

# Meat in Human Nutrition

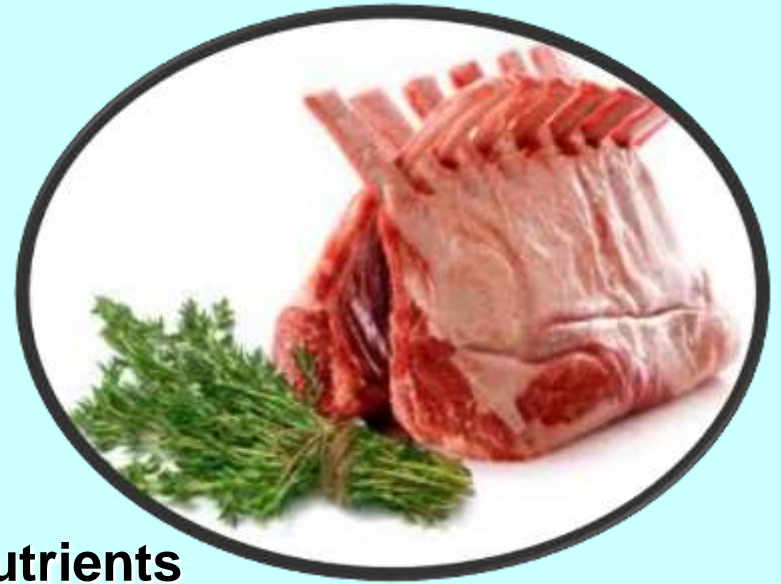
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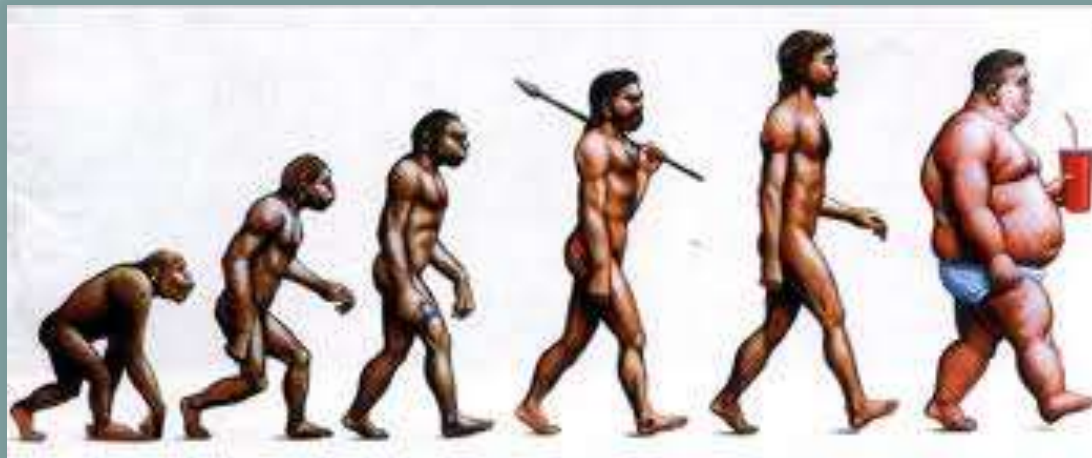
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# The EVOLUTION and NUTRITION

**scientific (materialistic) explanation**



Some (wrong?) imaginations

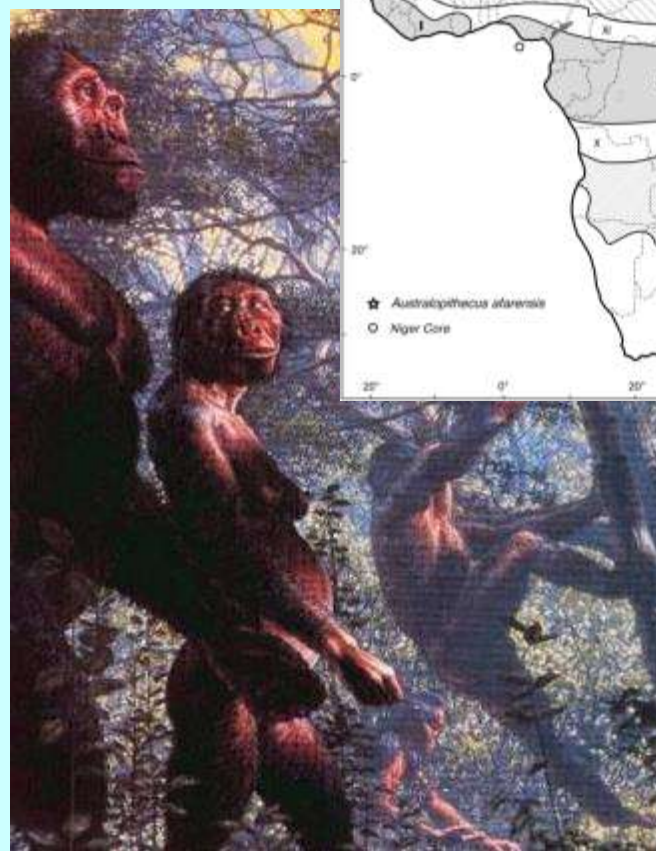
# Meat in our diet: the important evolution factor

Prior to 3.5 million years, *Australopithecus afarensis* looked for food in the African forest. 3 questions:

- I. why humans began **anatomically differ from other primates** - what happened (the **first break** in the evolution)?
- II. why humans have **greater brain** (the **second break** in the evolution)?
- III. why a man **moved** (the **third break** in the evolution)?

Explanation - hypothesis by (Leonard, 2002):

