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Nutrición y Genómica

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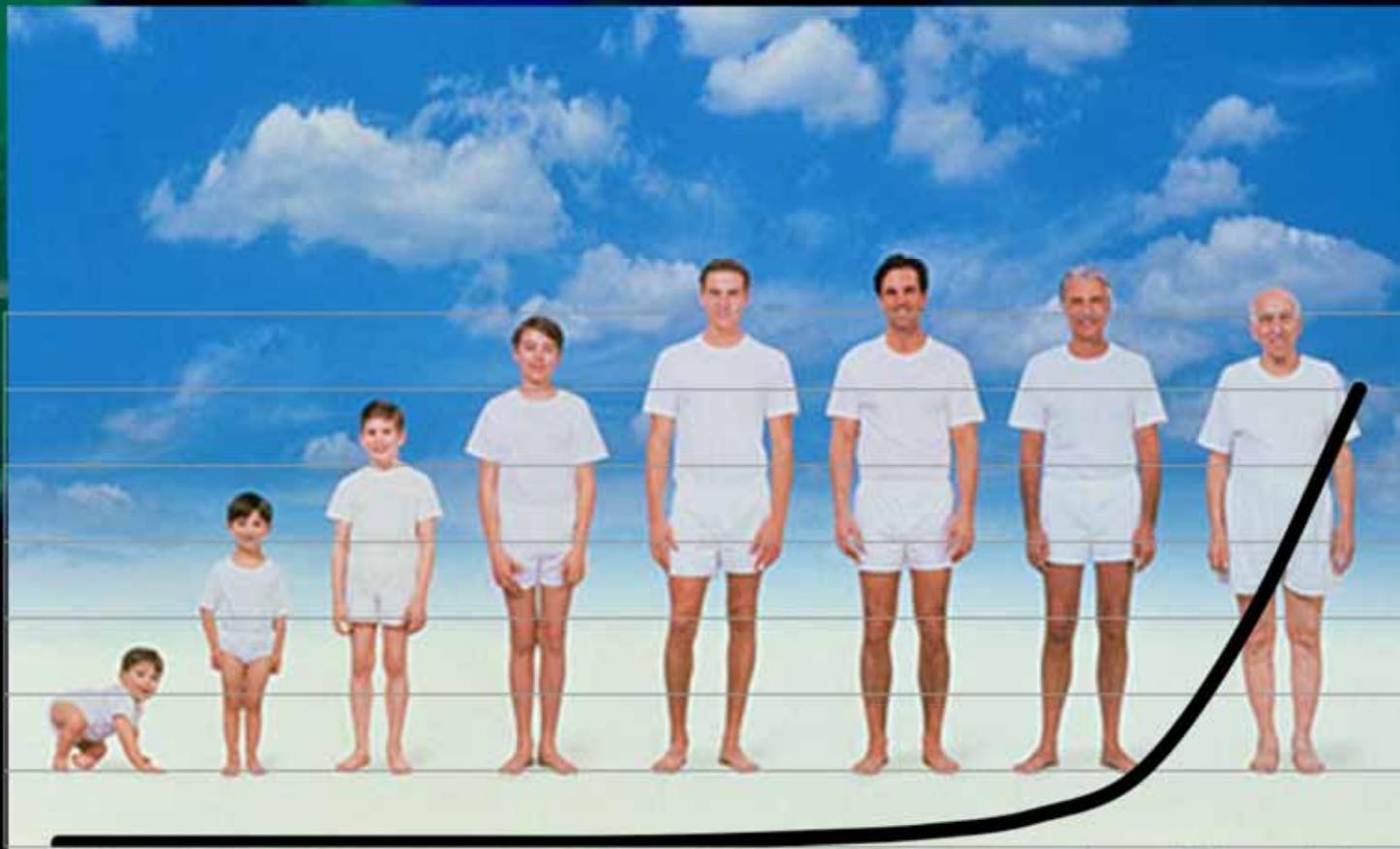
Las nuevas tecnologías “ómicas”
claves en la personalización de la
prevención
y tratamiento de la enfermedad

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and Population Genetics Department, CNIC and
IMDEA (Madrid) and the USDA-HNRCA at Tufts
University, (Boston)

Today's
Reactive
Medicine



COST



Baseline Risk

Preclinical Progression

Disease Initiation/Progression

Therapeutic decision

Earliest biomarker detection

Earliest clinical detection

Typical current intervention

Today's
Reactive
Medicine



Tomorrow's
Proactive
Medicine

Predictive

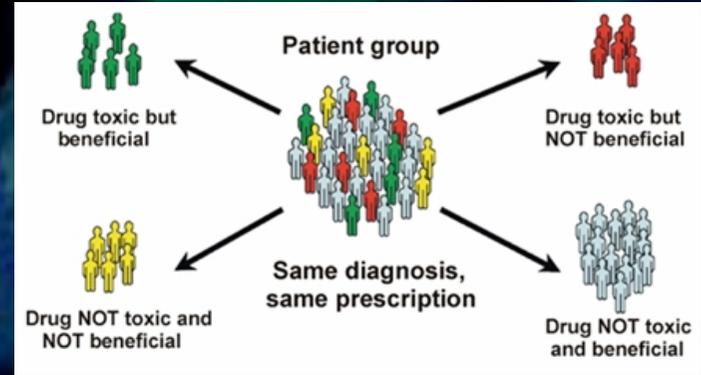


Tomorrow's



Medicine

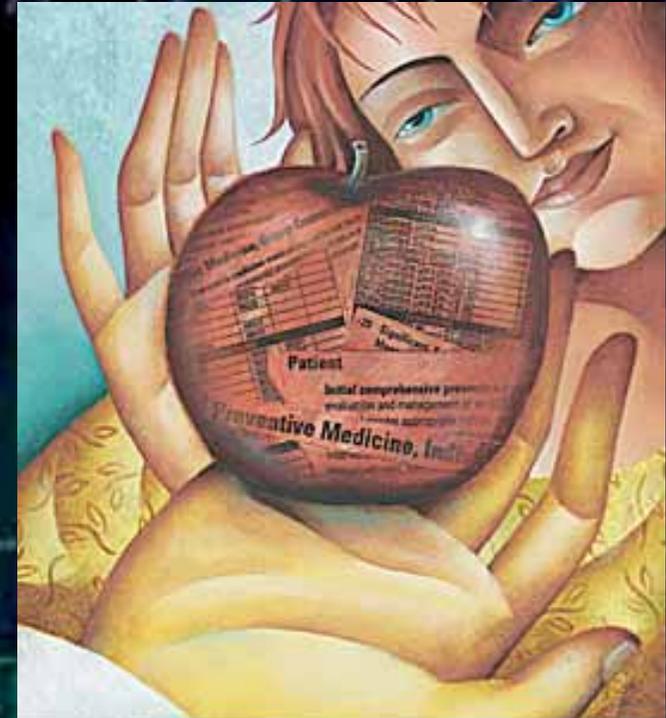
Personalized



Participatory



Preventive



Prevention and Therapy are Personal (Personalized Medicine)

- We are all different.
- Some of our differences translate to how we react to foods and drugs –as individuals.
 - Some people need twice the standard dose to be effective
 - Some drugs work for one person but not for another
 - Some people have side effects, other don't
 - Some people get cardiovascular disease (cancer, obesity, diabetes) and others don't
- This is why individualized, or personalized medicine is important for each one of us.

