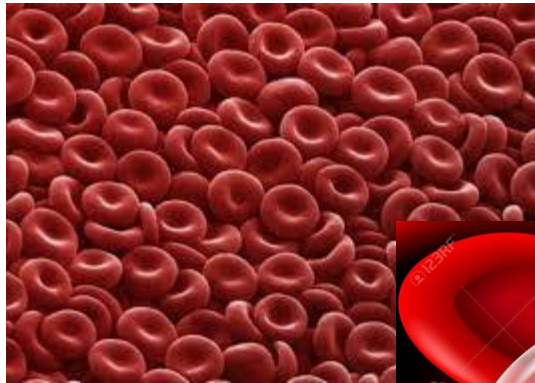




# GENERAL BIOLOGY CURS1

# HUMAN COMPLEXITY



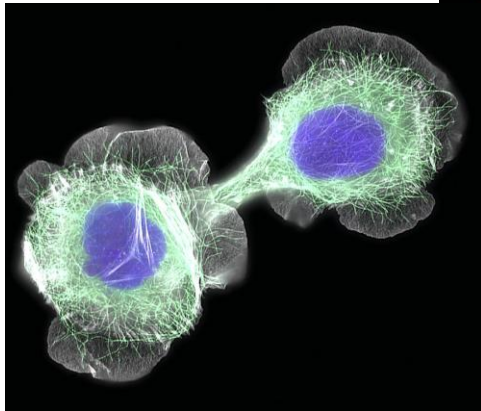
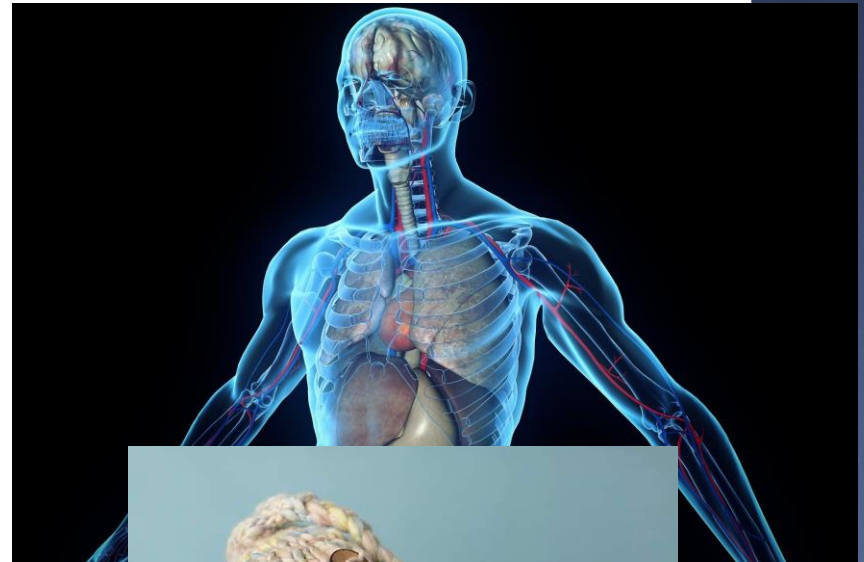
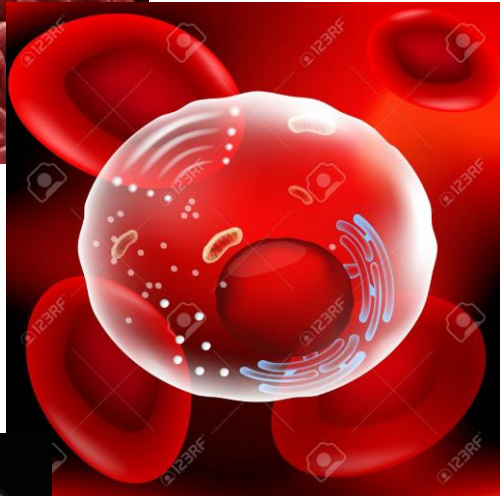
**cancer**