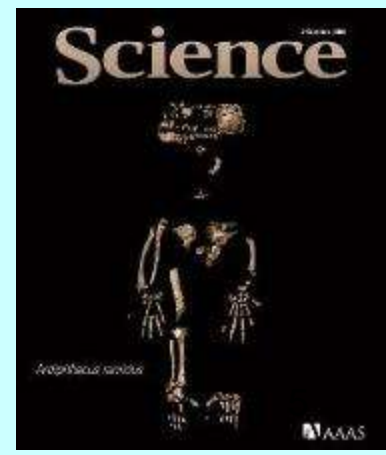
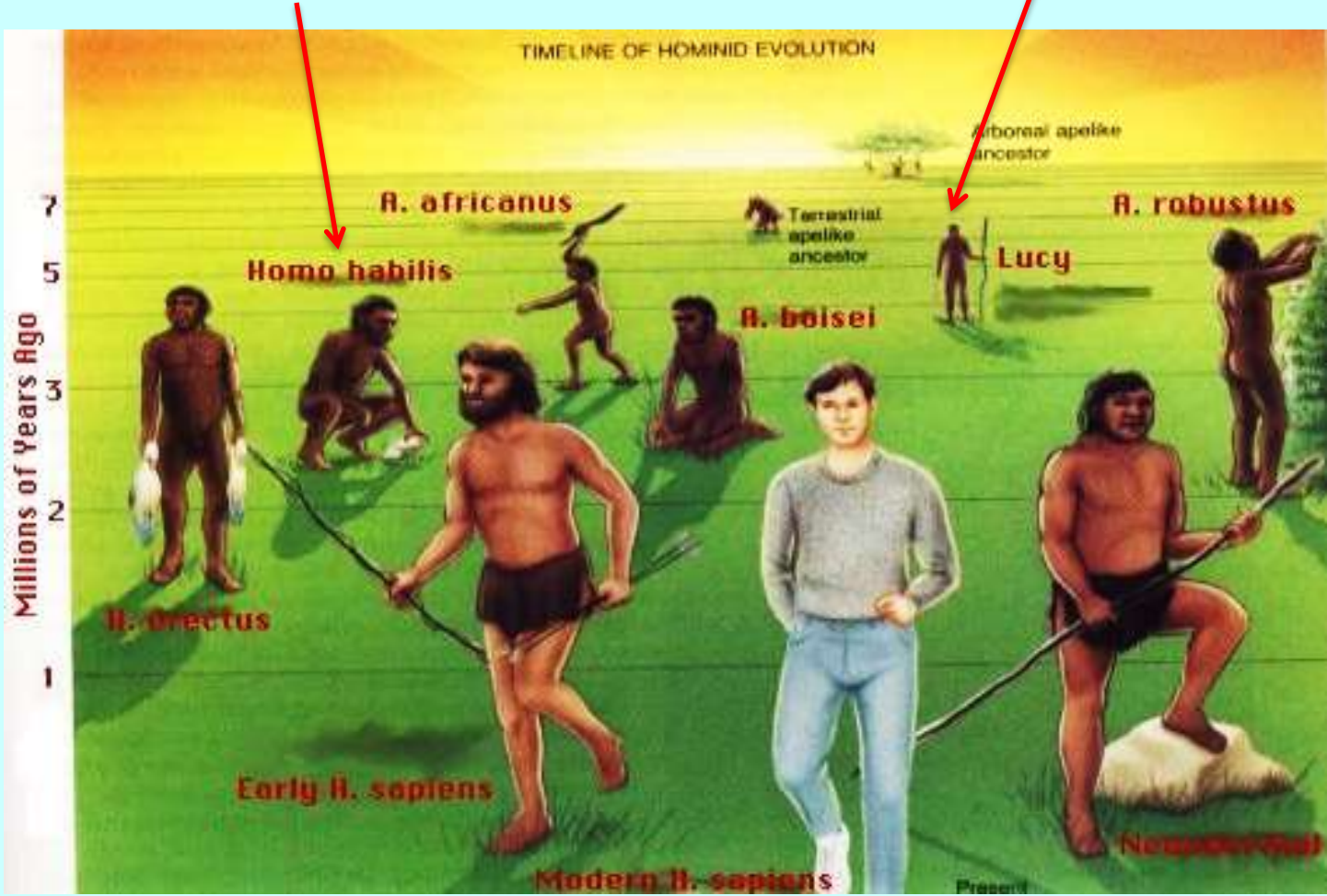
- In the Pliocene, about 1.8-5 million years ago a climate change started morphological revolution.
- Africa becomes drier, forest was disappearing and sources of food were reduced.
- Competition of species was increasing and the Humanoid species went through important changes.



# The first break in the evolution: anatomic differences

## - walk on two legs

- Reasons - energy sources, free arms, savanna – food, water, predators
- 1. *Ardipithecus ramidus* (4,4 mill. years), Ardi (1994)
- 2. *Australopithecus afarensis* (3,2 mill. years), Lucy (1974)
- 3. Species *Homo* (2,3 – 1,6 mill. years), Turkan's boy (barrel-shaped chest)



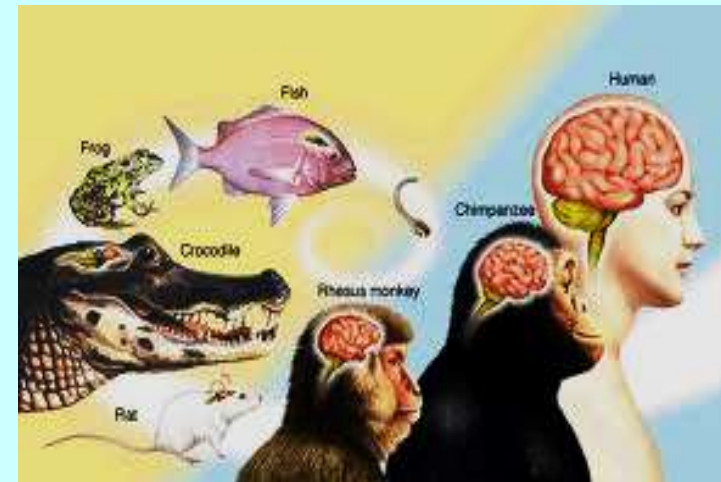
# The second break in the evolution: bigger brain

- **Brain = 2% of human weight, but it needs 20% of calories, 60% of the infant**
- **Development of speech ability**
- **Longer and more active life ( where to get more energy?)**

