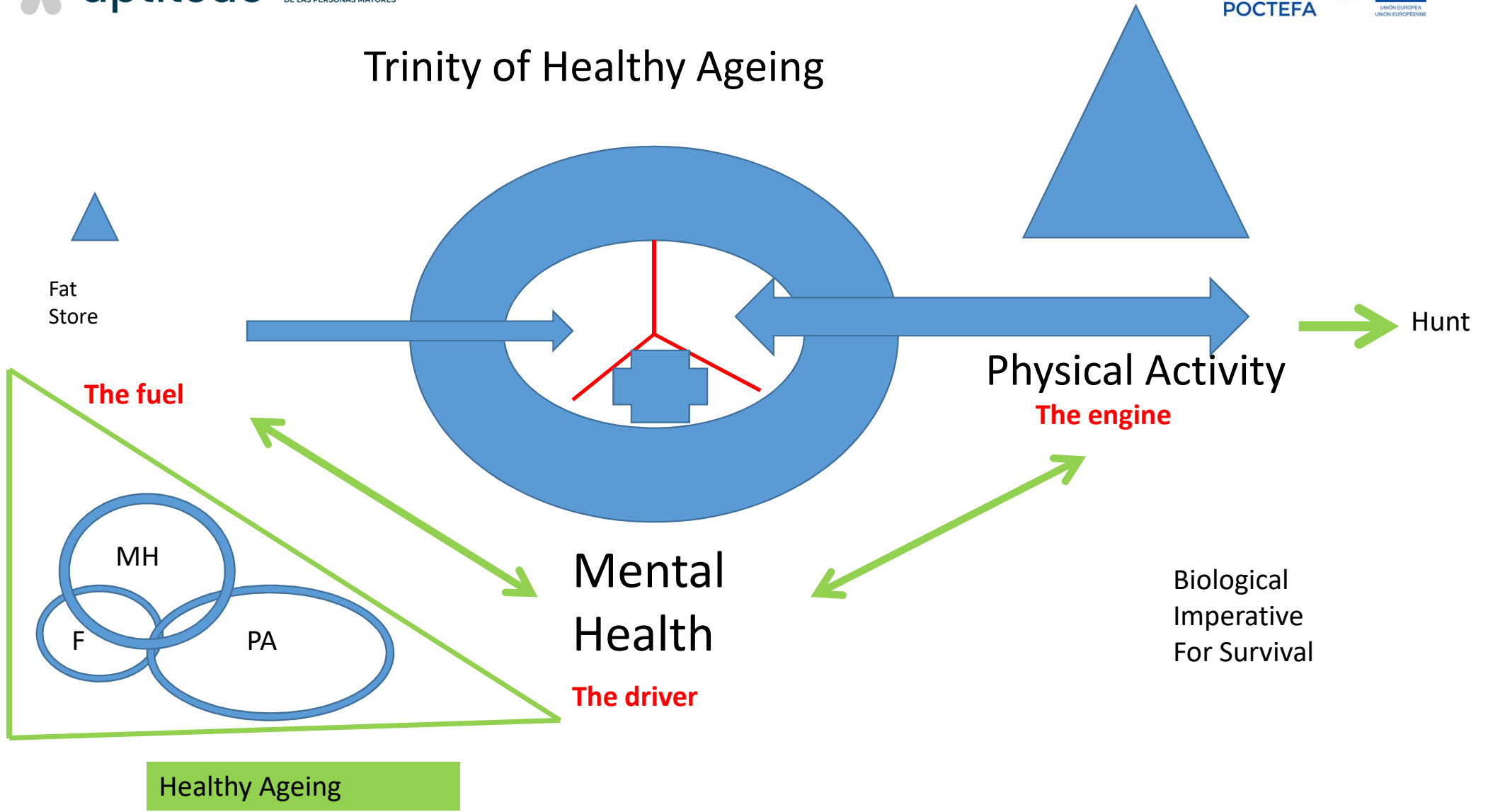


**Key**

Maximum Sea Level during the Ice Age

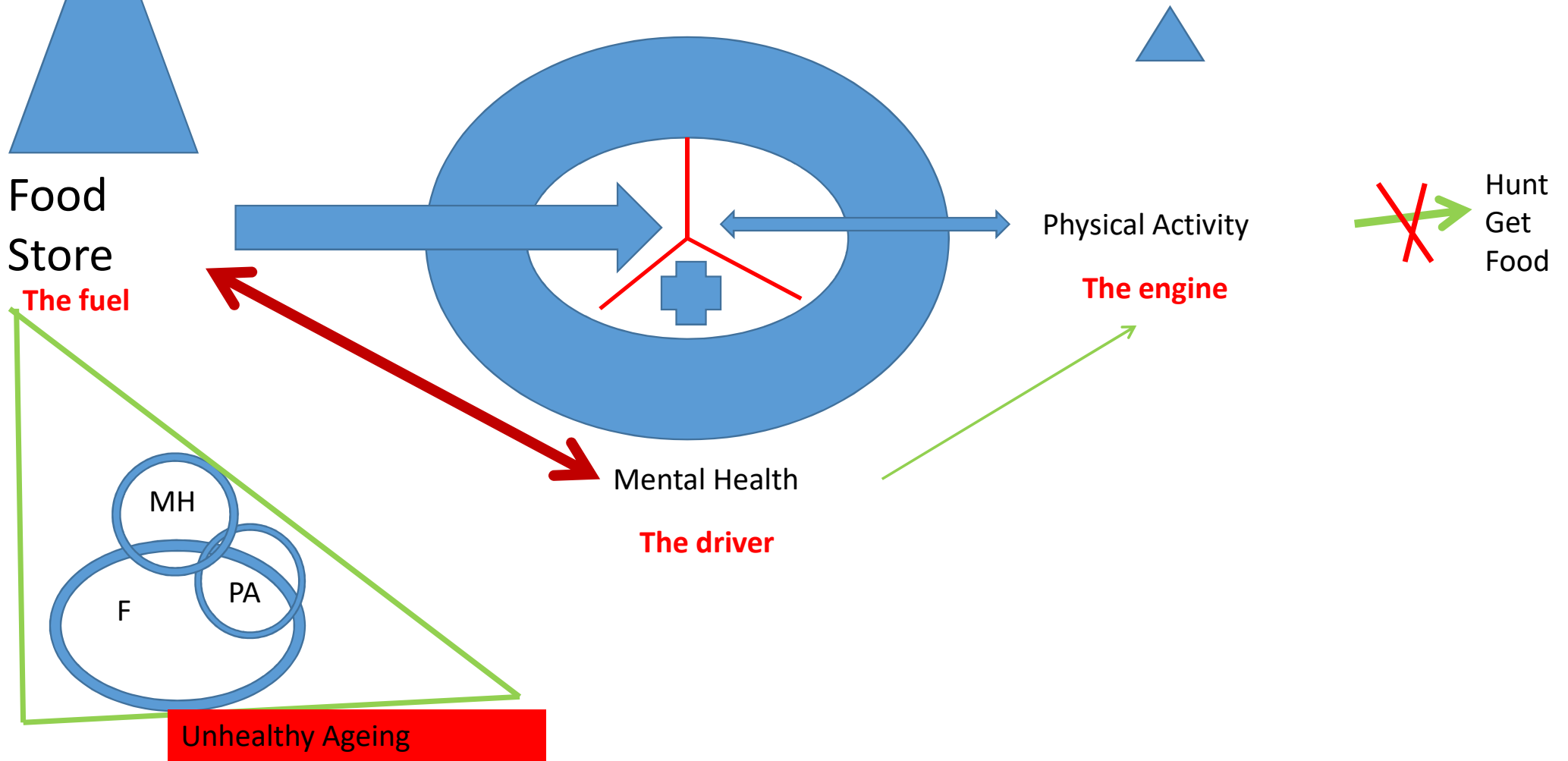


# Trinity of Healthy Ageing



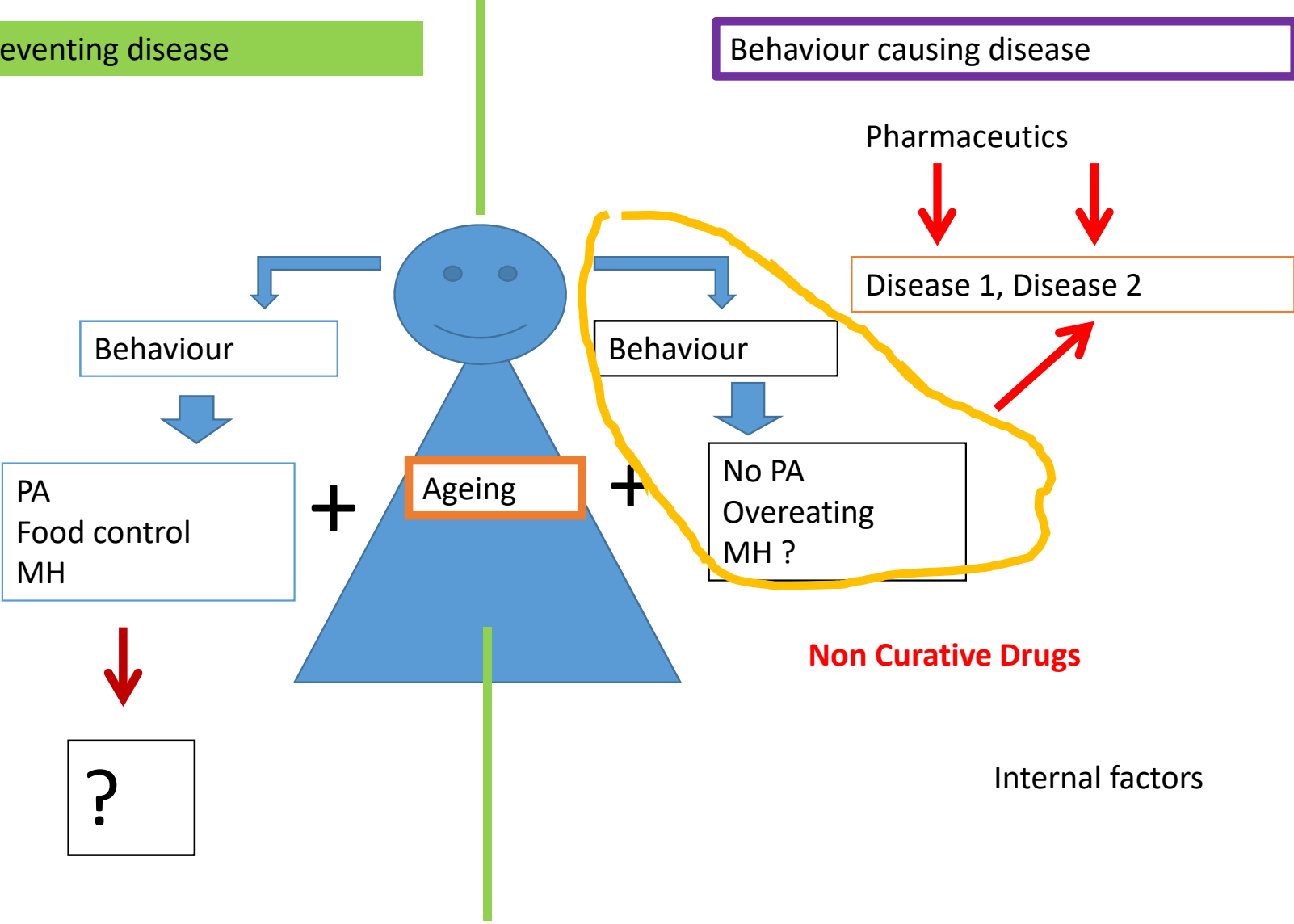
# Trinity of Unhealthy Ageing

Behavioural Change



Behaviour preventing disease

Behaviour causing disease



Pharmaceutics

Disease 1, Disease 2

PA  
Food control  
MH

Ageing

No PA  
Overeating  
MH ?

Non Curative Drugs

Internal factors

?

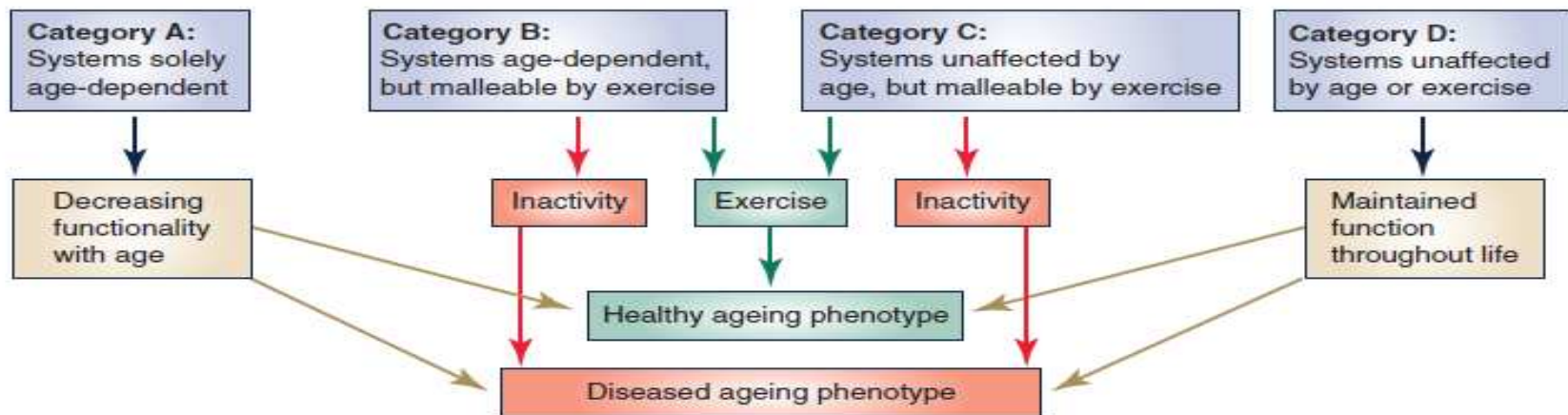