**atherosclerosis**

**diabetes**

**antibiotic resistance**

**aging**



**allergies**



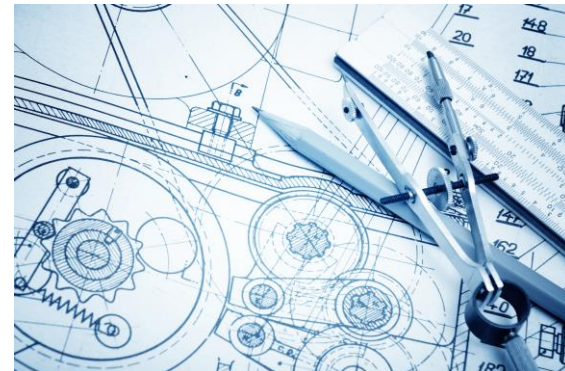
**coronary disease**



Mechanical part



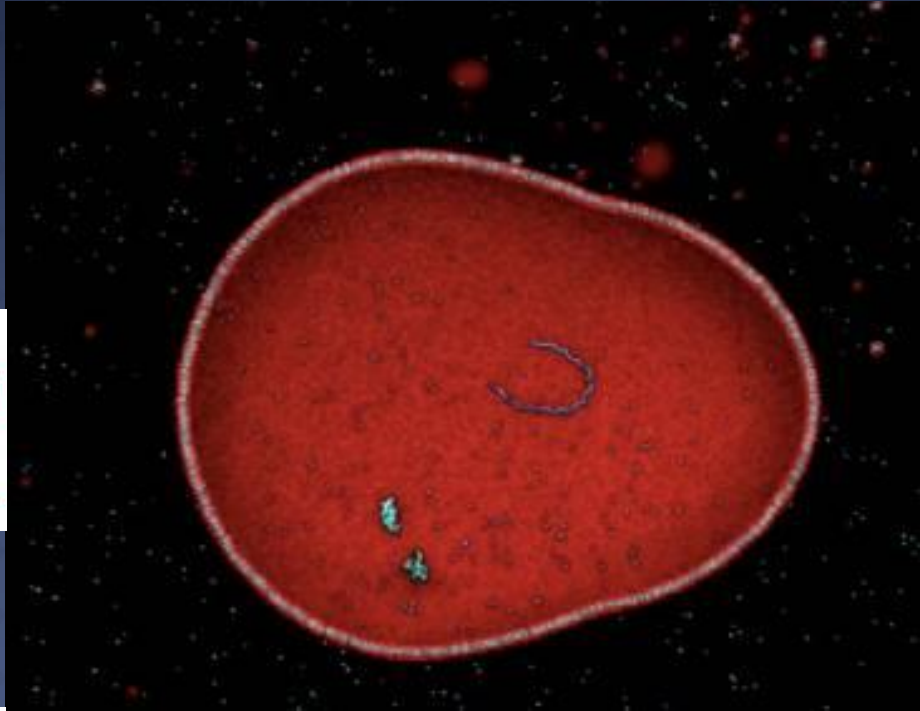
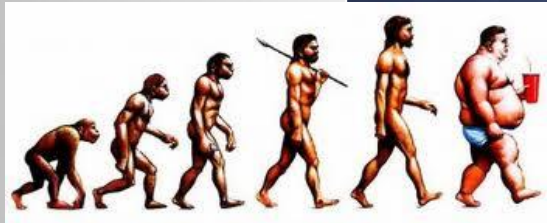
Engineering