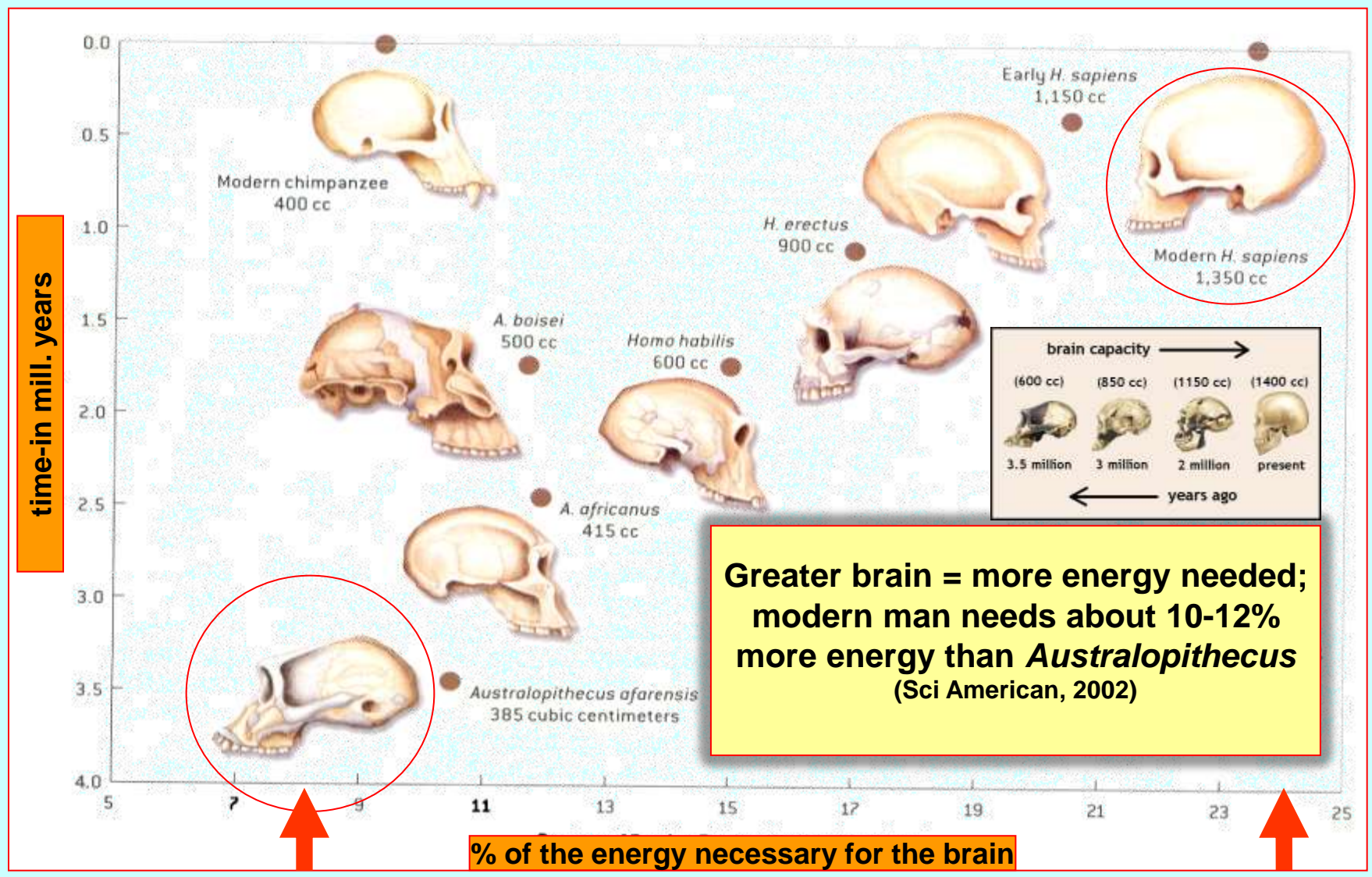


*Ch. Darwin: natural selection ?!*

- **Meaty diet!** (like predators) ... calories, proteins = growth of the brain and also social reasons
- **Our genes are from 99% like a chimpanzee!**
- **Only in 1.2% of our genes that are active (identifying the genes) differ from chimpanzees**
- **5-6 million years ago - hominids separated from the branch of the chimpanzees**
- **Primate as omnivore = the most intelligent, discoveries of new resources food**



# Greater brain increases a need for energy



# Chimpanzee: mainly vegetable diet but also meat





## Comparison of energy sources: solution by *Australopithecus* x *Homo*



„*Australopithecus*“ addressed the problem -  
**morphologically.**

Anatomical specializations have led to a strengthening of those parts of the body, which served for **chewing a greater range of plant food**. Proof may be a permanent increase in faeces of the findings later.

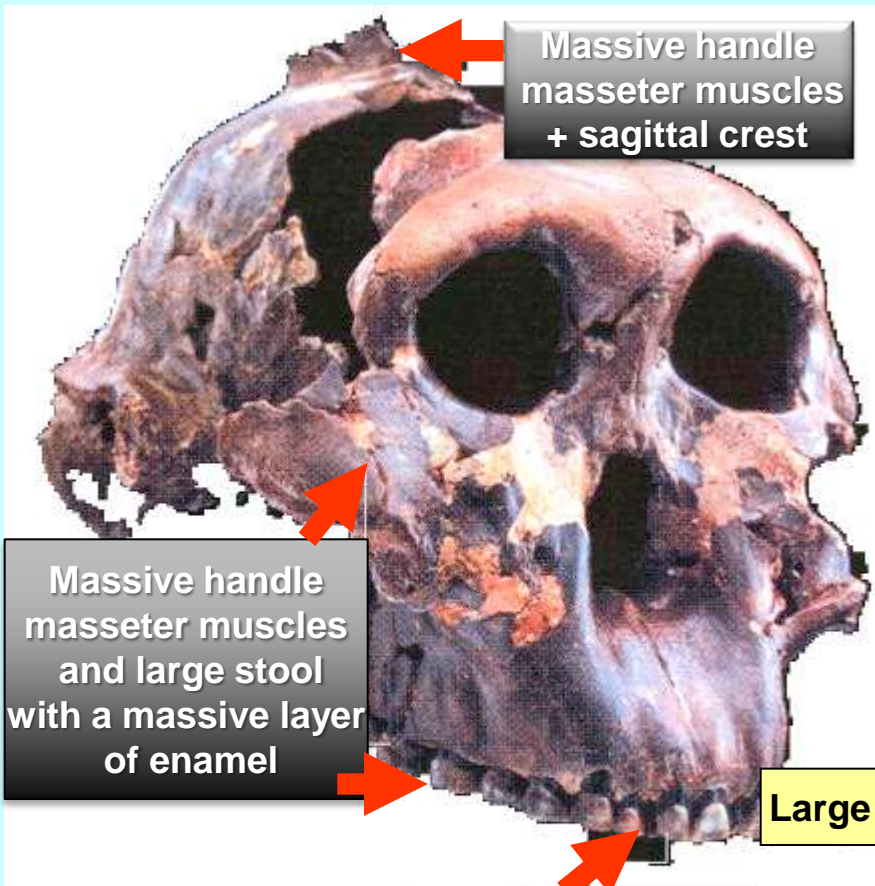
"*Homo*" solved the problem – **behaviorally.**

*H. erectus* was the first hominid, who has **hunted deers in the African savanna**. Proof may be a large number of the findings of animal bones in the places of the seats of *H. erectus*.

*H. habilis* - tools for working of leather and cutting of meat (predators); he had a smaller abdomen and shorter bowel.



# Construction of teeth, skull muscles and diet



Massive handle masseter muscles + sagittal crest

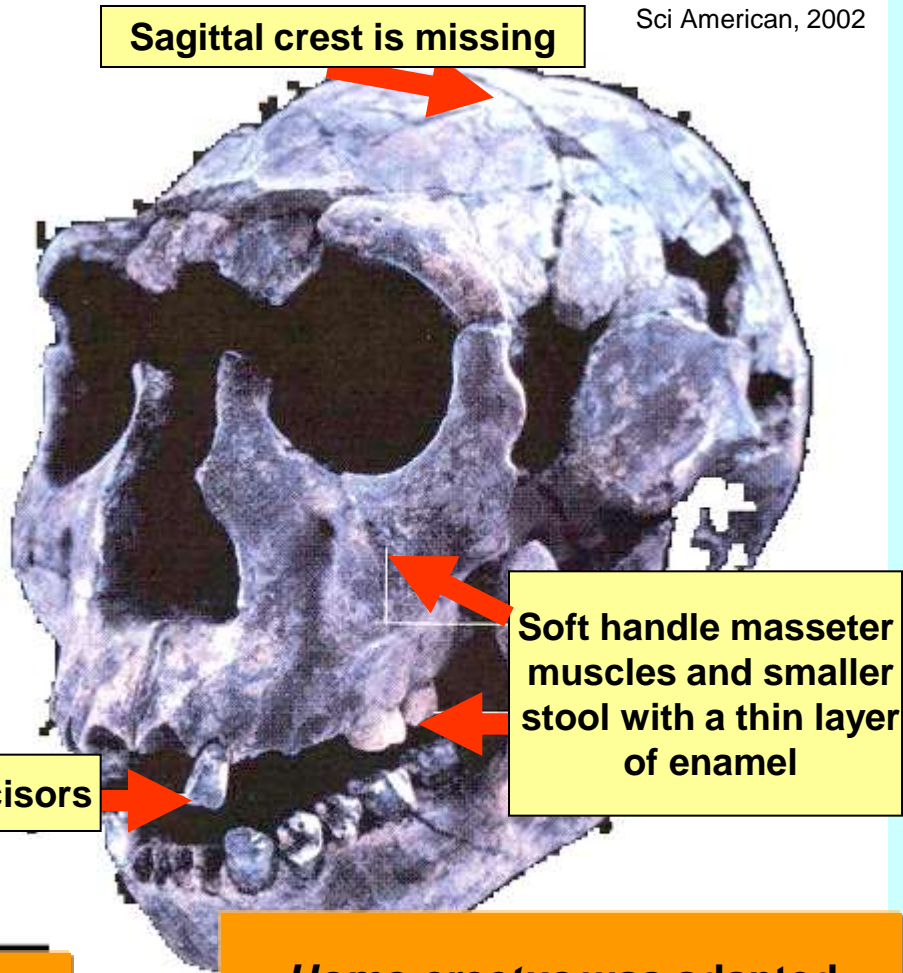
Massive handle masseter muscles and large stool with a massive layer of enamel