## Summary:Resumen

- 1.All behavioural diseases of “ageing” have the same initiating causes
- 2.The relationship between one, two or three components necessary for healthy ageing is unbalanced
- 3.They are diseases of “self harm”
- 4.How do they present clinically so differently?

1. Todas las enfermedades de comportamiento del envejecimiento tienen la misma etiología subyacente
- 2.Son enfermedades de autolesión
- 3.Carecen de uno, dos o tres componentes necesarios para un envejecimiento saludable
- 4.¿Como se presentan de manera diferente?

**Categories of physiological regulation during ageing:  
Production of healthy and diseased phenotypes**



The Journal of  
**Physiology**

**Figure 1. A schematic overview of the hypothesised regulation of healthy or diseased older phenotypes through the interaction of ageing and exercise**

Lazarus, Lord and Harridge (2019) Journal of Physiology

**A**

Solo dependiente  
de la edad

**B**

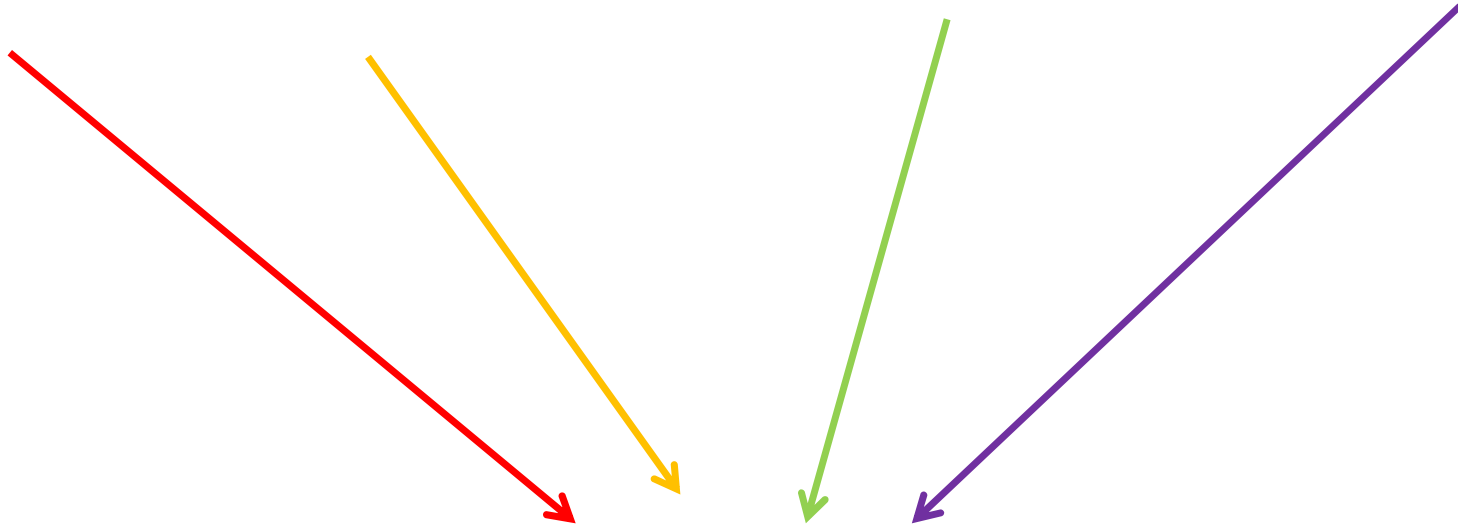
Dependiente de la edad,  
pero modificada por el  
ejercicio