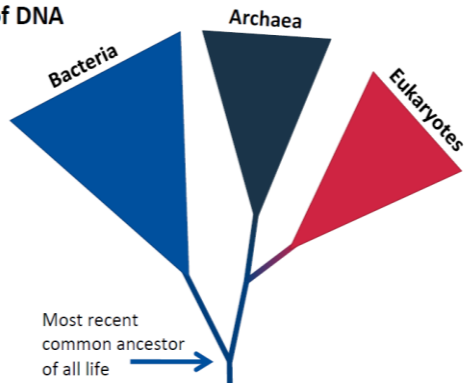


# ORIGIN

# OF LIFE

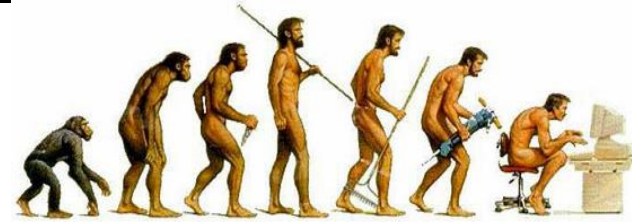


Evolutionary continuity of DNA

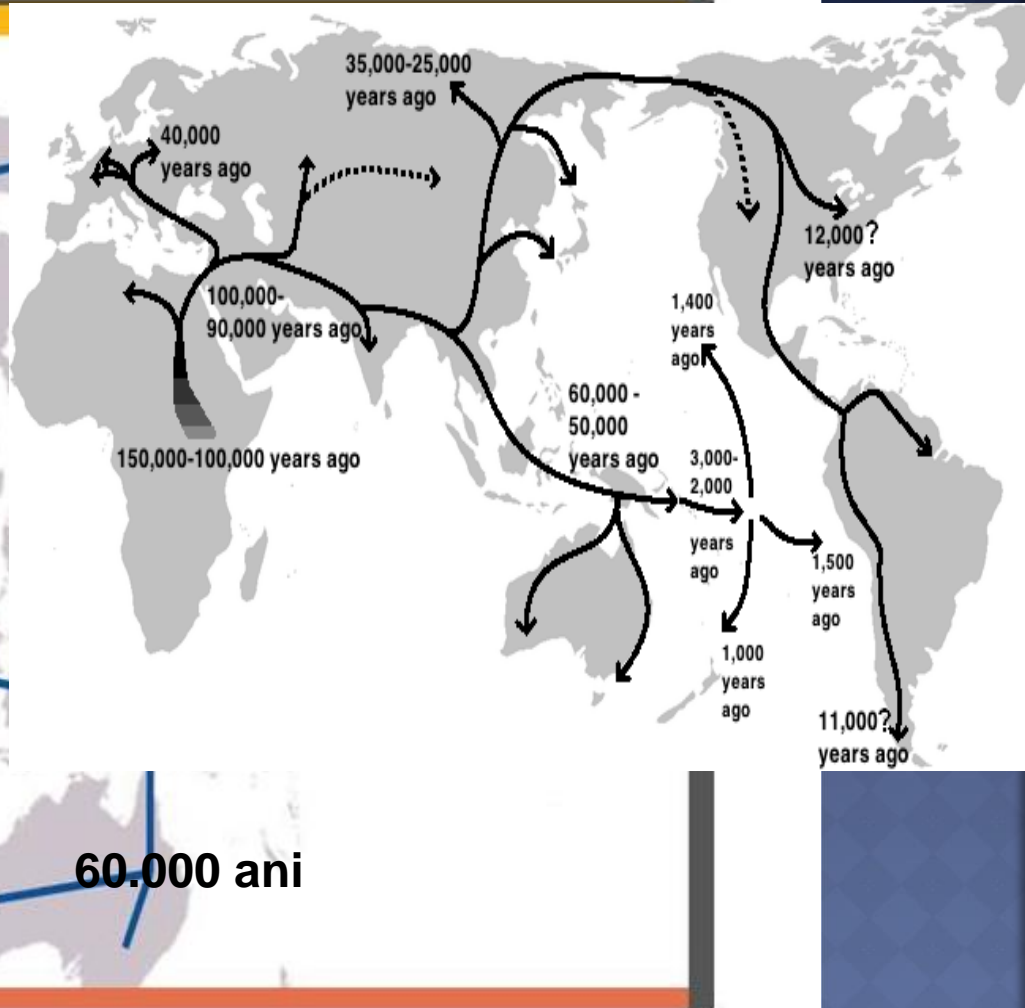
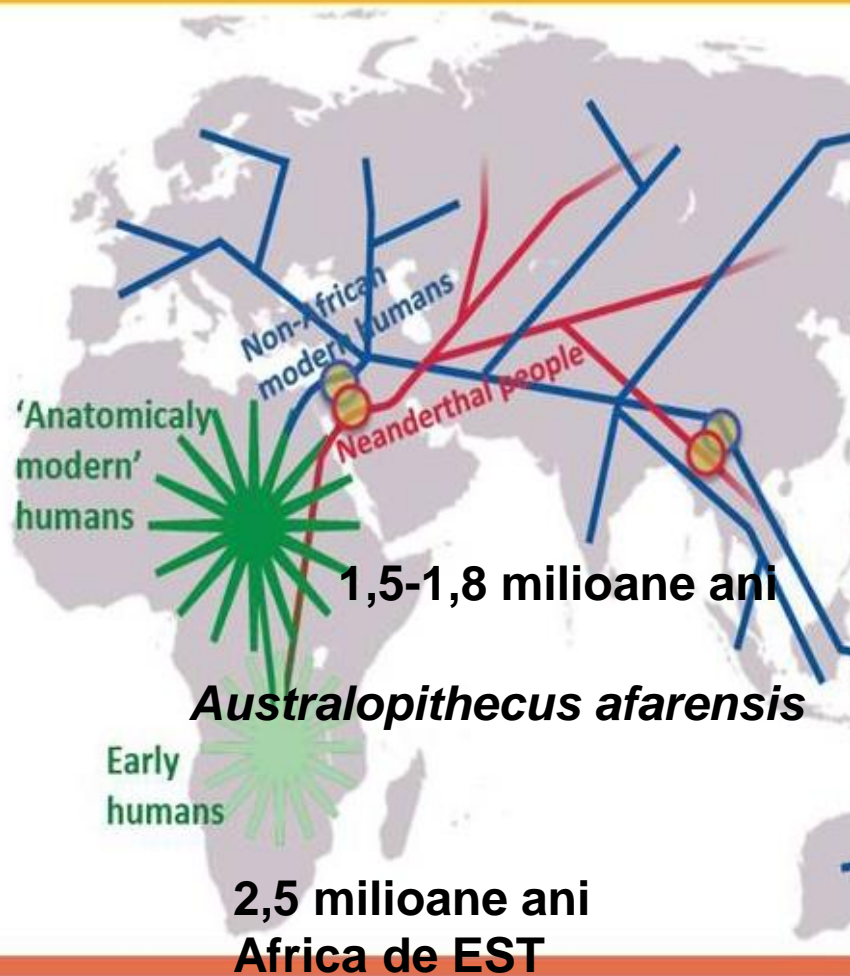