Large incisors

Small incisors and canines

*Australopithecus bosei* was adapted to tough plant food

Sci American, 2002



Sagittal crest is missing

Soft handle masseter muscles and smaller stool with a thin layer of enamel

*Homo erectus* was adapted to softer and better diet

# New energy sources



It could be (1) **meat**, but it also could be the (2) a **use of fire** for the preparation of vegetable food. Heat increases the digestibility of complex carbohydrates.

The added energy then let *H. erectus* **start to hunt**, which is energy-consuming, with greater frequency.

It seems that the **origins of fire use** for the preparation of food falls within the period 1.8 mil. years back, when *Homo erectus* lived.

The use of **fire was a technological innovation**, which would significantly affect the human diet.

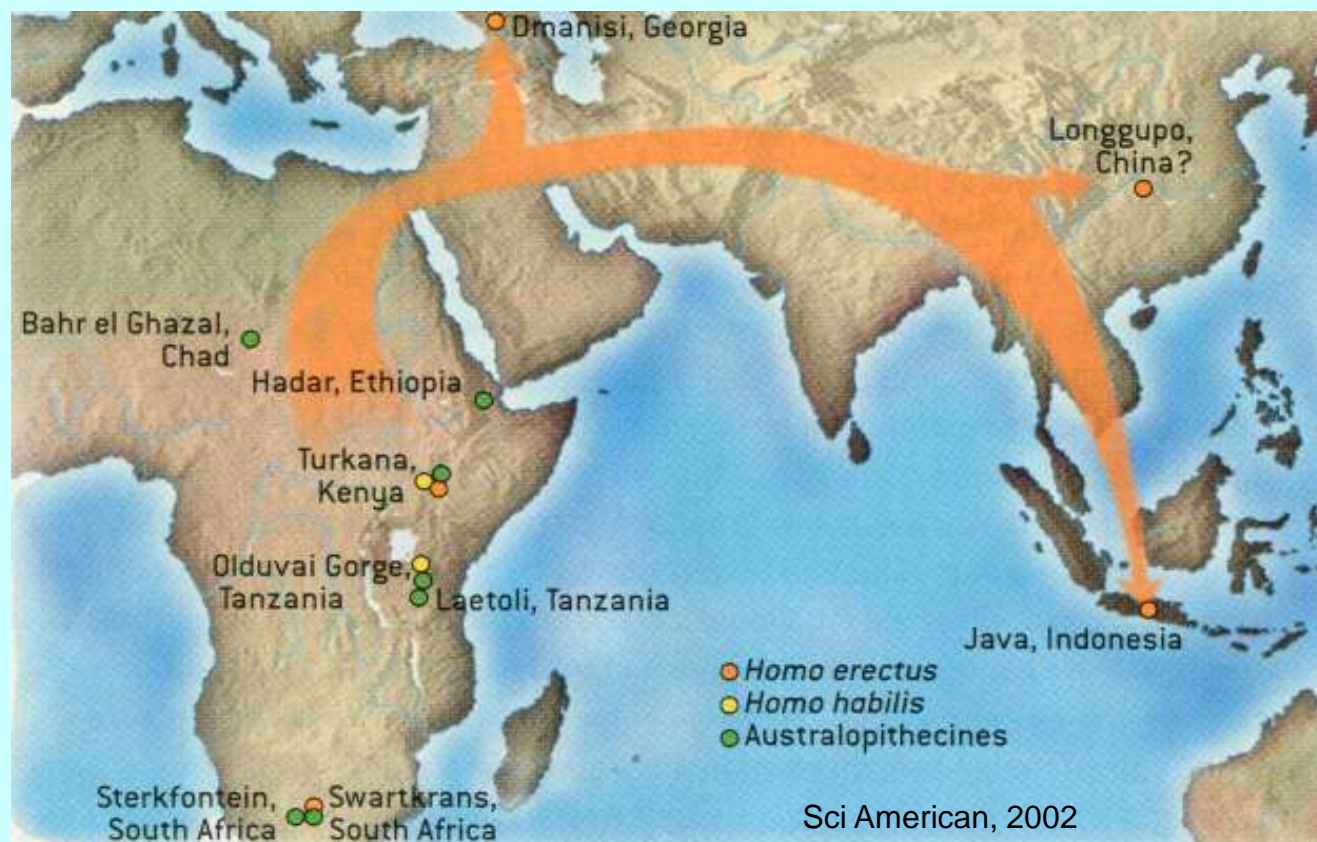


## The third break in the evolution of man: moving

- Early forms of *H. erectus* moved from Africa about 1.4-1.8 million years ago
- Why they moved? The reason was most likely migration of food-animals

- More hunting  
*H. erectus* moved with a source of food (animals)

- It is estimated that hunting *H. erectus* required 10 times larger area to sustain than *Australopithecus*



# New map of human migrations by using of DNA

- The path and the time of migrations are estimated according to the relatedness of mitochondrial DNA inherited from mother line (genes, stable)