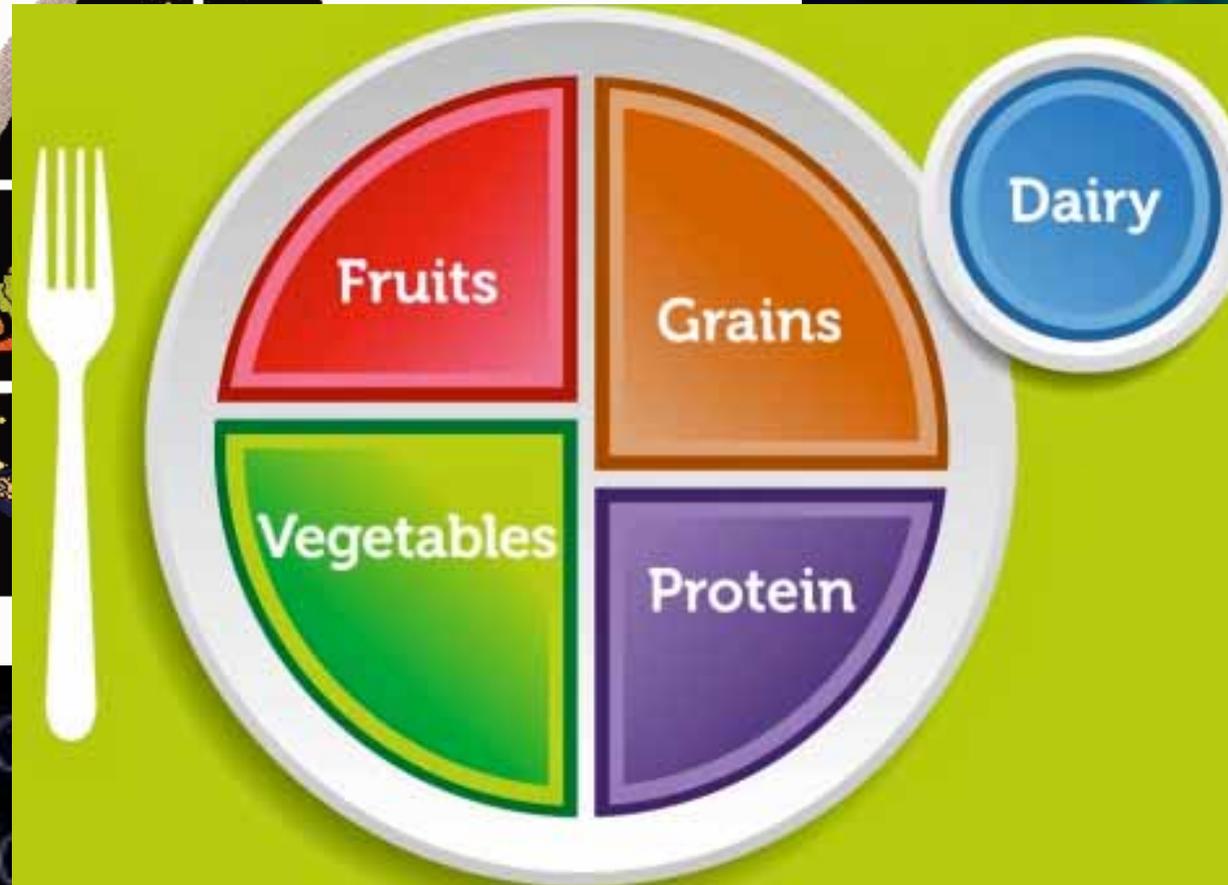
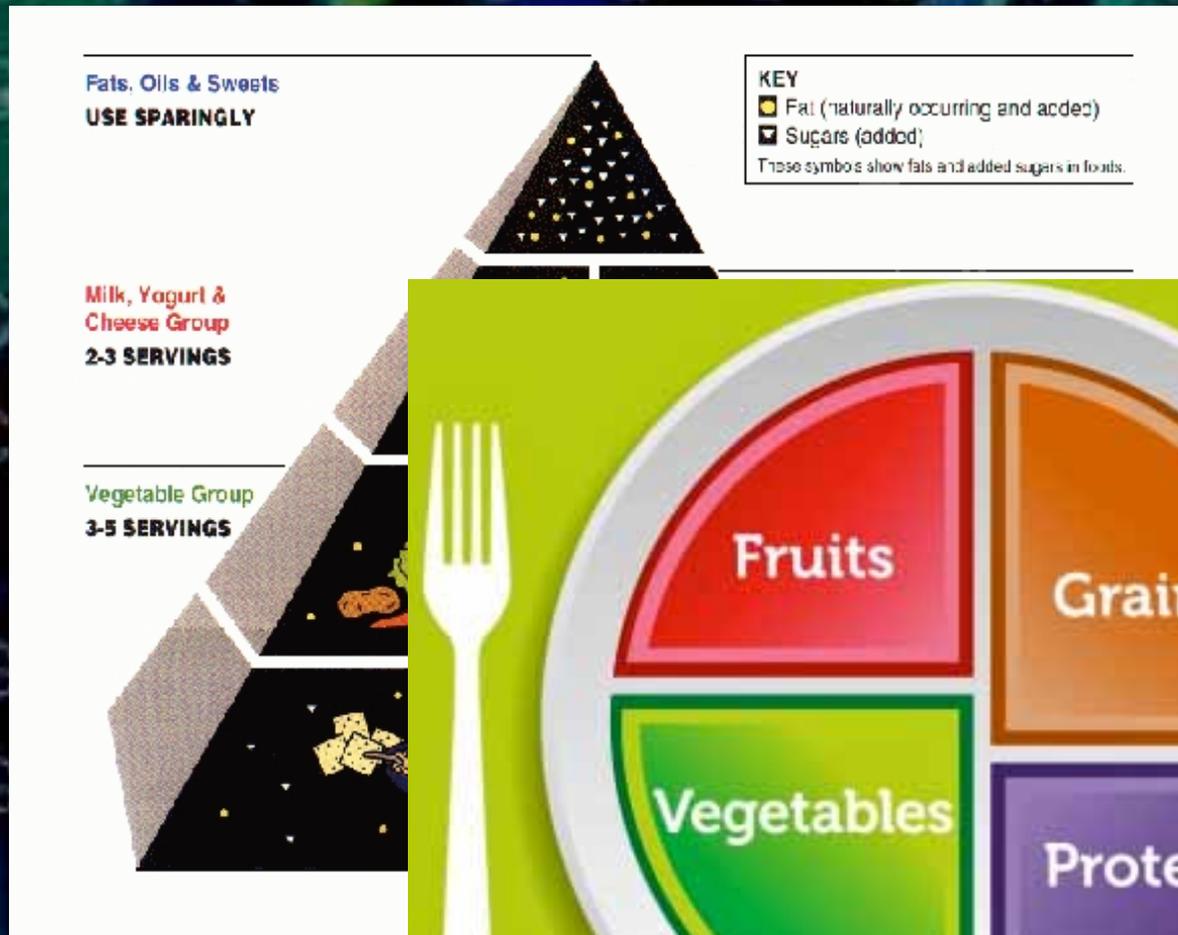
One Size (Dose) Fits All (Current Medicine)



Prevention and Therapy are Personal (Personalized Medicine)

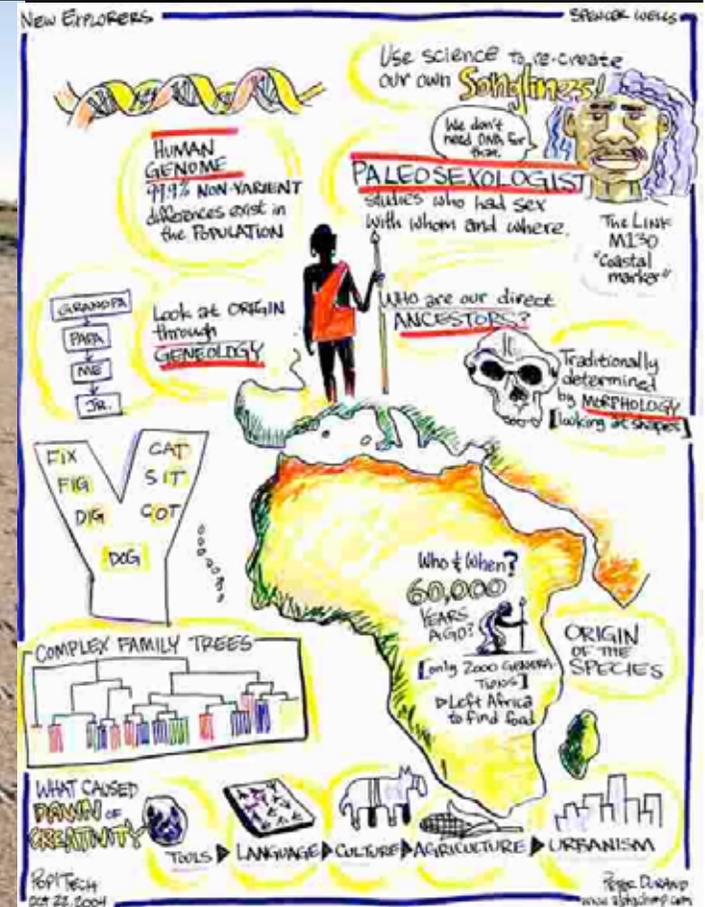
- The **Right Dose** of
- The **Right Drug** for
- The **Right Indication** for
- The **Right Patient** at
- The **Right Time**.