# EVOLUTION AND THE ORIGIN OF DISEASE

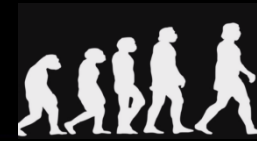
# Sapiens



# ORIGINEA OAMENILOR PE PAMANT?



# Hominid evolution



C.R.D. (1809-1882)

7.0 mya 6.0 5.0 4.0 3.0 2.0 1.0 0.0

## Representative genera

- *Sahelanthropus*
- *Orrorin*
- *Ardipithecus*
- *Australopithecus/Paranthropus*
- *Kenyanthropus*
- *Homo*
- Chimpanzee-human last common ancestor

CH-LCA ?

*S. tchadensis**Ar. kadabba**O. tugenensis**Au. anamensis**Ar. ramidus**K. platyops**Au. afarensis*

500 cc

*P. aethiopicus**H. habilis*

650 cc

*Au. sediba**Au. garhi**Au. africanus**P. robustus**P. boisei**H. ergaster**H. neanderthalensis**H. heidelbergensis**H. sapiens**H. erectus**H. floresiensis*

1300 cc

1200-1600 cc

900 cc

◀ Miocene

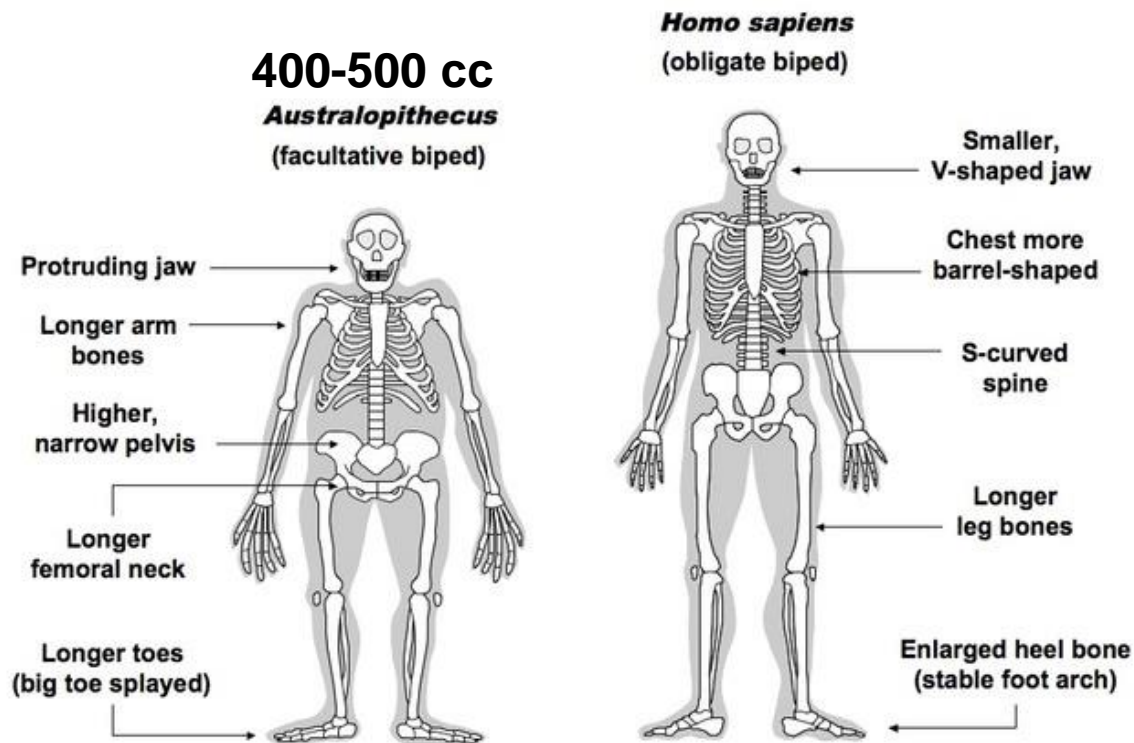
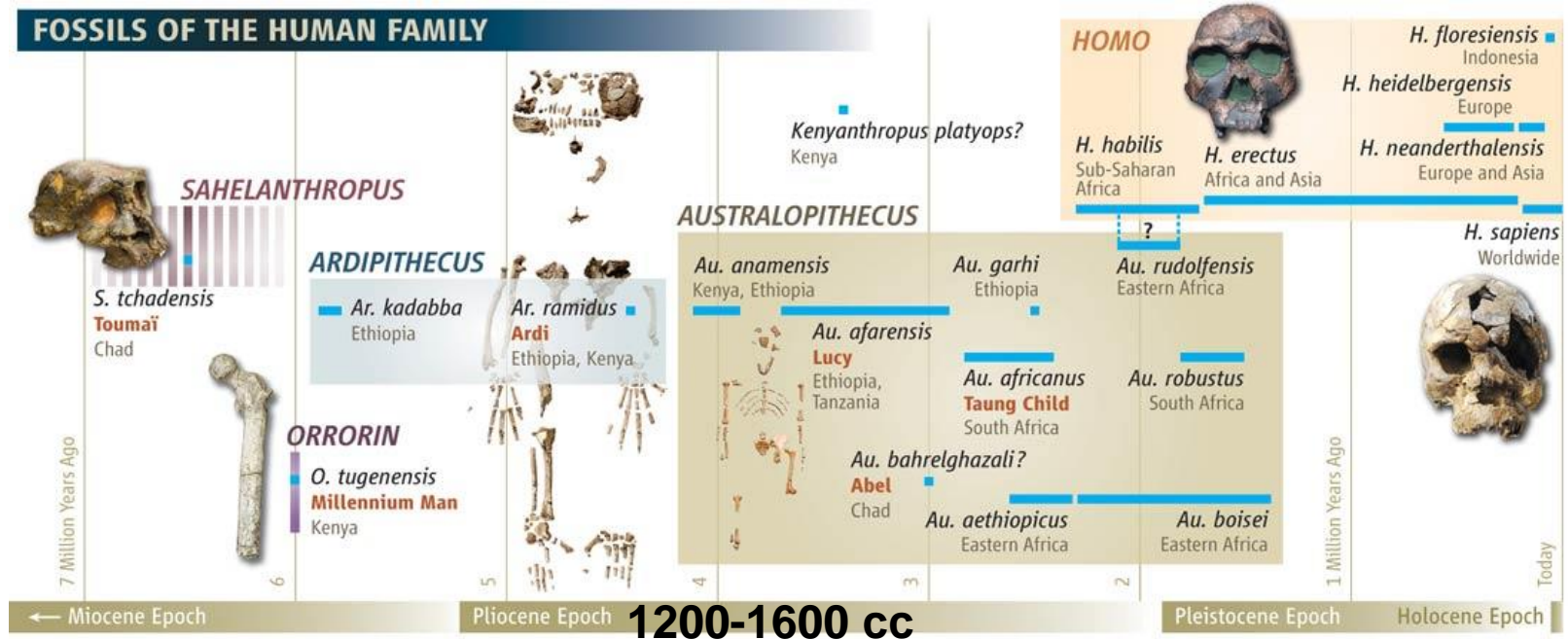
Pliocene