Thousands of years

# MEAT in NUTRITION TODAY

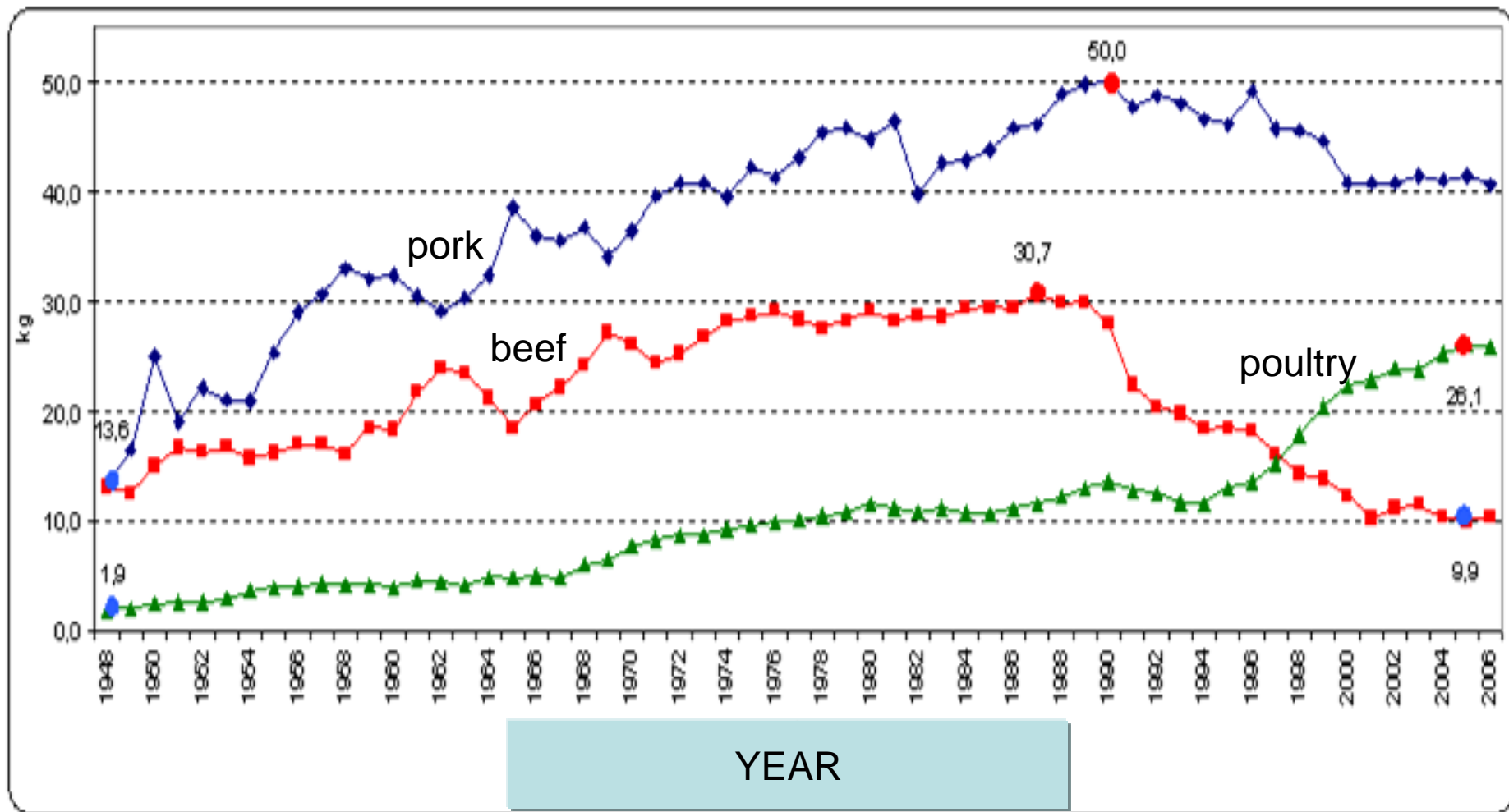


# Old traditions in nutrition: „meat as a part of our diet = health“

- The consumption of meat continuing at least **15 thousand generations**
- To consume meat - evolutionarily meant **survival** (man – hunter/gatherer)
- Symbol of "forces" (the mythical notions) - meat as a part of diet has been **the symbol of health and prosperity**
- Some **societies increase production** and consumption of meat for centuries



# Example: meat availability in the Czech Republic during years 1948-2006





# Factors driving meat consumption

Fugu fish (tetrodotoxin)



- **Economical (political)**
- **Philosophical (vegetarians, vegans, ...)**
- **Cultural (Guinea pig, dog, horse, donkey, Fugu fish ...)**
- **Geographical (climate-hot /cold areas, Inuit)**

## • Religious



– Jews

- *In the Old Testament: Deuteronomy 14,8: Even the pig; While hooves, do not chewing; It will be unclean for you. You must not eat their meat nor their carcasses touch.*



– Christians

- *In the New Testament: the Corinthians 10.25: Eat all meat sold in shops, and for your conscience, you don't need to ask any questions.*



– Muslims

- *The Koran forbids pork*



– Buddhists

- *Consume meat, but strict Buddhists do not eat meat, eat beef in India is not accepted (but not strictly)*

# Large variation in meat consumption versus health

Population	Energy (kcal/d)	Energy from animal food %	Energy from veg.food %	Cholesterol in blood (mg/100 ml)	BMI
<b>Hunters-gatherers</b>					
Kung, Botswana	2100	33	67	121	19
Inuit, America	2350	96	4	141	24
<b>Keepers of cattle</b>					
Turkana, Kenya	1411	<b>80</b>	20	186	<b>18</b>
Evenk, Russia	2820	41	59	142	22
<b>Farmers</b>					
Quechua, Peru	2002	<b>5</b>	95	150	<b>21</b>
<b>Industrial society</b>	2250	<b>23</b>	77	204	<b>26</b>

**Why is the industrial society wrong? Much fat and just little motion!**

# Comparison of meat „consumption“

- The world meat consumption: average **41 kg/p/y**
- **BUT BIG DIFFERENCES** - USA: 110 kg, India 2 kg