One Diet fits all?



Out-of-Africa

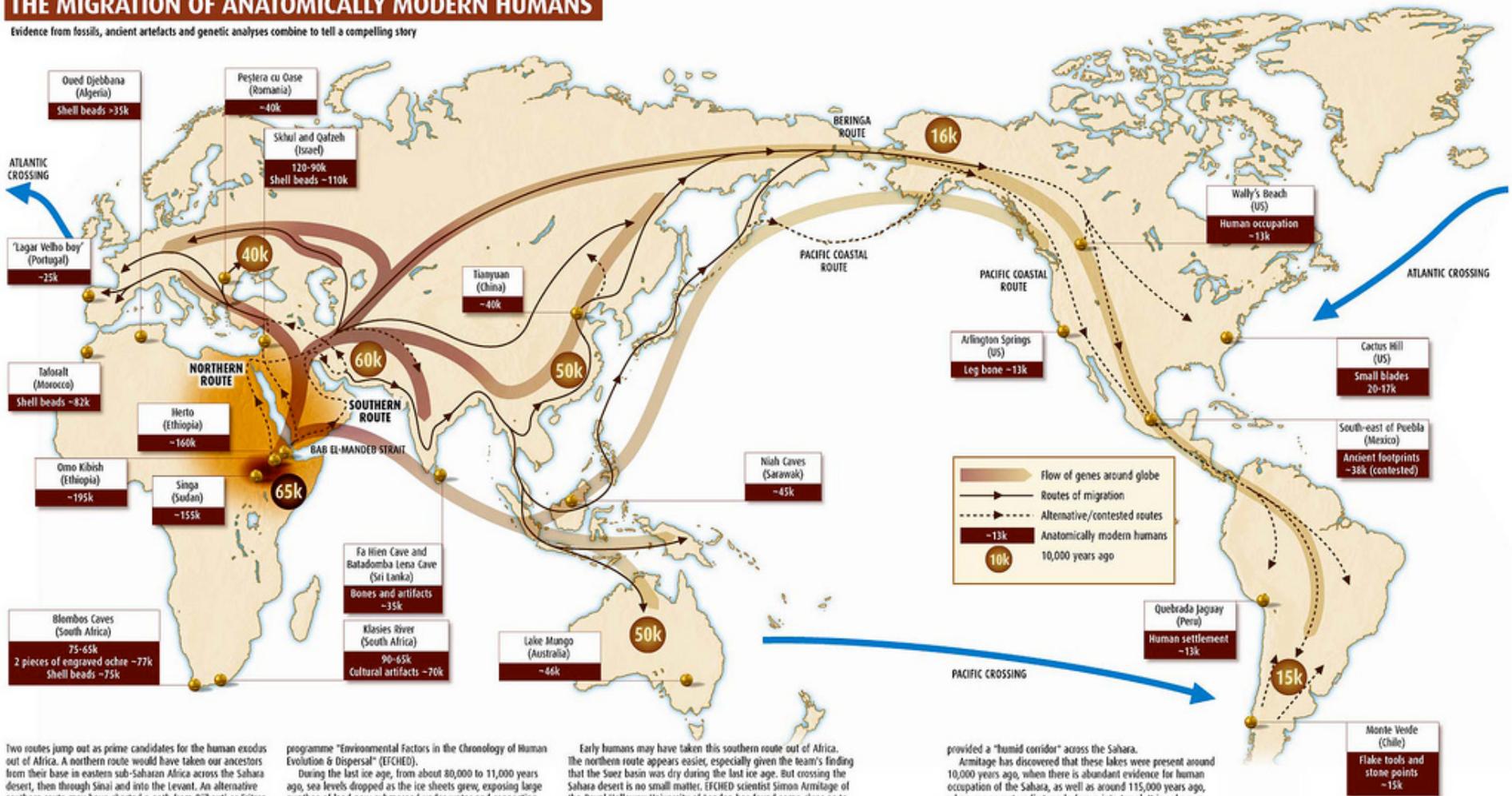
- 100-200 mil años



Out-of-Africa

THE MIGRATION OF ANATOMICALLY MODERN HUMANS

Evidence from fossils, ancient artefacts and genetic analyses combine to tell a compelling story



Two routes jump out as prime candidates for the human exodus out of Africa. A northern route would have taken our ancestors from their base in eastern sub-Saharan Africa across the Sahara desert, then through Sinai and into the Levant. An alternative southern route may have charted a path from Djibouti or Eritrea in the Horn of Africa across the Bab el-Mandeb strait and into Yemen and around the Arabian peninsula. The plausibility of these two routes as gateways out of Africa has been studied as part of the UK's Natural Environment Research Council's

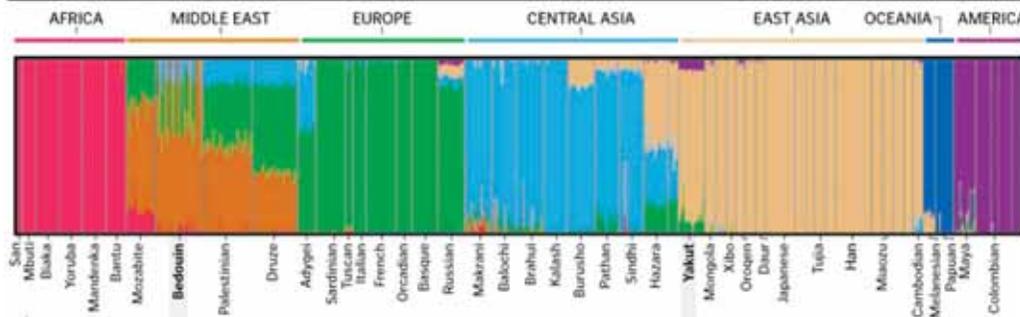
programme "Environmental Factors in the Chronology of Human Evolution & Dispersal" (EFCHEd).
During the last ice age, from about 80,000 to 11,000 years ago, sea levels dropped as the ice sheets grew, exposing large swathes of land now submerged under water and connecting regions now separated by the sea. By reconstructing ancient shorelines, the EFCHEd team found that the Bab el-Mandeb strait, now around 30 kilometres wide and one of the world's busiest shipping lanes, was then a narrow, shallow channel.

Early humans may have taken this southern route out of Africa. The northern route appears easier, especially given the team's finding that the Suez basin was dry during the last ice age. But crossing the Sahara desert is no small matter. EFCHEd scientist Simon Armitage of the Royal Holloway University of London has found some clues as to how this might have been possible. During the past 150,000 years, North Africa has experienced abrupt switches between dry, arid conditions and a humid climate. During the longer wetter periods huge lakes existed in both Chad and Libya, which would have

provided a "humid corridor" across the Sahara. Armitage has discovered that these lakes were present around 10,000 years ago, when there is abundant evidence for human occupation of the Sahara, as well as around 115,000 years ago, when our ancestors first made forays into Israel. It is unknown whether another humid corridor appeared between about 65,000 and 50,000 years ago, the most likely time frame for the human exodus. Moreover, accumulating evidence is pointing to the southern route as the most likely jumping-off point.

Diversidad Humana

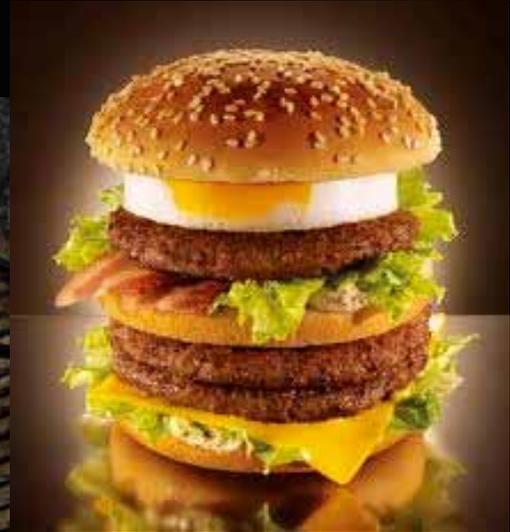
- Somos diferentes!!!!
- Una de las razones detras de la diversidad esta en las variantes geneticas en nuestros genomas.
- Se estiman unos 10 millones de variantes comunes en la poblacion.



Sampling of Ethnicities

The Bedouin show unusual genetic diversity, with ancestry traceable to the Middle East, Europe, Central Asia and even Africa.