Pleistocene

Holocene ▶



# FOSSILS OF THE HUMAN FAMILY

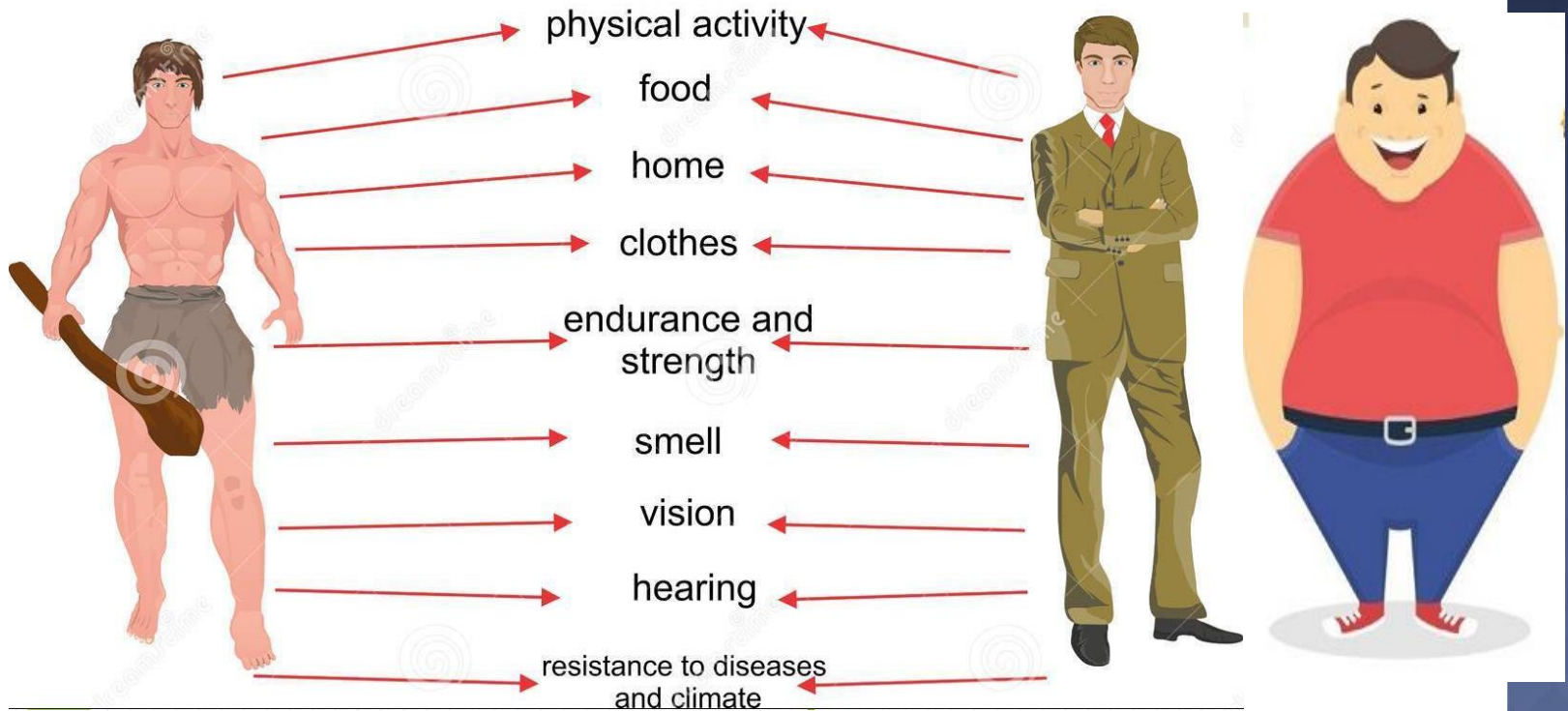


<http://www.berkeley.edu/news/media/releases/2009/10/images/ardi-timelineHR.jpg>



# WHAT HAS CHANGED?





# 10 Diseases Caused by Evolutionary Mismatches

*These diseases were once rare, but are today highly prevalent. You can lower your risk of developing these and many other mismatch diseases by adhering to a species-appropriate diet and lifestyle*

**www.Darwinian-Medicine.com**

## **Myopia**

**Common causes:** Too much near work, chronic inflammation, imprudent, highly insulinogenic diet, inadequate outdoor activity

## **Asthma**

**Common causes:** Chronic inflammation, dysbiosis, immune dysregulation, air pollution, indoor allergens

## **Non-alcoholic fatty liver disease**

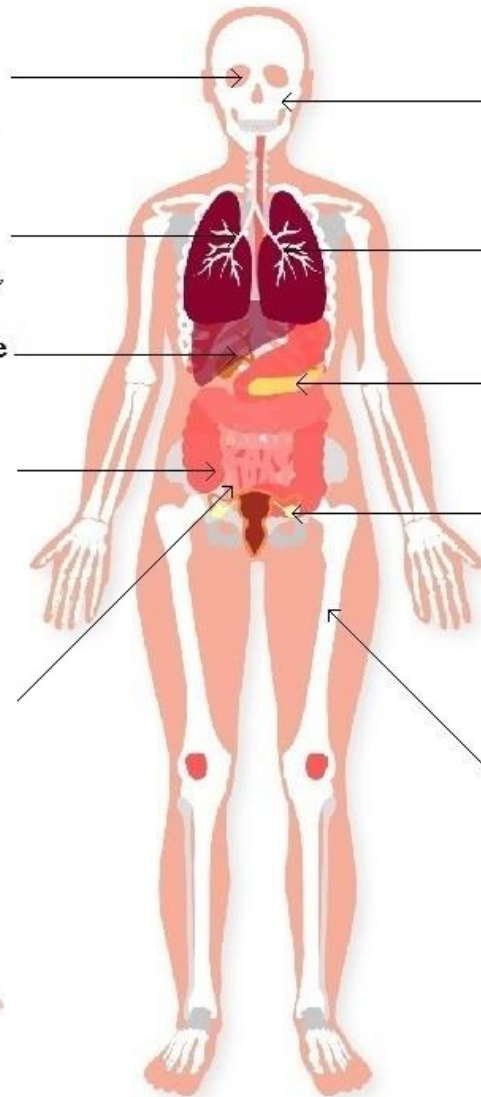
**Common causes:** The metabolic syndrome, obesity, imprudent, calorie-dense diet, inadequate physical activity