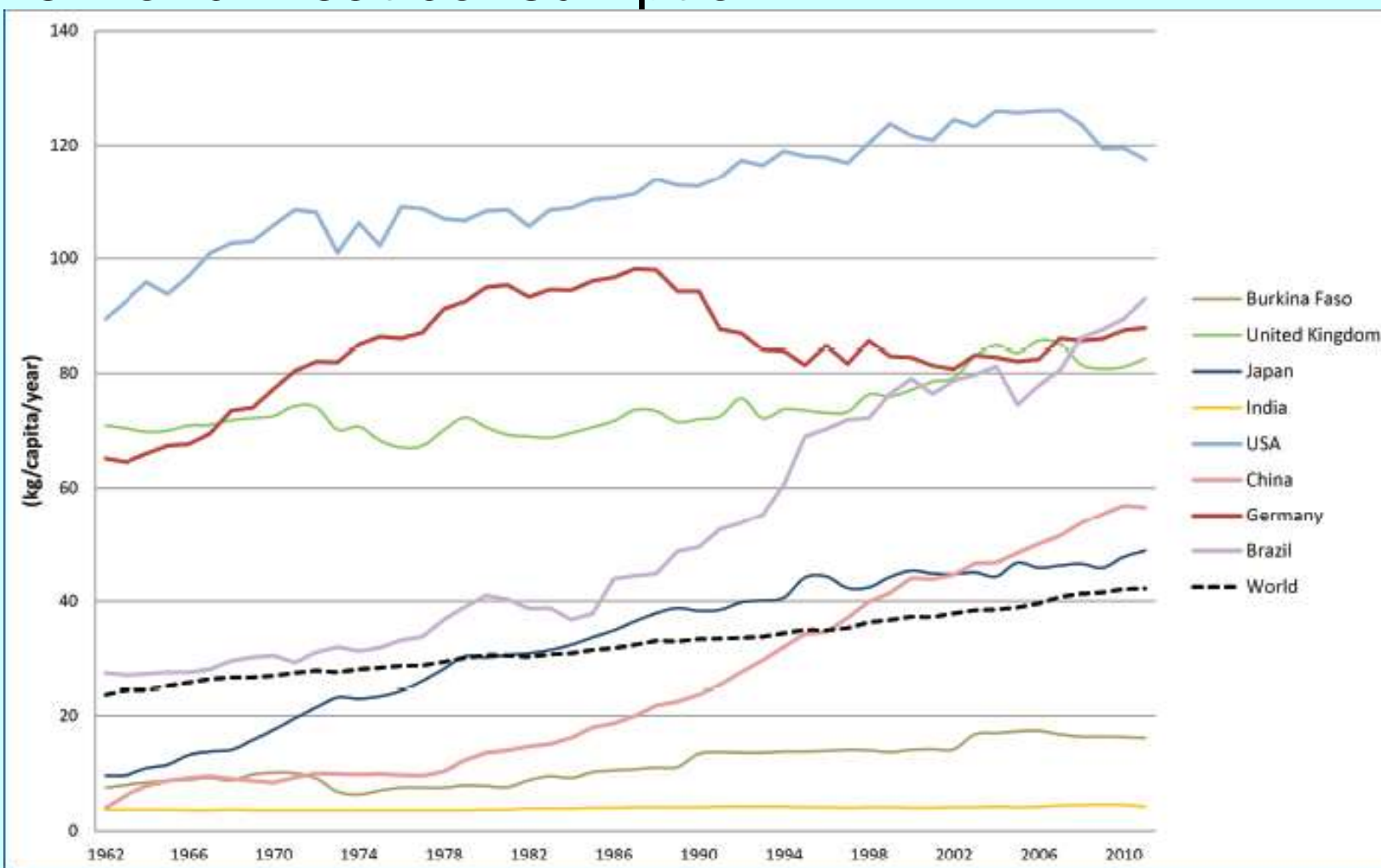


- CZ meat consumption: average **82 kg/person/year**
  - Pork: 41 kg
  - Poultry: 26 kg
  - Beef: 12 kg
  - Other: 3 kg (rabbit, mutton, horse, veal, venison)
  - Fish: 6 kg (including about 2 kg of freshwater fish)