The Yakut, native to eastern Siberia, are most similar to other East Asians, but also have European and Native American relatives.

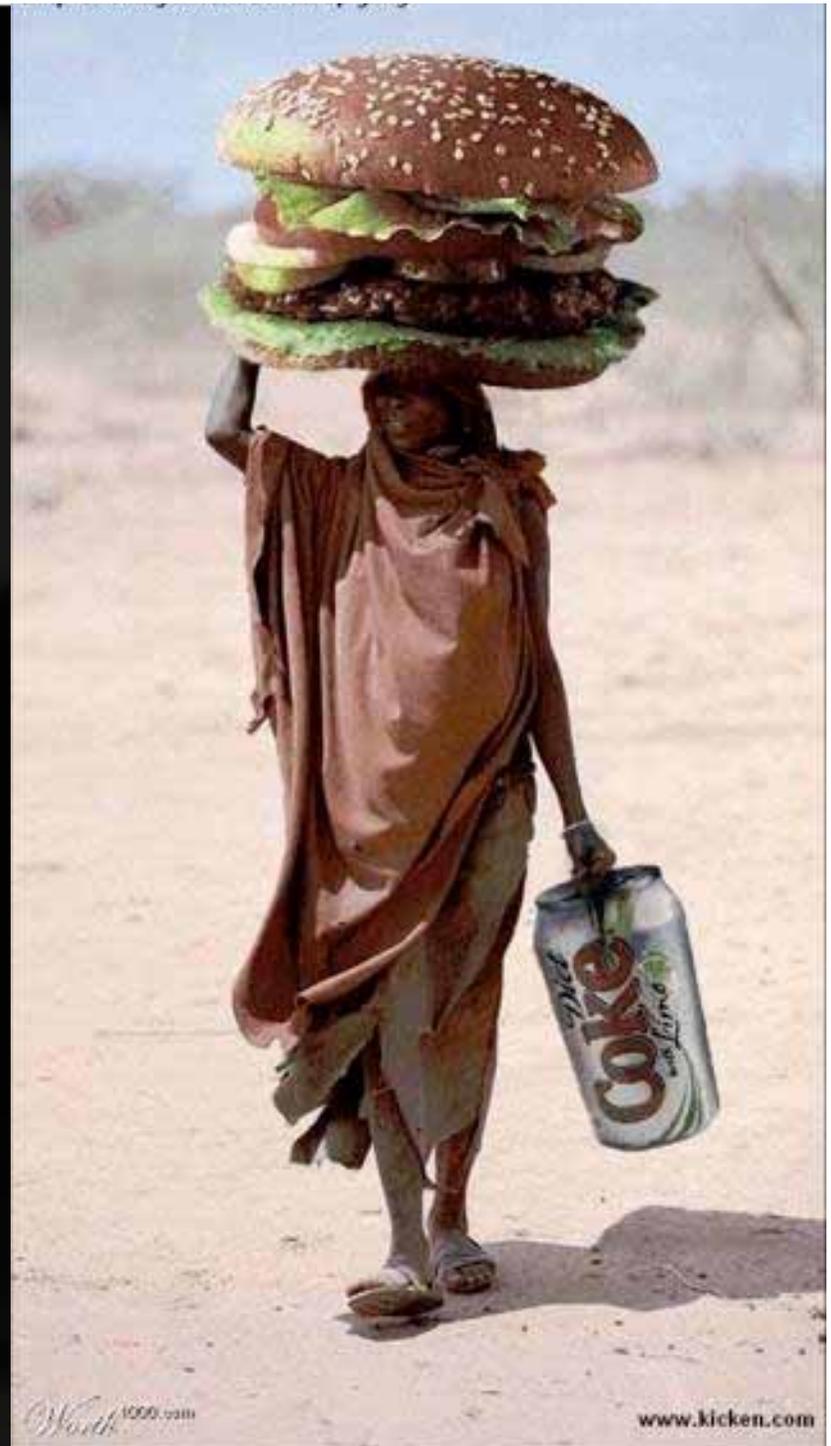




Globalización



7000 especies vegetales se producen para alimentación humana, pero el 50% de nuestros alimentos vienen del trigo, maíz y arroz



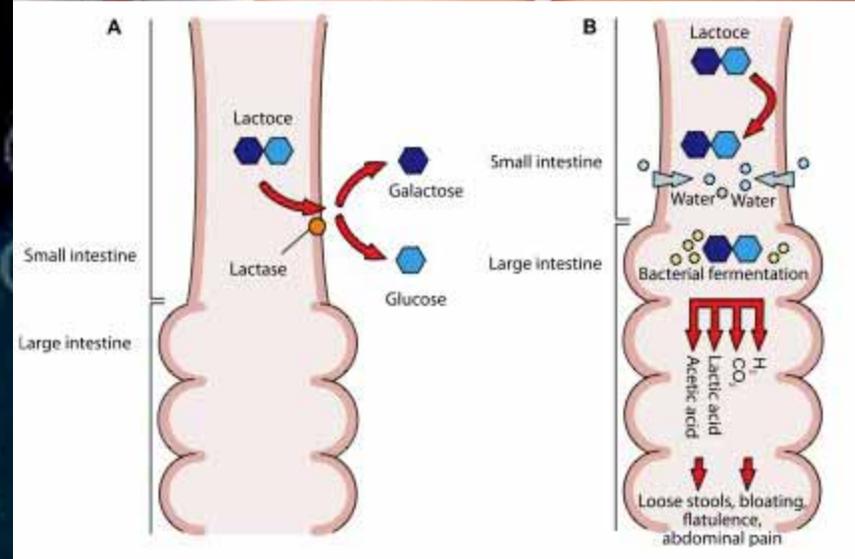
Lactose Tolerance/Intolerance

A. Sufficient Lactase:

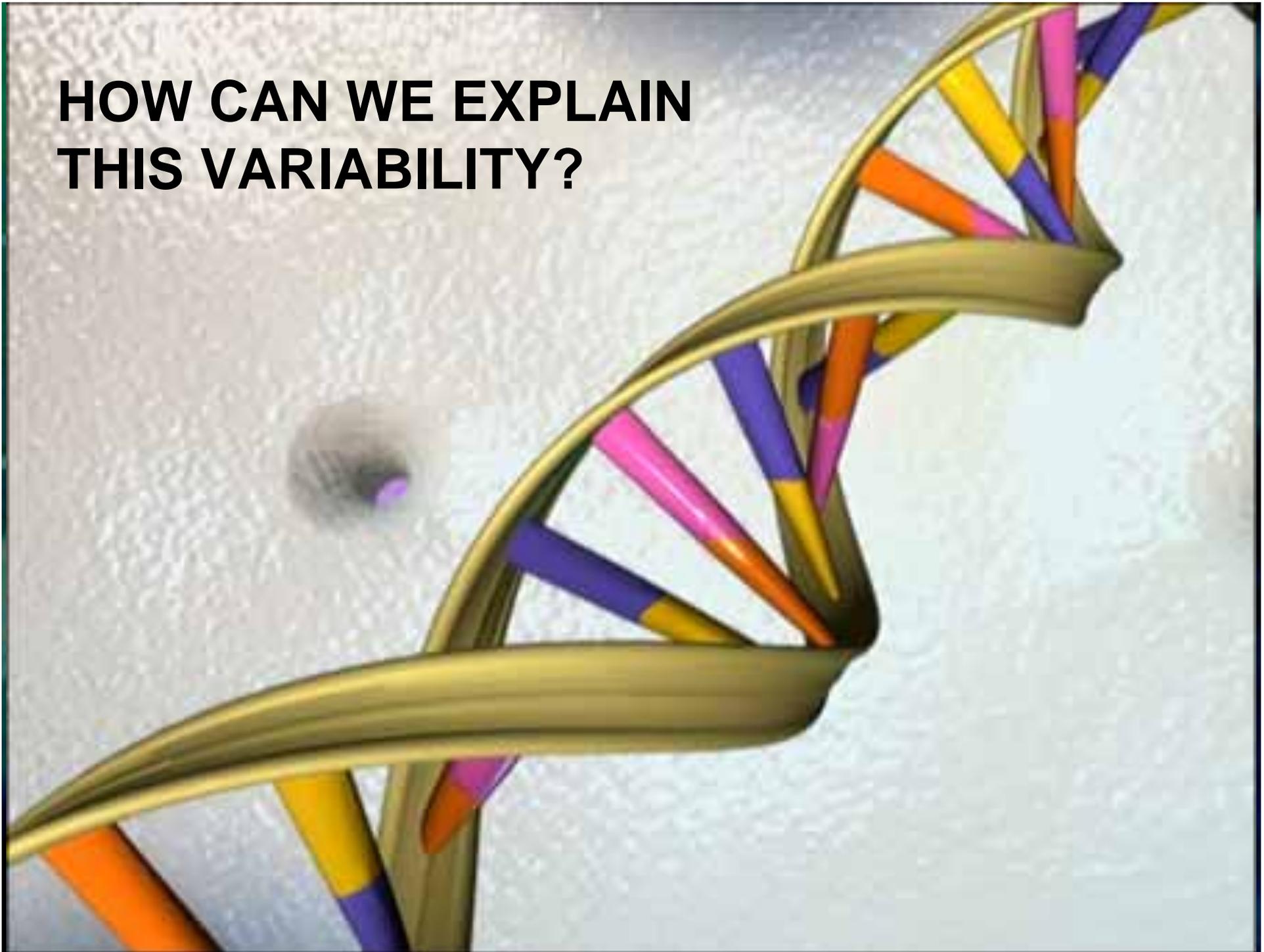
- Lactase degrades lactose.
- No symptoms of lactose intolerance.