## **Inflammatory bowel disease**

**Common causes:** Inflammation, severe gut dysbiosis, imprudent diet

## **Colon cancer**

**Common causes:** Colonic dysbiosis, imprudent, low-fiber diet



## **Acne vulgaris**

**Common causes:** Dysbiosis of the skin and gut, chronic inflammation, imprudent, refined diet

## **Chronic obstructive pulmonary disease**

**Common causes:** Inflammation, smoking, lung dysbiosis, pollution, various airborne chemicals

## **Type-1 diabetes**

**Common causes:** Gut dysbiosis, immune dysregulation, chronic inflammation

## **Ovarian cancer**

**Common causes:** High number of menstrual cycles, inflammation, obesity, hormonal dysregulation

## **Osteoporosis**

**Common causes:** Inadequate physical activity (in particular weight-bearing activities), unhealthy diet, inadequate sun exposure



# The Etiology, Prevention, and Treatment of the Diseases of Civilization

A Darwinian Conceptual Framework

*www.Darwinian-Medicine.com*



2.6 million years ago  
Start of the Paleolithic era

12,000 years ago  
The Agricultural Revolution

250 years ago  
The Industrial Revolution

Present time

**Environments of evolutionary adaptedness**

**Genome-environment mismatch**

## Living conditions

Natural environment

Small mobile, isolated communities

## Life style

-Regular physical activities

-occasional bouts of acute stress

-Plenty of sun exposure

-Sleep patterns synchronized with natural fluctuations  
in light and dark

# The Etiology, Prevention, and Treatment of the Diseases of Civilization

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Present time

## The Environments of Evolutionary Adaptedness (EEA)

### Living conditions

- Natural environment
- Small, mobile, and isolated communities

### Lifestyle

- Regular physical activity
- Occasional bouts of acute stress
- Plenty of sun exposure
- Sleep patterns synchronized with the natural fluctuations in light and dark

### Diet

- Meat, seafood, eggs, nuts, vegetables, and fruit
- Exclusively composed of wild plants and animals
- Nutrient dense
- Low in antinutrients
- High in protein, omega-3, and fiber
- Low in sugar, omega-6, and saturated fat

### Health/physical fitness

- Low incidence of chronic diseases (e.g., heart disease, cancer, diabetes, osteoporosis)
- Low incidence of malocclusion, myopia, and musculoskeletal disorders
- Low incidence of infectious disease
- Good general health
- Good cardiorespiratory fitness

### Longevity

- Low average life expectancy, due in part to high infant mortality
- Modal (most common) age of adult death may have been approx. 70

### Phenotype

- Lean
- Moderately muscular
- Broad shoulders
- Tall
- Wide, well-developed jaws and faces

## Genome-environment mismatch

### Living conditions

- ↑ Population density
- ↑ Pathogens
- ↓ Microbial old friends
- ↓ Mobility

### Lifestyle

- ↓ Aerobic exercise
- ↓ Sun exposure

### Diet

- ↑ Famine
- ↑ Cereal grains and dairy
- ↑ Starch, alcohol, sugar, omega-6, and saturated fat
- ↑ Antinutrients
- ↓ Nutrient density
- ↓ Diet diversity
- ↓ Protein, omega-3, and fiber

### Health/physical fitness

- ↑ Chronic, lifestyle-related diseases
- ↑ Infectious disease
- ↑ Bone-related disorders (e.g., malocclusion, osteoporosis)
- ↑ Oral health problems (e.g., tooth decay)
- ↓ Cardiorespiratory fitness
- ↓ General health

### Longevity

- ↓ Average life expectancy (at least initially), in part due to an increased infectious disease burden

### Phenotype

- ↓ Facial development
- ↓ Height

## Genome-environment mismatch

### Living conditions

- ↑ Social isolation
- ↑ Microbes associated with the built environment
- ↑ Pollutants and harmful chemicals
- ↑ Artificial lighting
- ↑ Technology
- ↓ Microbial old friends
- ↓ Natural biodiversity

### Lifestyle

- ↑ Chronic stress
- ↑ Drugs
- ↓ Sleep duration and quality
- ↓ Physical activity
- ↓ Sun exposure

### Diet

- ↑ Processed food
- ↑ Sugar, salt, trans-fat, saturated fat, starch, omega-6, and fructose
- ↑ Energy density
- ↓ Nutrient density
- ↓ Fiber, omega-3, and protein
- ↓ Fasting

### Health/physical fitness

- ↑ Chronic, lifestyle-related diseases (e.g., cancer, autoimmune conditions, cardiovascular disease)
- ↑ Chronic health problems (e.g., myopia, depression, anxiety, back pain)
- ↑ Chronic inflammation
- ↓ Infectious disease (developed nations)
- ↓ Cardiorespiratory fitness
- ↓ Muscular strength
- ↓ General health