**C**

Edad independient  
pero modificada  
por el ejercicio

**D**

Edad y ejercicio  
independient



**Fenotipo**

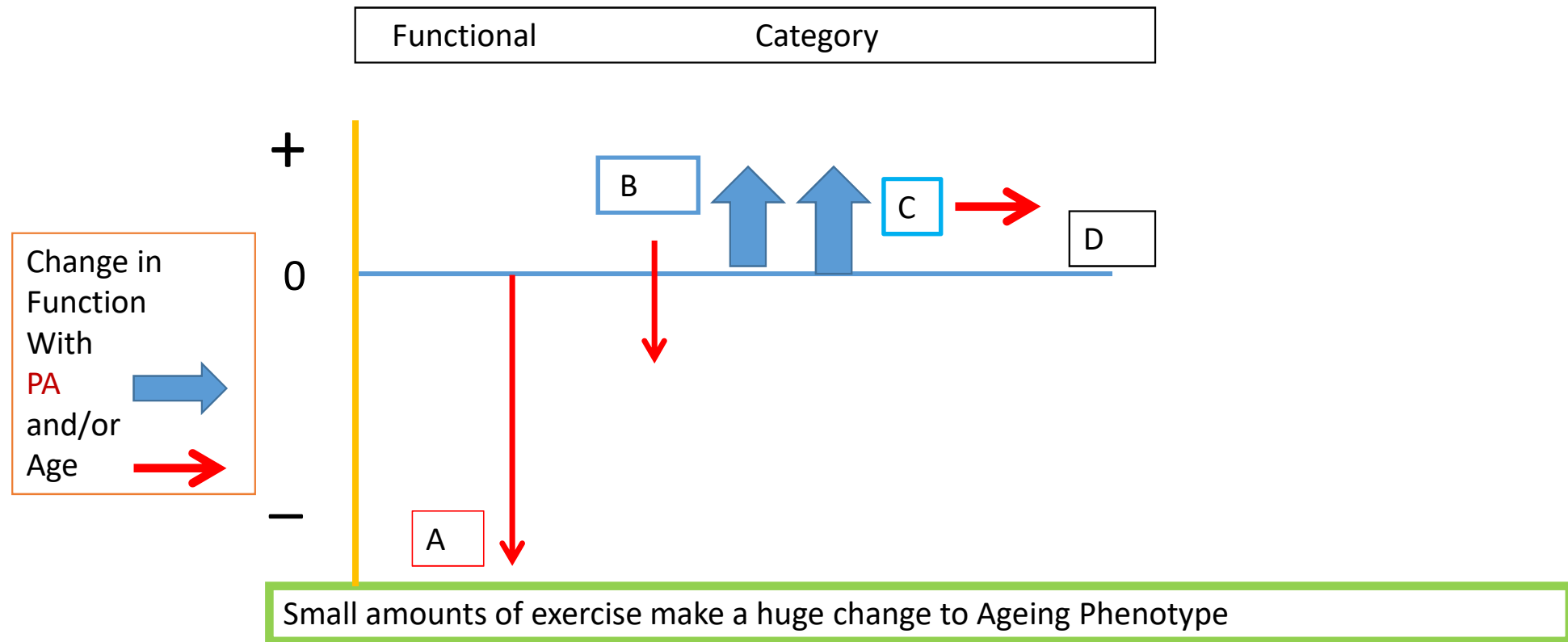
MHR  
Motor end units

VO2max

Resting heart rate

Small gut function  
Baroreceptor





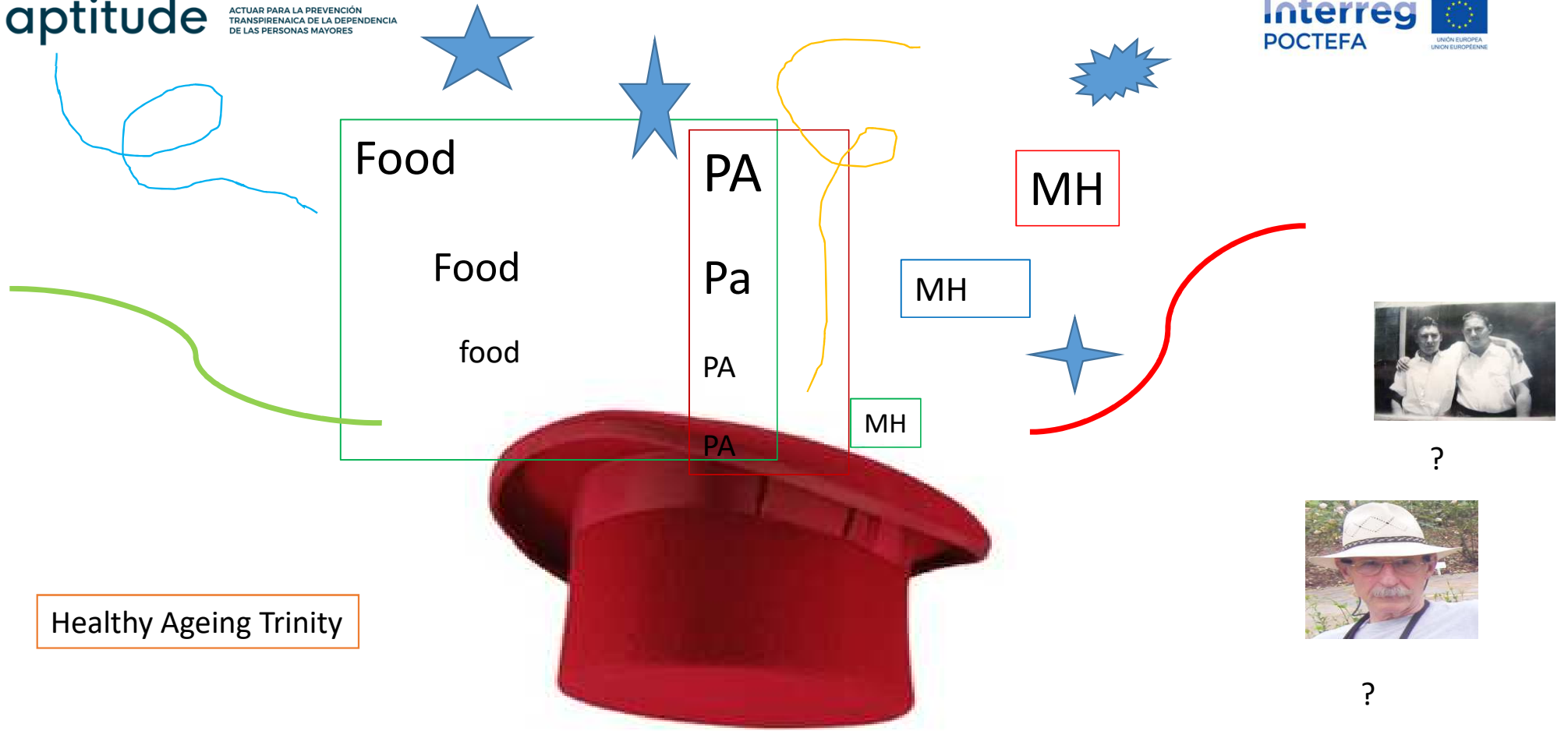
Variables: Food, PA, Mental Health, Categories A,B,C,D and differences in genetic make up



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Healthy Ageing Trinity

Trinity = Three Dimensional Snapshot



?



?