B. Absent or insufficient lactase:

- Unabsorbed lactose in the large intestine
- lactose intolerance symptoms
 - Loose stools
 - Bloating
 - Flatulence
 - Abdominal pain

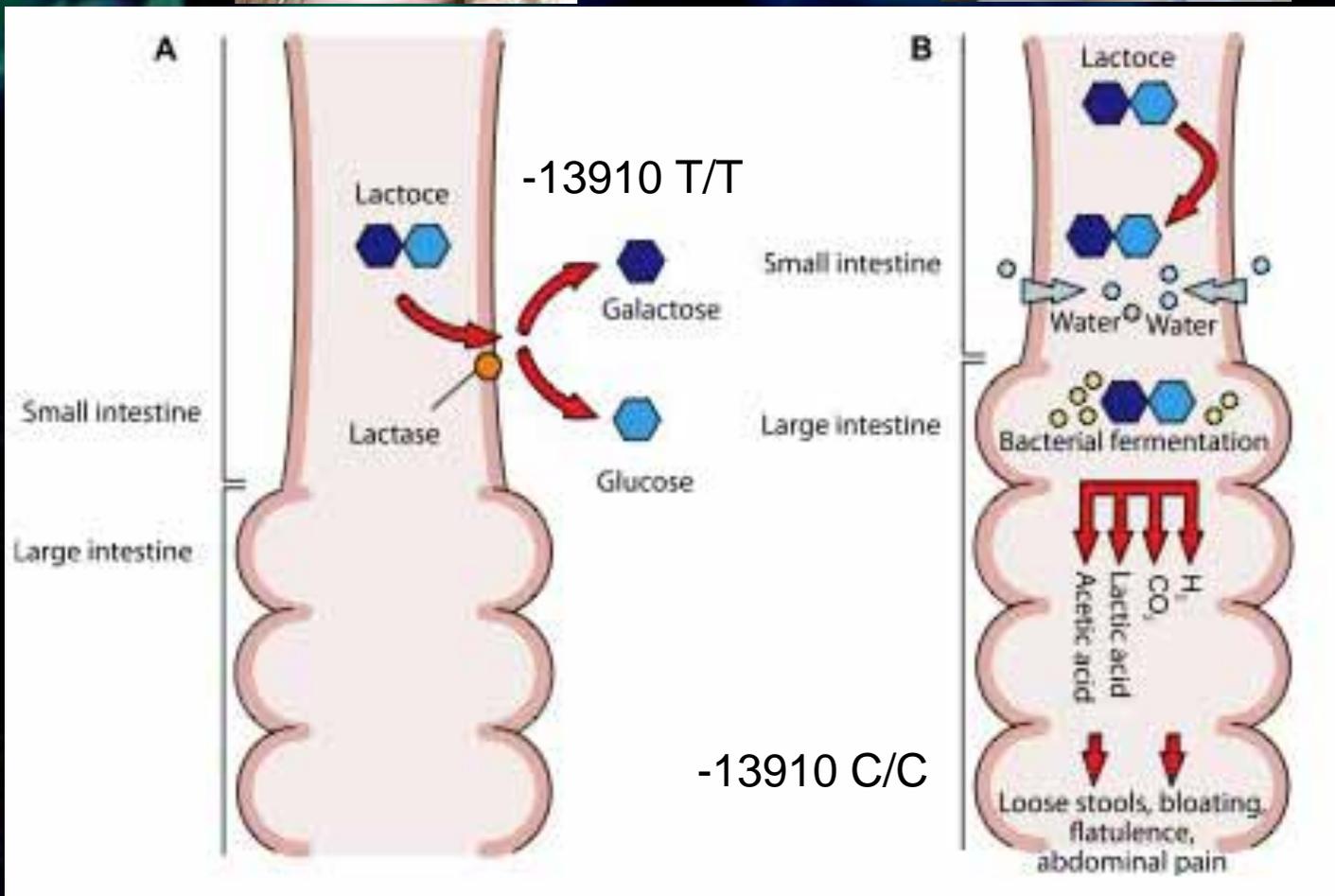


**HOW CAN WE EXPLAIN
THIS VARIABILITY?**



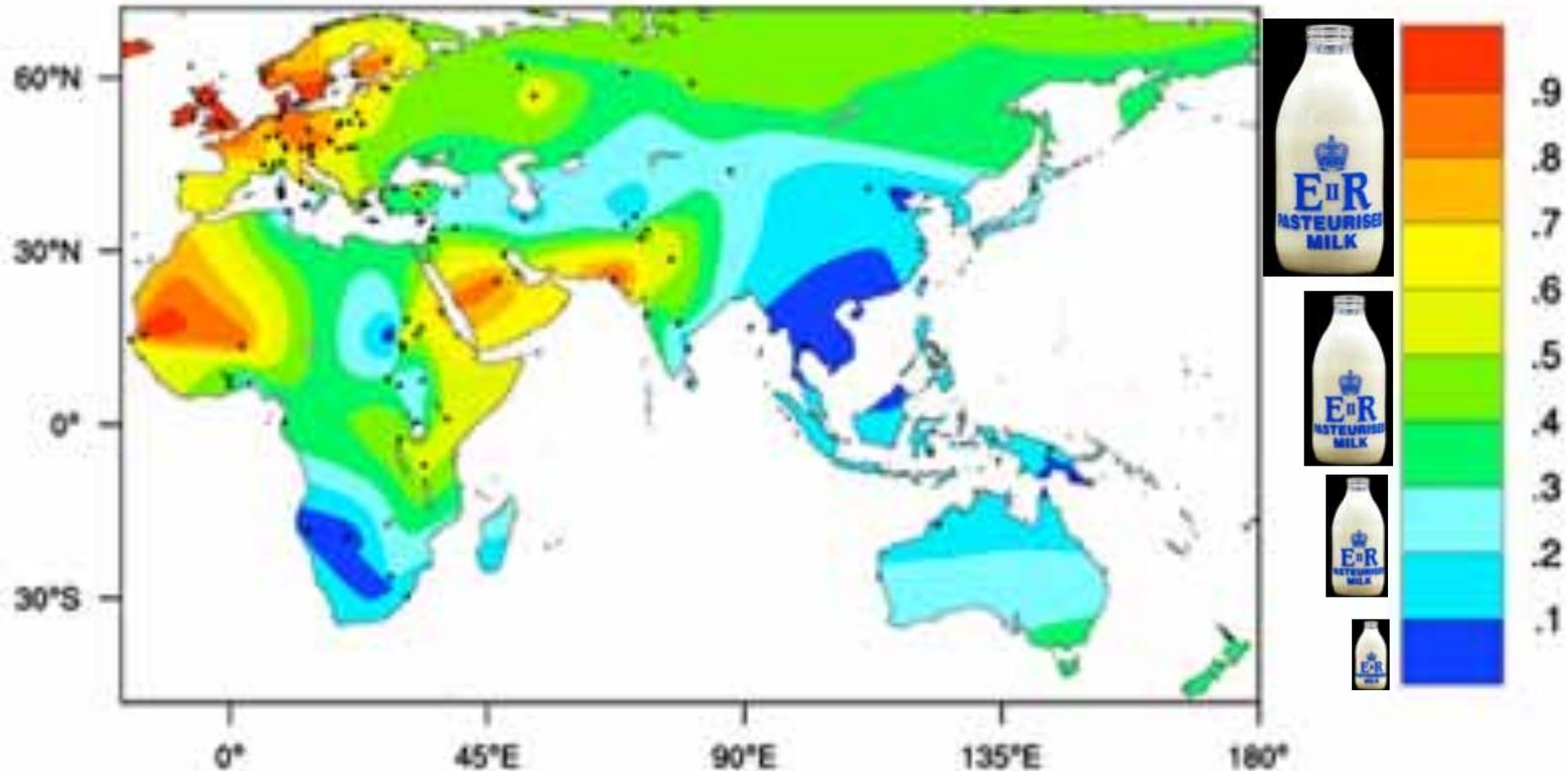


“Simple” Nutrigenomics



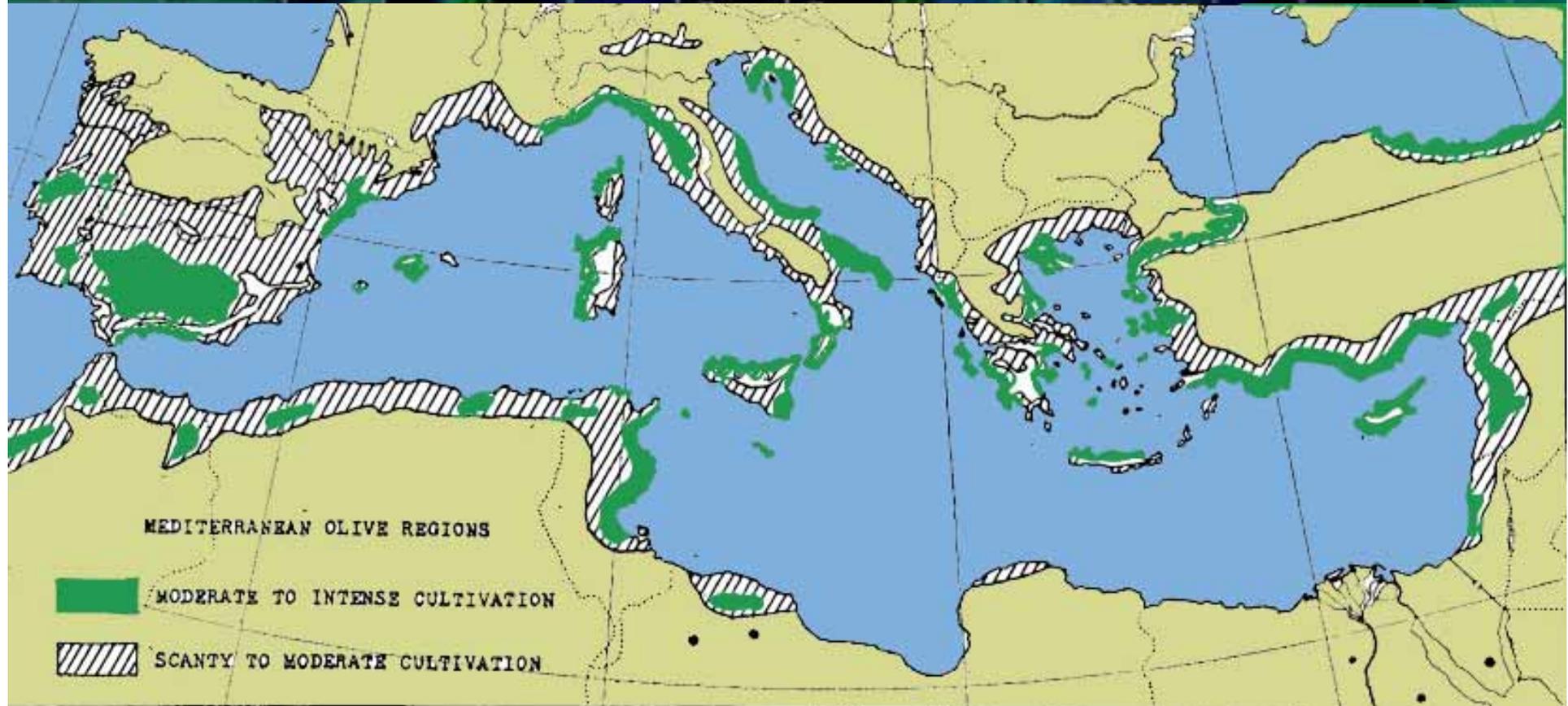
One Size Doesn't Fit All