(we are referring to consumption of „meat as produced“ , not as consumed) 19

# Comparison of meat „consumption“

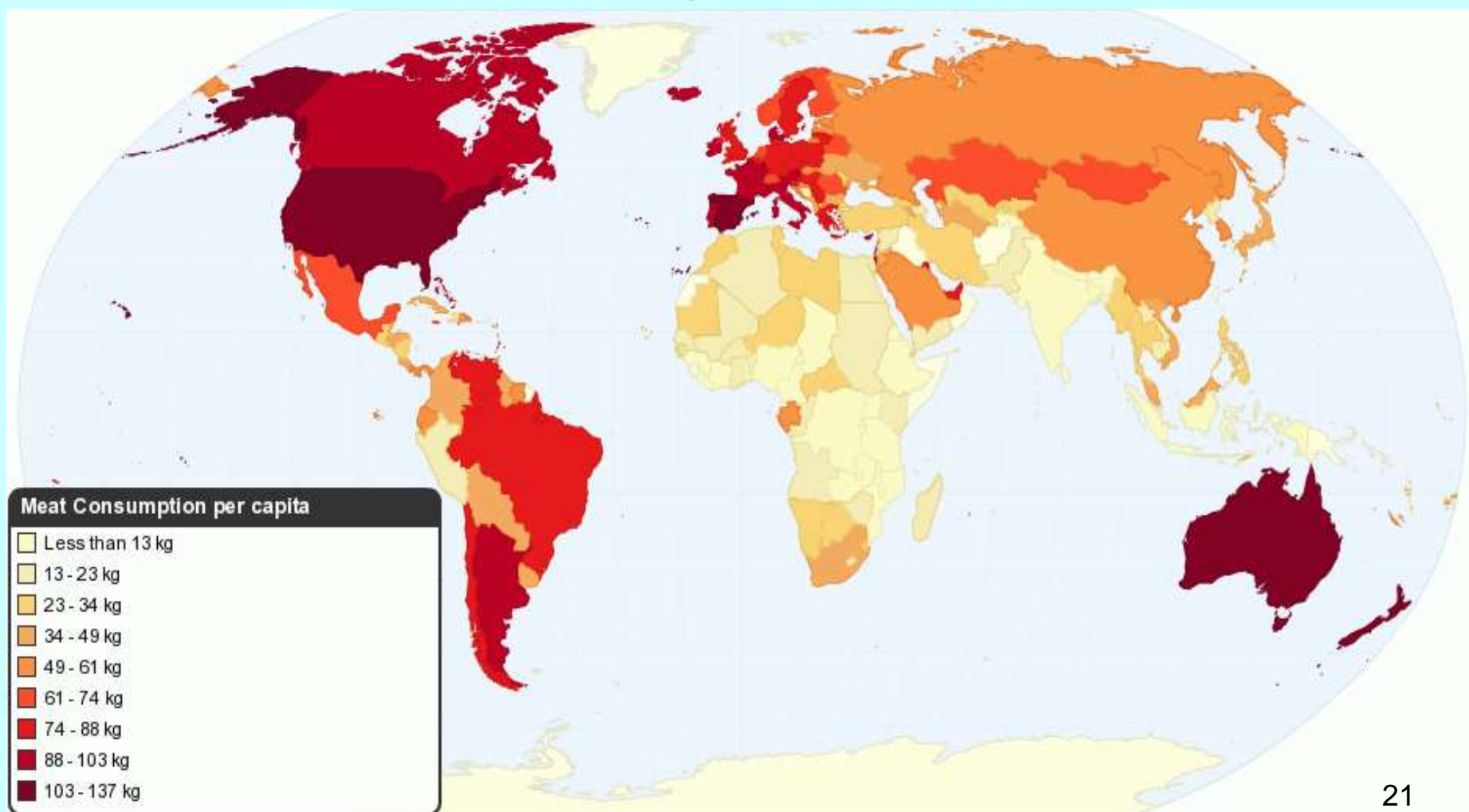
- The world meat consumption



Source: Uta Schmidt; FAOSTAT 2014

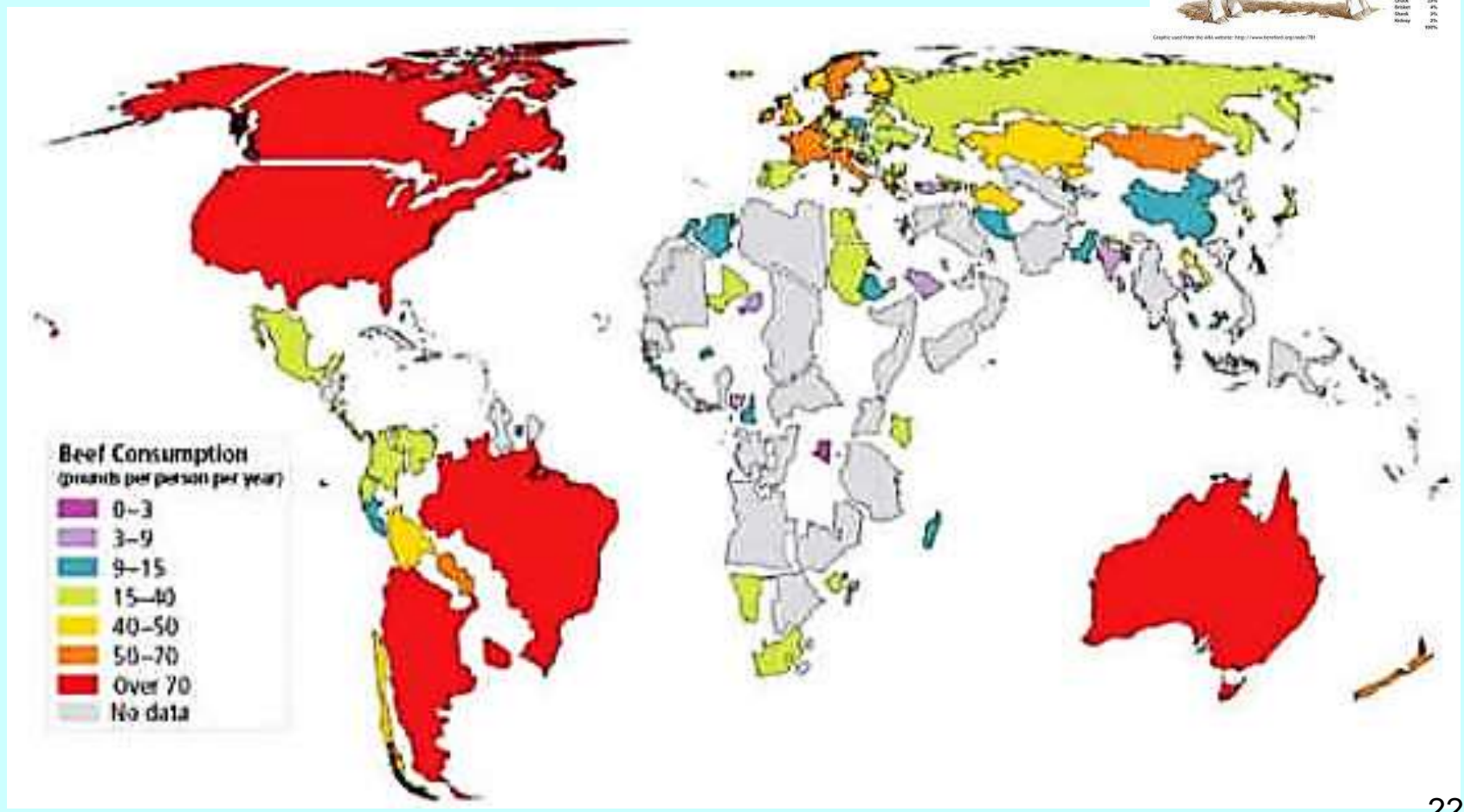
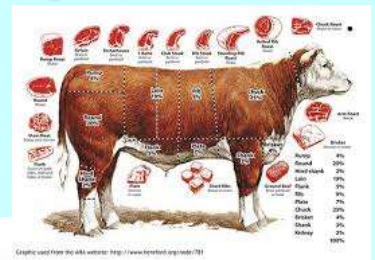
# Comparison of meat „consumption“