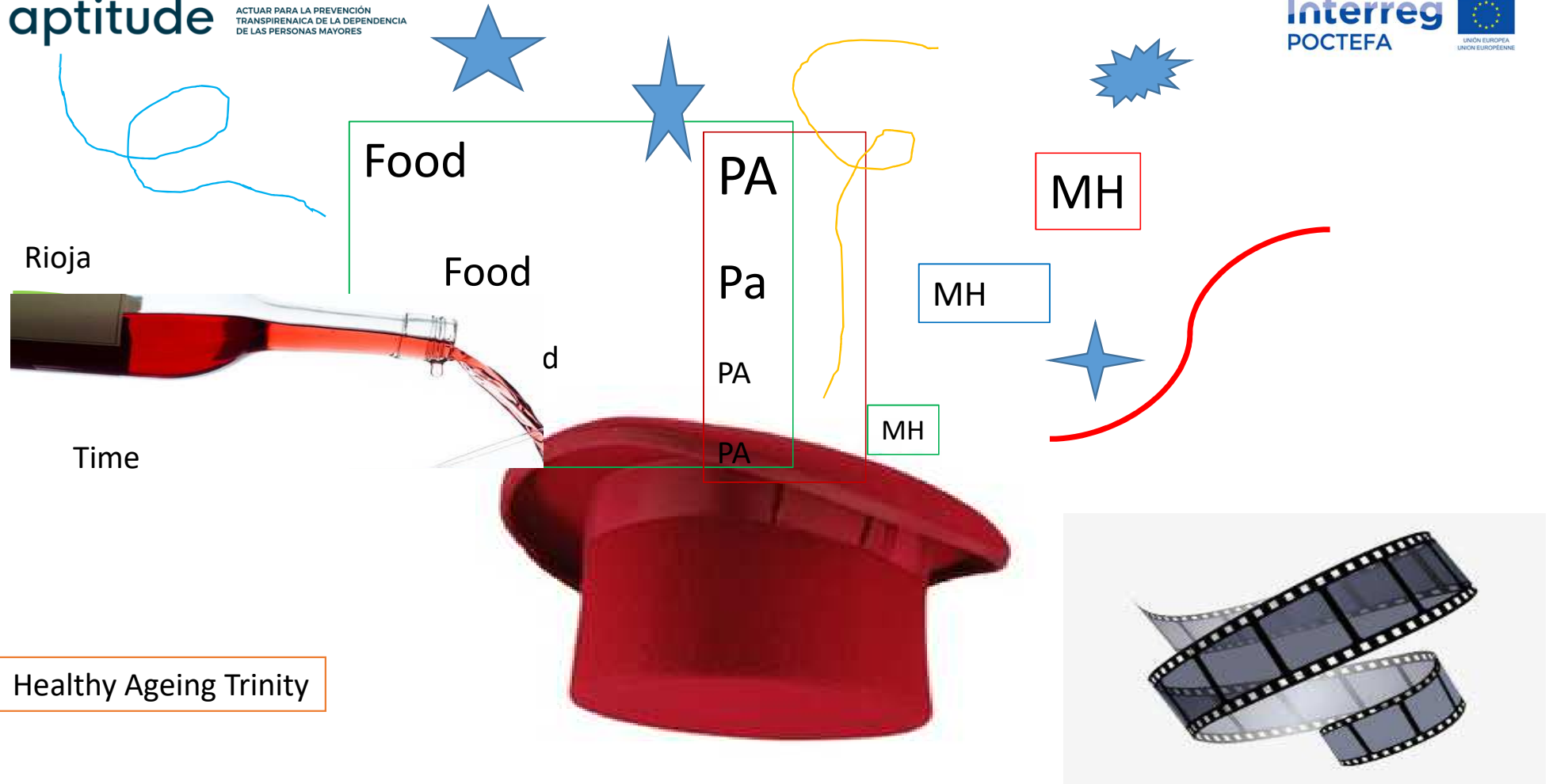




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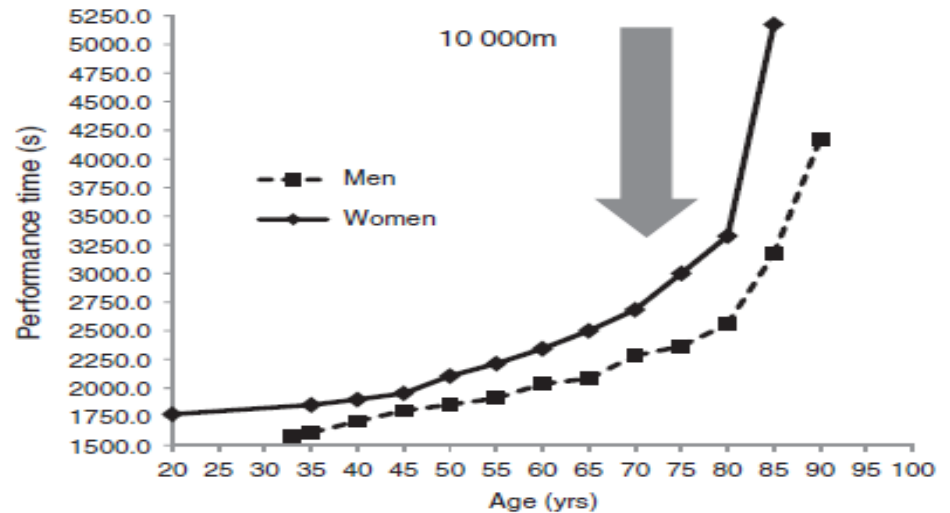
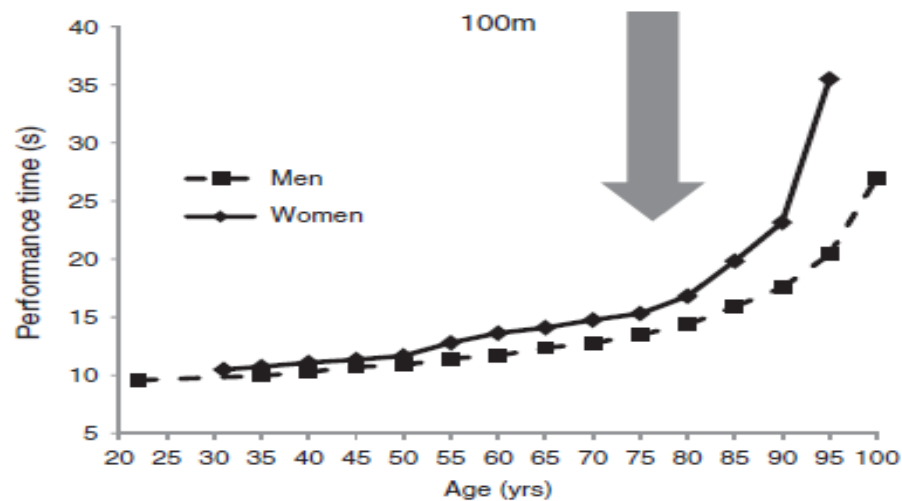


Healthy Ageing Trinity

Trinity + Longitudinal study (Time)

MAGIC





**Figure 1. World record performances for the 100 m and 10,000 m track event as of June 2016 for both male and female master athletes**

The data are from each age category group (5 year increments) from age 35 and also include the current world record performances by non-master athletes. (Data from [www.world-masters-athletics.org](http://www.world-masters-athletics.org).) The arrows indicate the accelerated increased in performance times around the eighth decade.