World Map Lactase Persistence



Geographic distribution of lactase persistence matches distribution of dairy farming

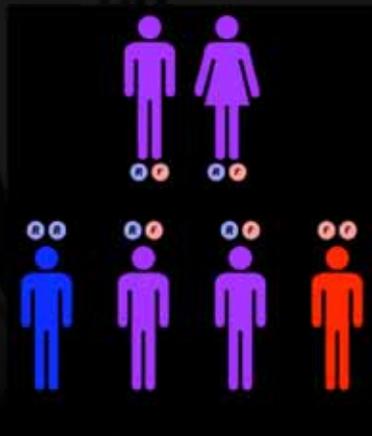
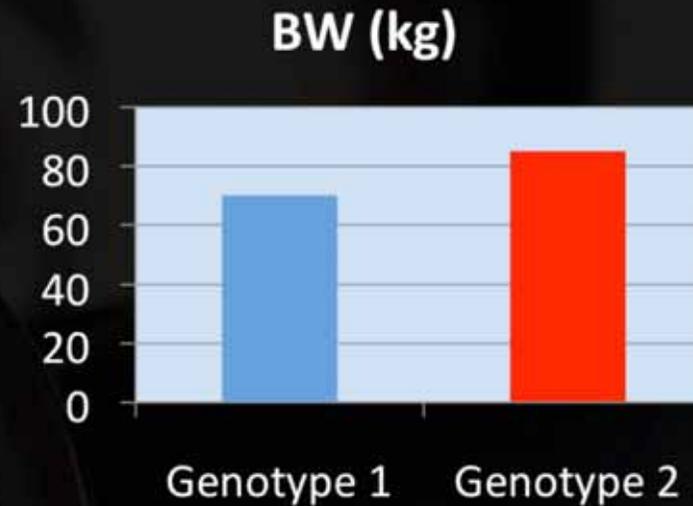
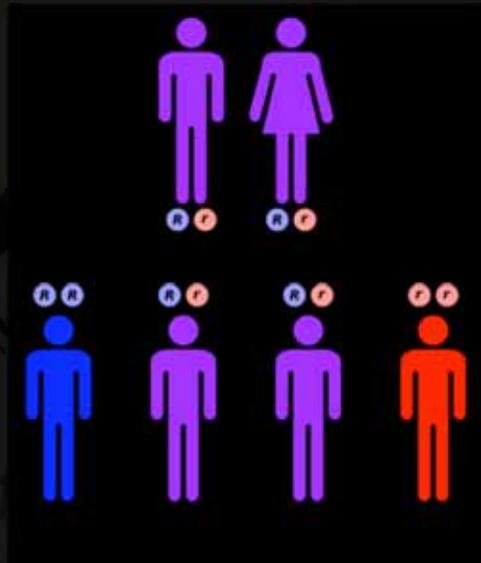
Mediterranean Olive Oil Production (99% World Production)



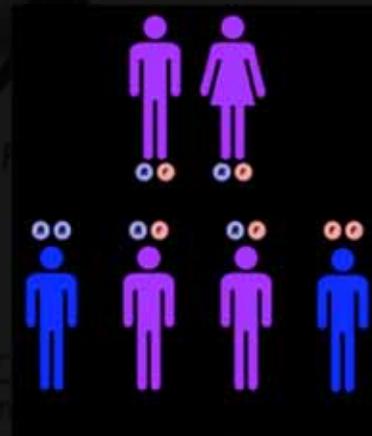
Is There an Olive Oil Preference Gene(s)?