### Longevity

- ↑ Average lifespan (industrialized nations), in part due to modern medicine

### Phenotype

- ↑ Fat mass
- ↑ Anterior pelvic tilt
- ↑ Shoulder protraction
- ↓ Muscle mass
- ↓ Facial development and width
- ↓ Shoulder broadness

# The Human Condition

*From Hunter-Gatherer to Doughnut-Eating Office Worker*

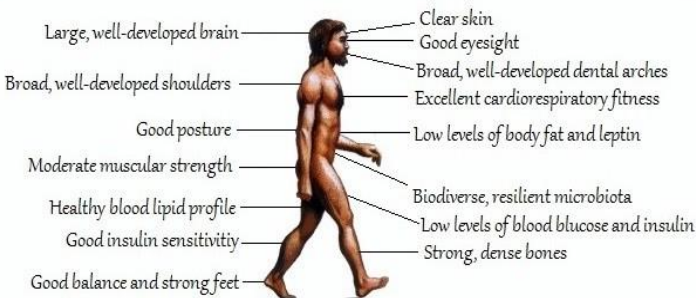
www.Darwinian-Medicine.com

## The Environments of Evolutionary Adaptedness

*Species-appropriate nutrition, regular physical activity, low exposure to pollutants and harmful chemicals, frequent social interactions, adequate sun exposure, adequate sleep, species-appropriate microbial milieu, intermittent bouts of acute stress*

## Modern Environments

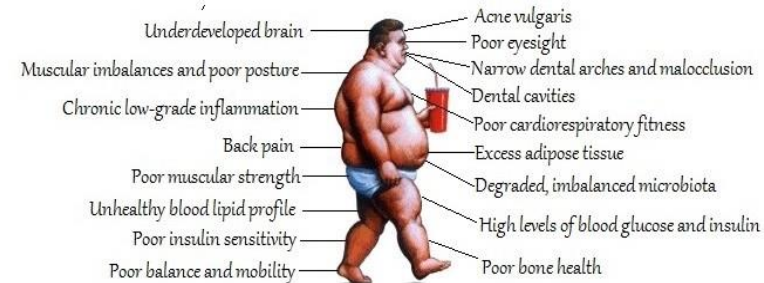
*Species-inappropriate nutrition, inadequate physical activity, high exposure to pollutants and harmful chemicals, social isolation, inadequate sun exposure, disordered and inadequate sleep, species-inappropriate microbial milieu, chronic stress, exposure to artificial light and modern technology*



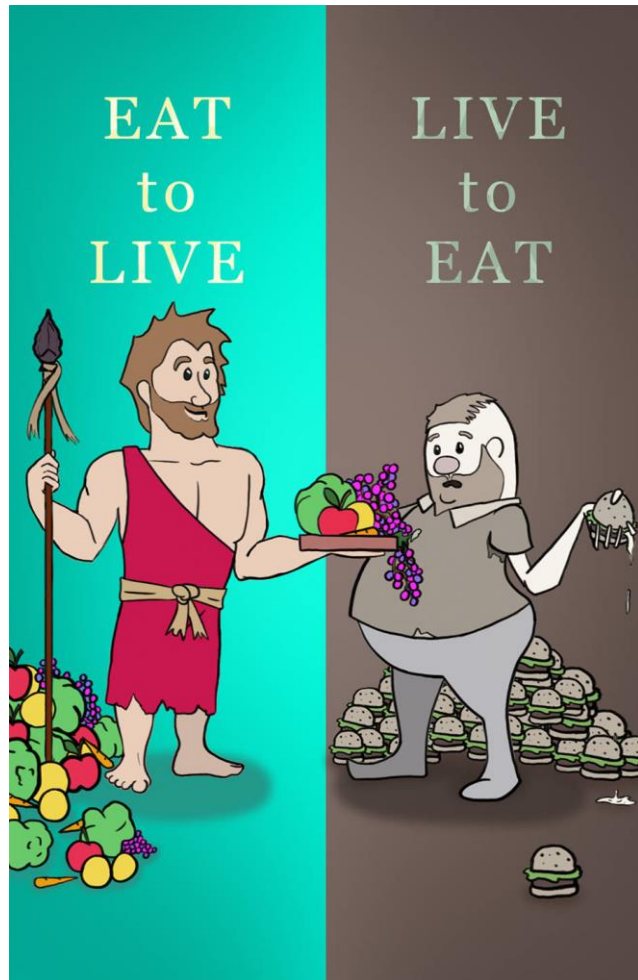
Changes in gene expression caused by rapid and profound environmental changes



Mismatch resolution via Darwinian medicine







# EVOLUTIONARY MEDICINE