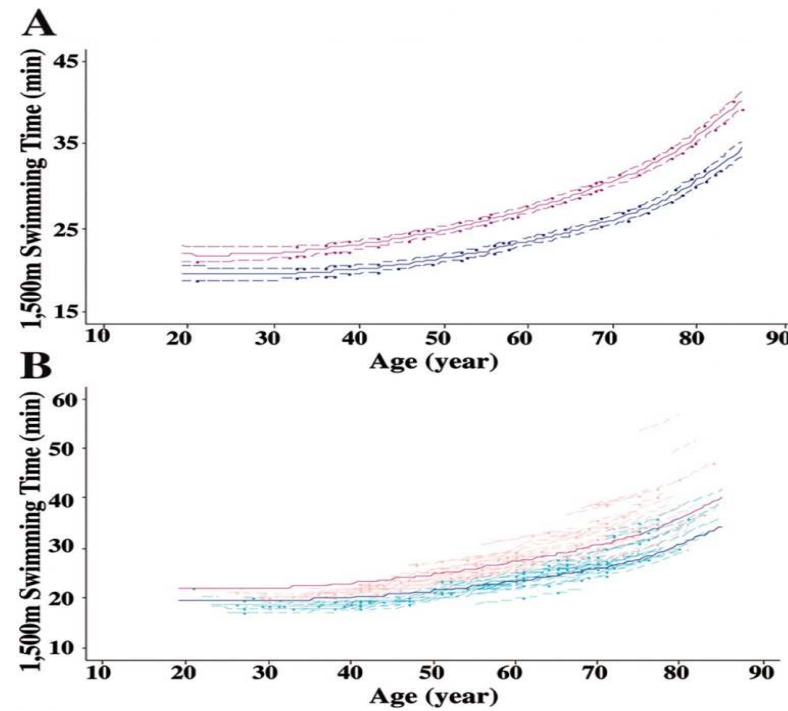
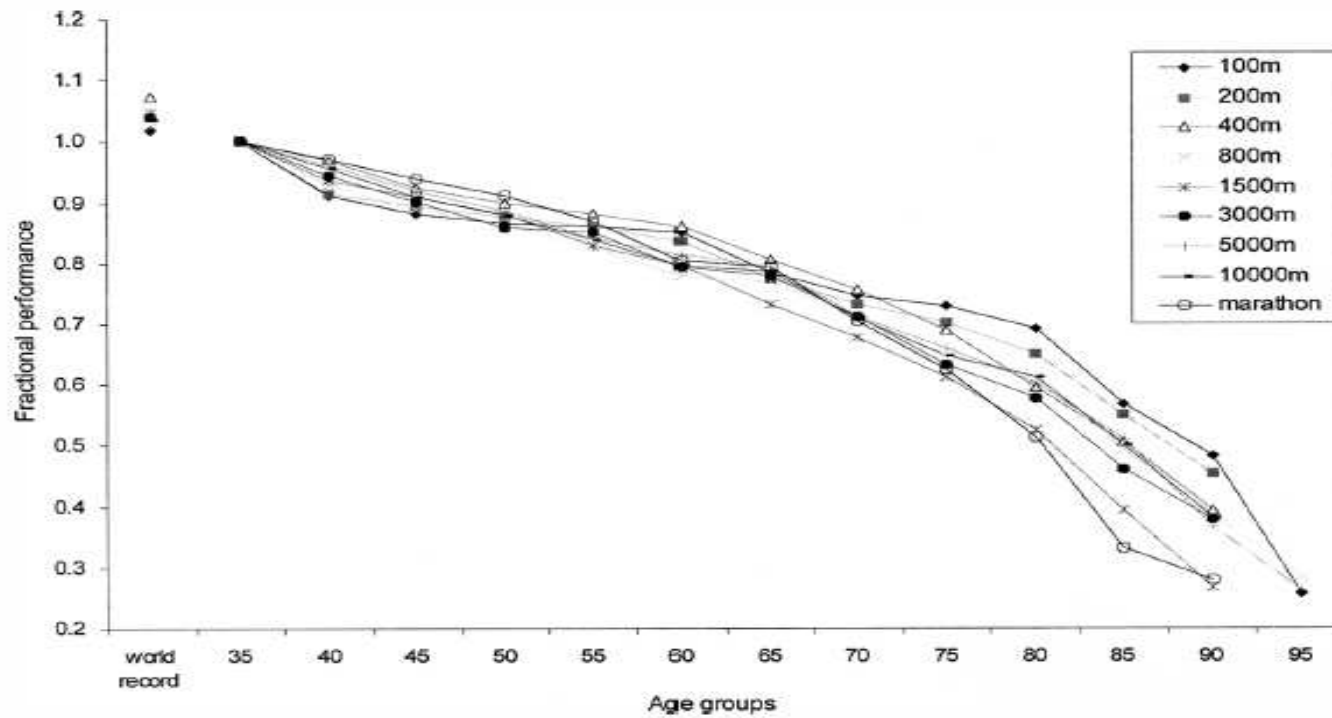


Fig. 1. US Masters Swimming 1,500-m freestyle performance times with advancing age. *A*: mean (population) quadratic line and 95% confidence intervals. *B*: average quadratic line and individual regression lines. Pink identifies women, and blue identifies men.