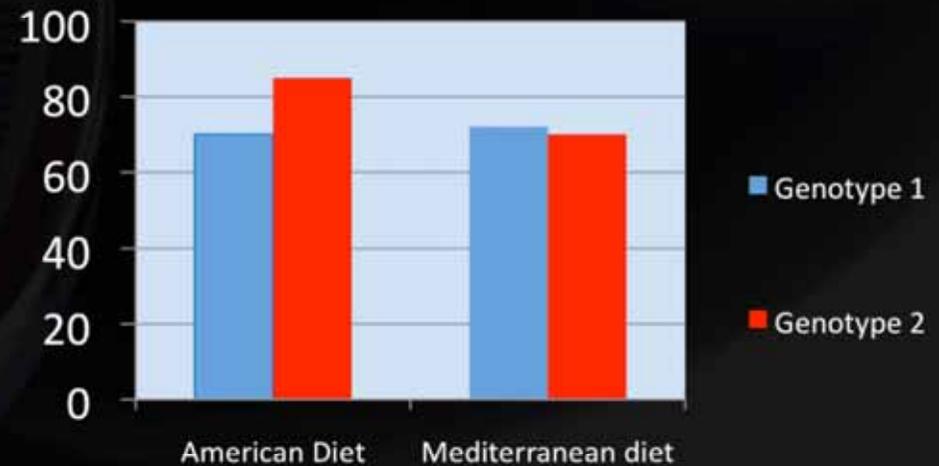
Ejemplo Interaccion Gen-Dieta: Nutrigenomica en Accion



American Diet



Mediterranean Diet

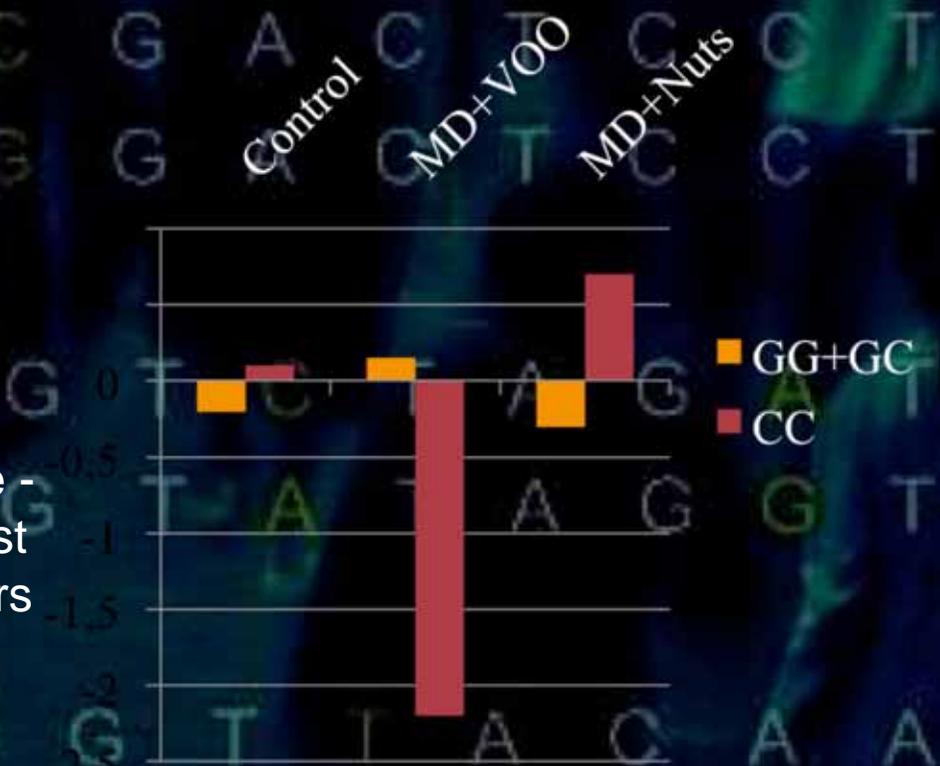


A Mediterranean diet rich in virgin olive oil may reverse the effects of the -174G/C IL6 gene variant on 3-year body weight change

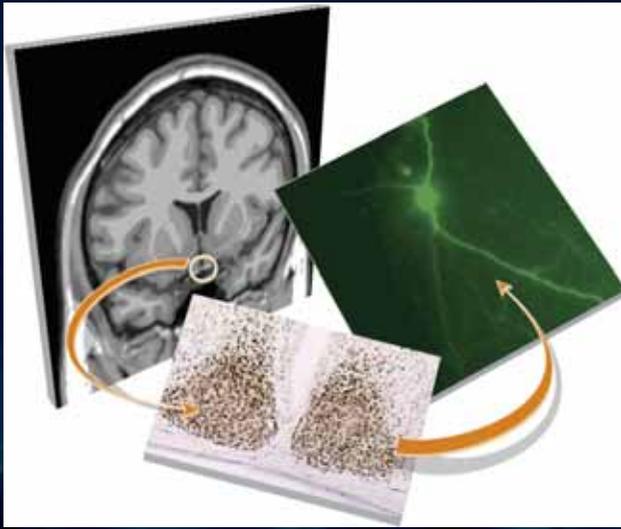
Baseline characteristics according to the genotype for the IL6 SNPS

	GG+GC (n=622)	CC (n=115)
Sex (%FEM)	55	54
Age	67.7	68.3
Weight (kg)	74.6	77.2
BMI (kg/m ²)	29.1	29.8

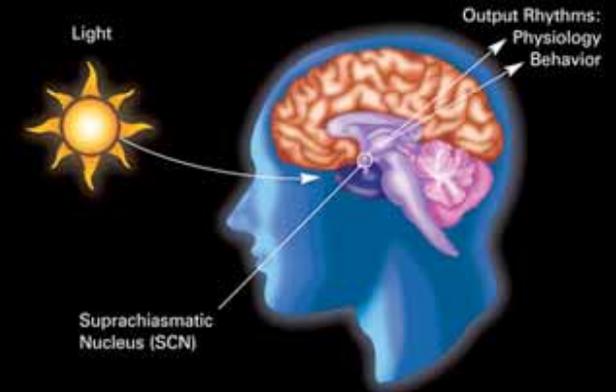
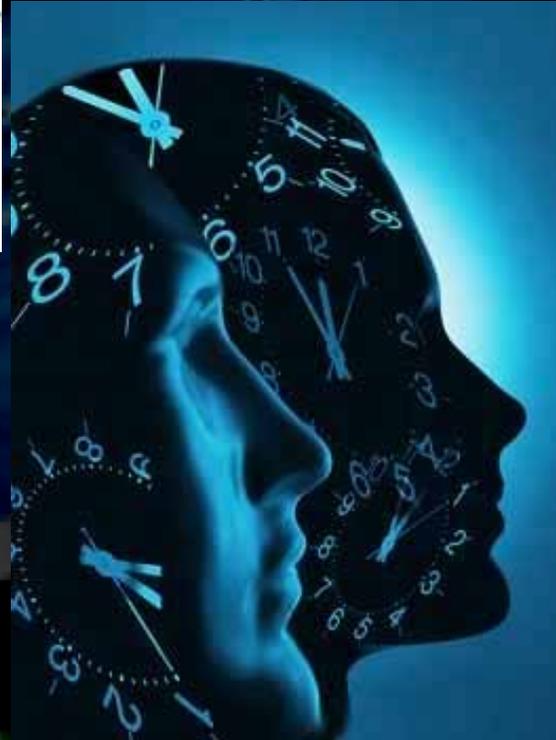
Mean Body changes according to IL6 genotype and diet



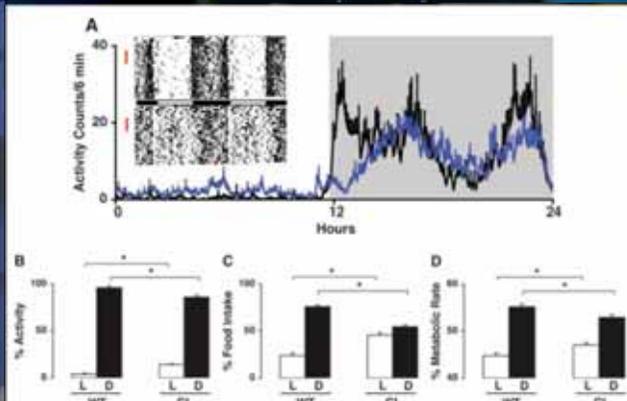
Conclusion: at baseline, CC subjects for the -174G/C polymorphism of IL6 had the highest body weight and BMI. However, after 3 years of nutritional intervention with MD+VOO, these subjects were predicted to have the greatest reduction in body weight.



The primary circadian "clock" in mammals is located in the suprachiasmatic nucleus (or nuclei) (SCN), a pair of distinct groups of cells located in the hypothalamus.