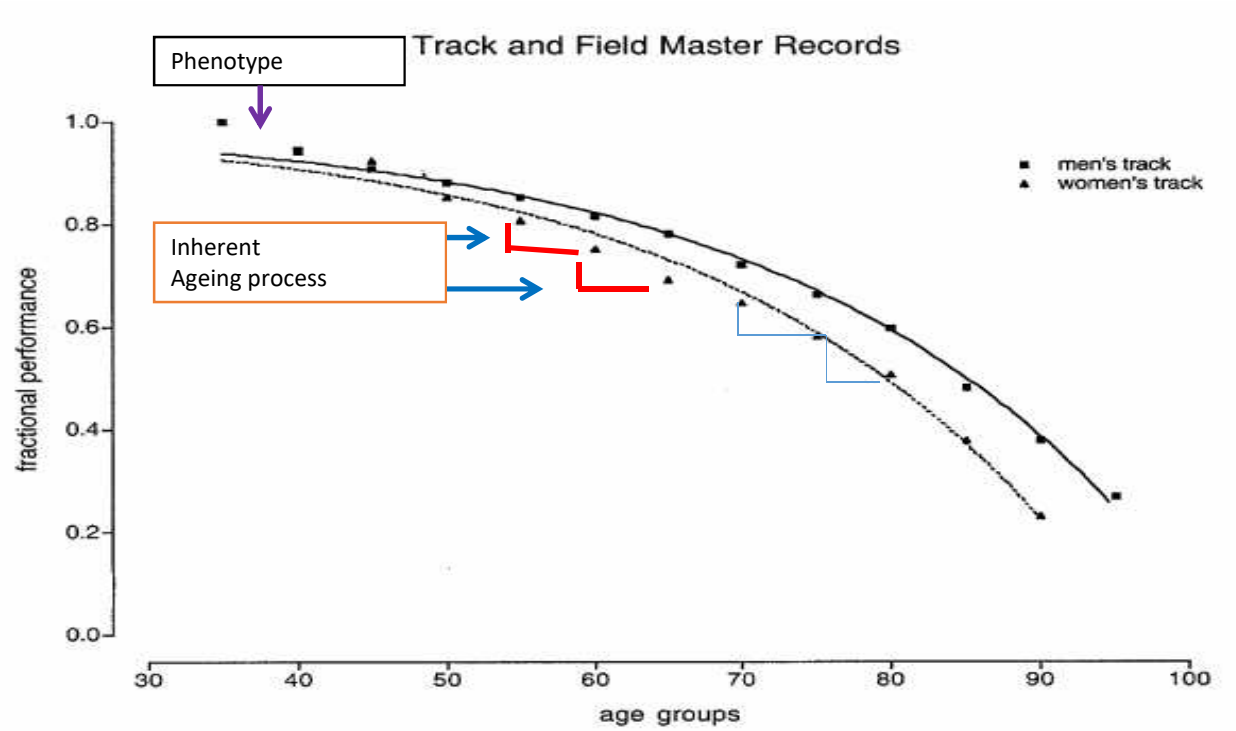
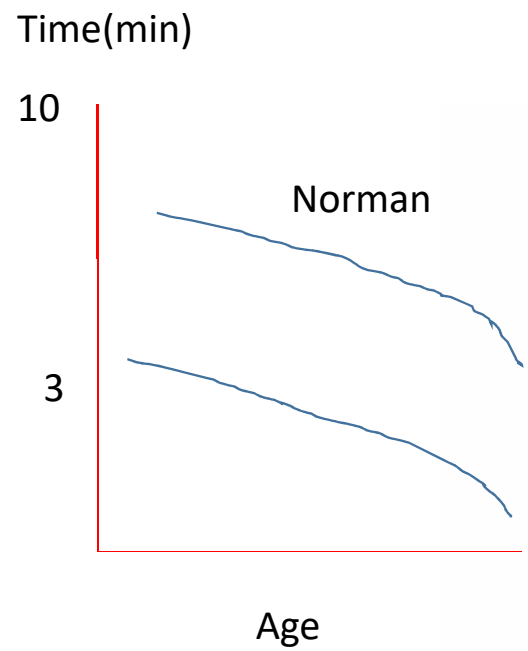
DOI: (10.1152/jappphysiol.00438.2002)

Donato et al 2002



**FIGURE 1** Men's Master track fractional records by age groups.

Baker and Tung 2010.



**FIGURE 3** Combined fractional records for track results by age groups. Curves of best fit using the equation  $y = (1 - \exp((T - T_0)/\tau))$  are shown.

Remember !!!!  
 The selection is  
 for athletic ability  
 NOT  
 for ageing



## ¿Qué hemos aprendido sobre el proceso de envejecimiento humano inherente?

No hay evidencia de desorden; coherente, síncrono e integrado

Tipo de ejercicio no altera la forma de la curva.

La distancia no altera la forma de la curva.

La forma del cuerpo no altera la forma de la curva.

El tiempo de actuación es impulsado por fenotipo.

La forma de la curva es impulsada por el proceso de envejecimiento

The ageing process has the fearful symmetry of a tiger

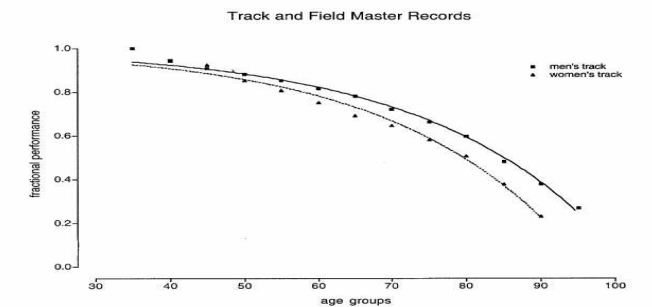


FIGURE 3 Combined fractional records for track results by age groups. Curves of best fit using the equation  $y = (1 - \exp(-(T - T_0)/\tau))$  are shown.



The Hole has been filled



PA  
Food  
MH



?



But

This lack of understanding affects  
every person on the planet

Absolutely no understanding  
of integrative physiology

### **Por último**

Debería ser posible clasificar sistemas fisiológicos, no sólo de la manera tradicional, sino por su capacidad de responder a la actividad física, edad o ambas.

### **Quizás**

Existe un enfoque fisiológico alternativo que pueda proporcionar nuevas perspectivas sobre los mecanismos detrás de las fisiologías opuestas entre personas que hacen ejercicio y las que no.

**El proceso de envejecimiento no puede ser considerado como un amigo, pero el entendimiento de su naturaleza nos brinda la oportunidad de vivir nuestros años de oro de la manera más productiva posible.**

Adios y gracias



# ¡Gracias! / Merci!

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