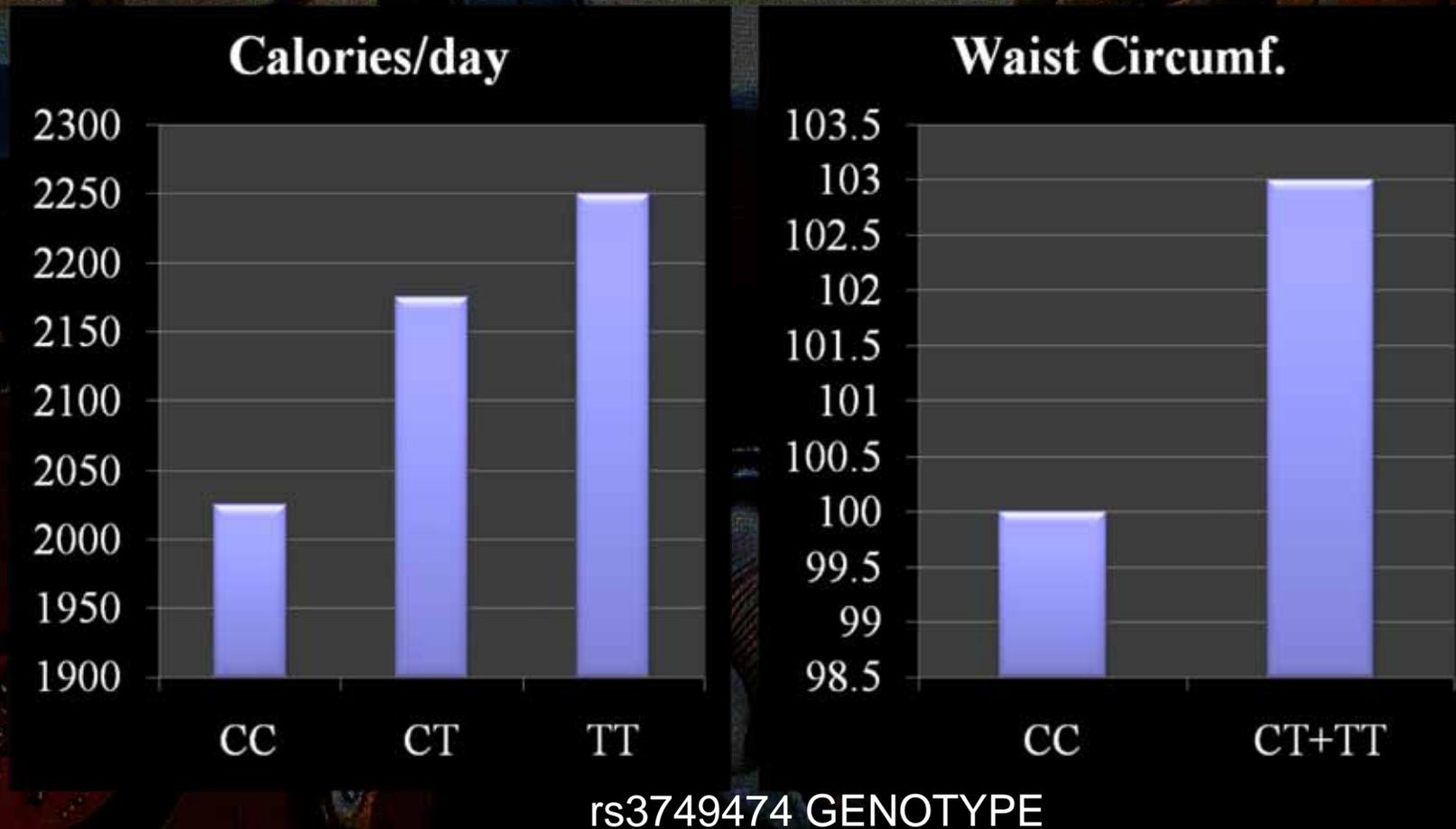


The SCN receives information about illumination through the eyes. The retina of the eye contains "classical" photoreceptors ("rods" and "cones"), which are used for conventional vision. But the retina also contains specialized ganglion cells which are directly photosensitive, and project directly to the SCN where they help in the entrainment of this master circadian clock.



Destruction of the SCN results in the complete absence of a regular sleep-wake rhythm.

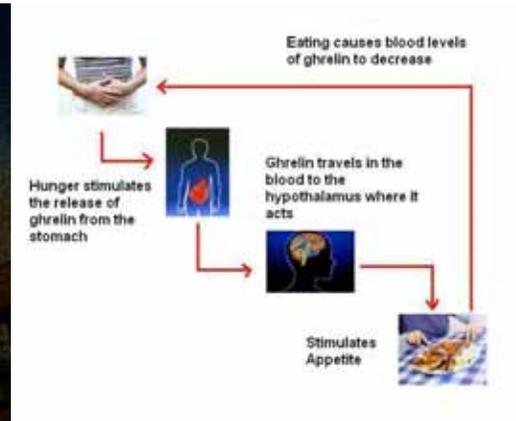
Associations between CLOCK SNPs (rs3749474) and dietary intake and obesity parameters.



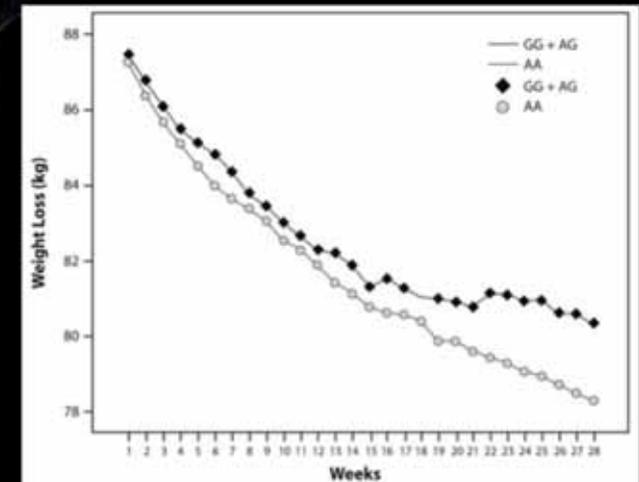
Garaulet M, et al. CLOCK gene is implicated in weight reduction in obese patients participating in a dietary programme based on the Mediterranean diet. *Int J Obes.* 2010;34:516-23.



More on Clock rs1801260



- Population: 1495 overweight/obese subjects (BMI: 25-40 kg/m²) of 20–65 y attending outpatient obesity clinics.
- Results: Significant association between the CLOCK 311T/C SNP and weight loss, which was particularly evident after 12-14 weeks of treatment.
- Carriers of the minor C allele were more resistant to weight loss than TT individuals.
- Minor C allele carriers had:
 - shorter sleep duration
 - higher plasma ghrelin concentrations
 - delayed breakfast time
 - evening preference
 - less compliance with a Mediterranean Diet pattern



Garaulet M, et al. Int J Obes. 2010;34:516-23.



Consulta Inicial

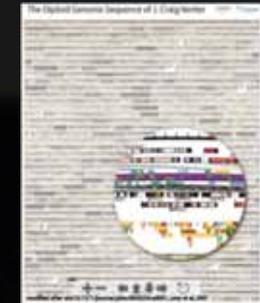


Toma de muestra



Aislamiento ADN

El Futuro de la Prevencion Personalizada



Analisis ADN

Consultas Actualizacion



Entrega resultados



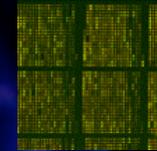
Consulta resultados y recomendaciones



Analisis Bioinformatico

Take Home Messages

- Genomic-based tests will allow early risk detection for CVD and other age-related diseases.
- For those at low genetic risk, the nutritional advice should include a dietary pattern consistent with local traditions.
- For those at high genetic risk, a more targeted (personalized), nutrigenomic/pharmacogenomic approach could be used to quench most of the genetic predisposition.
- Whereas the technology and scientific knowledge needed to achieve these goals is moving rather quickly, we still need to generate a new generation of health professionals able to translate and deliver this information to the population
- We need to Identify points of convergence of the government and academics research with pharma, diagnostic and food and drinks markets which may offer new opportunities for co development and translation and to avoid the “snake oil” syndrome.



TUFTS

HNRCA

Healthy Aging

THROUGH NUTRITION RESEARCH



JEAN MAYER USDA HUMAN NUTRITION
RESEARCH CENTER ON AGING

<http://hnrc.tufts.edu>

Thanks for your attention!