- The world meat consumption



# Comparison of meat „consumption“

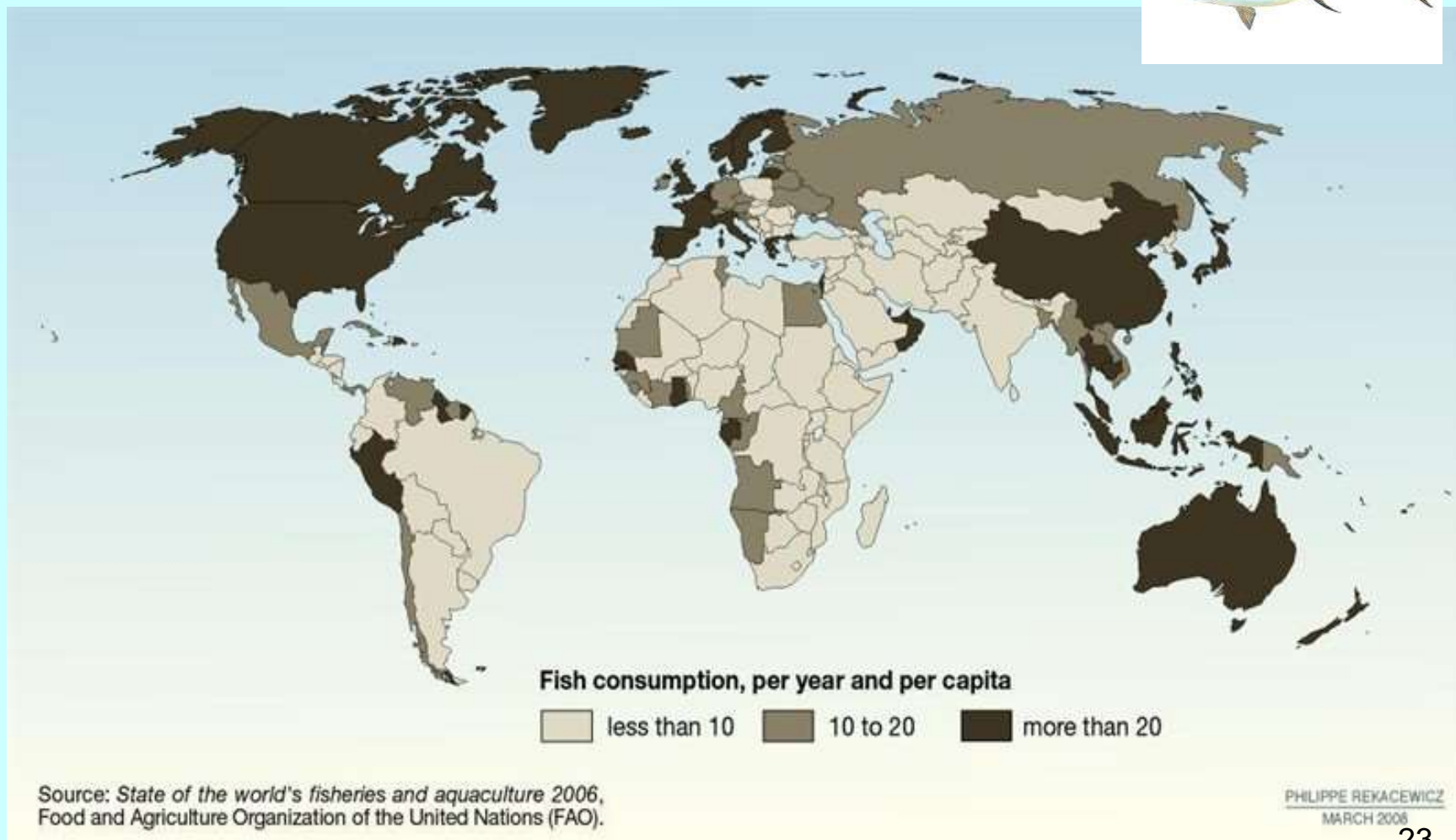
- The world beef consumption



# Comparison of meat „consumption“

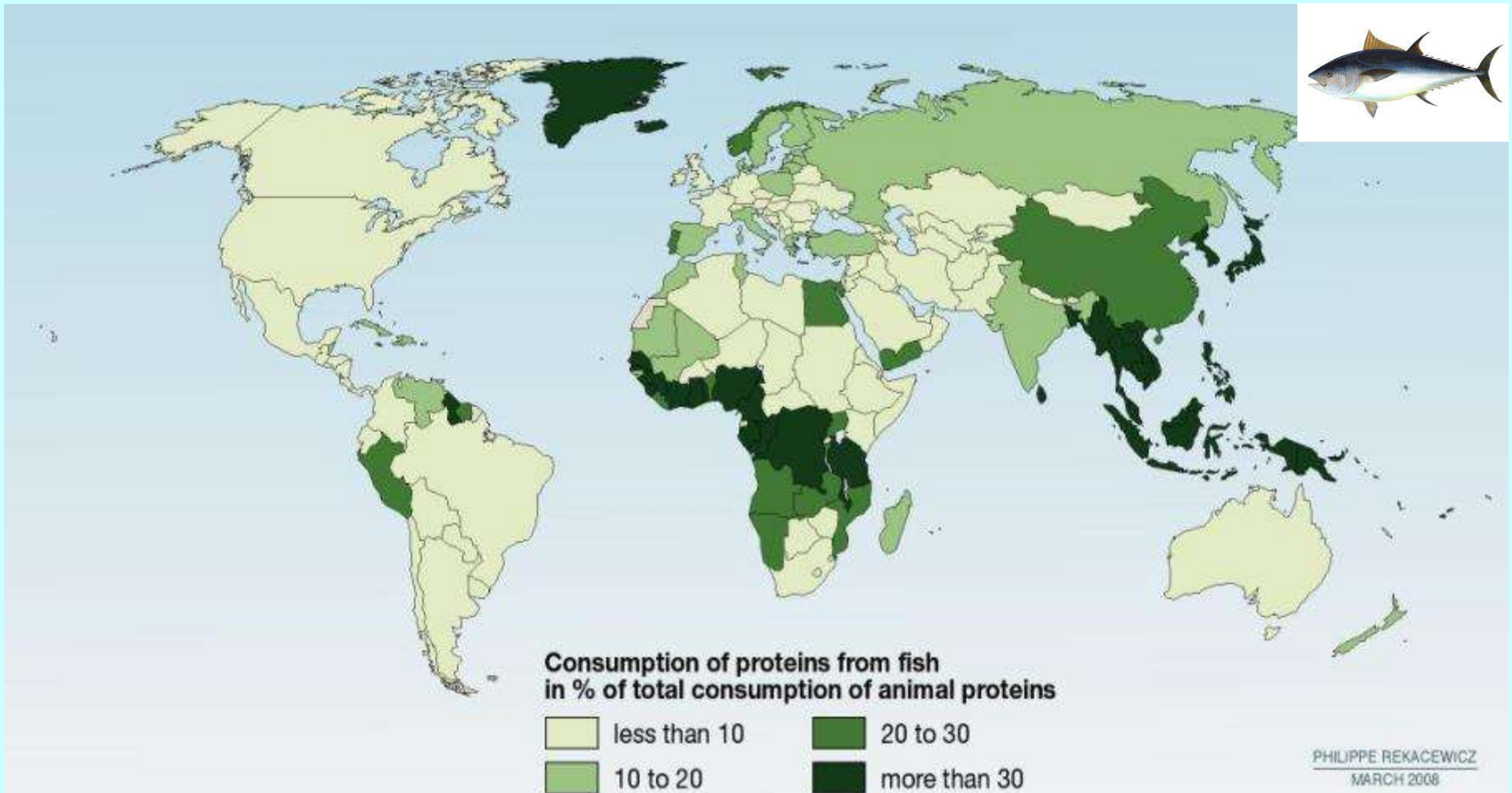


- The world fish consumption



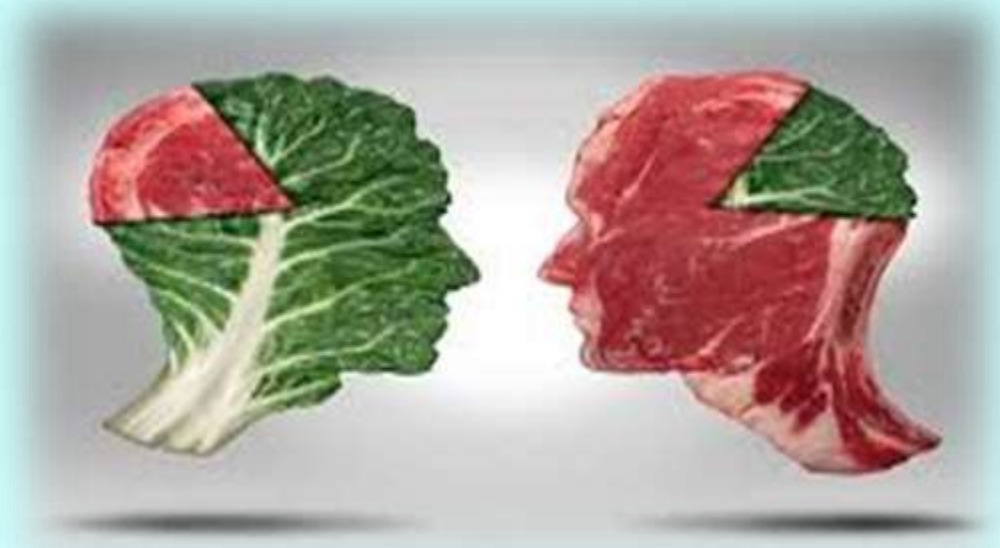
# Comparison of meat proteins „consumption“

- The world fish consumption – a source of proteins





# Today: pressure to decrease meat consumption



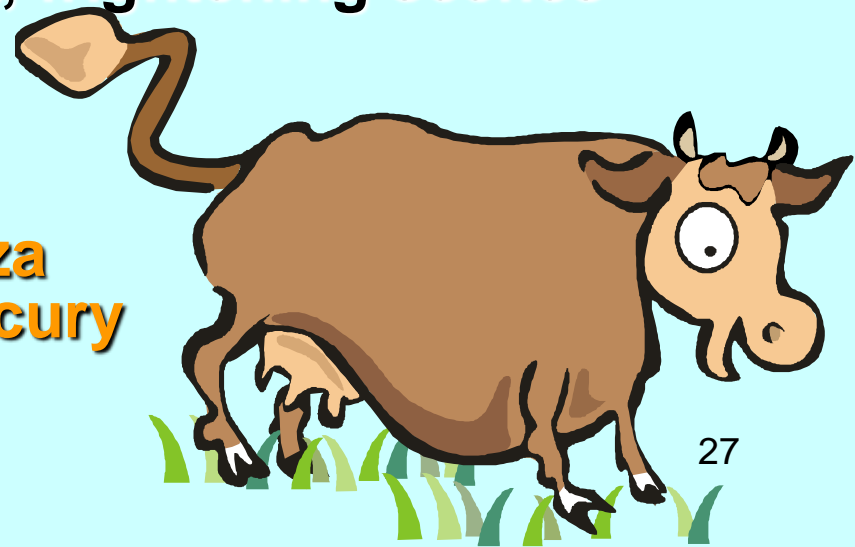
## Health image of meat - collapsed in the 80th

- Research confirmed the **negative effect of fat** on cardiovascular disease
- Attention paid to the **fat from red meat** because it is usually the largest source of SFA in the traditional diet - confirmed in the years 1980 – 1984
- Multifactorial origin of CVD (smoking, stress, nutrition, physical activity ...) is clearly known from the 90s **negative associations about the harmfulness of red meat remains**



## Decreasing of meat health reputation in the 90th

- The association between high consumption of **red meat and certain types of cancer** (especially colorectal cancers) - WCRF, 1997, COMA, 1998) - although there are still some disputes about causality
- **BSE** – panic due to possible incurable disease called new form of CJD
- Problems with **foot-and-mouth disease** - lack of confidence in the safety of meat, frightening scenes during destroying of herds
- Problems also with poultry (the transmission of the **influenza virus**) and with fish (**methyl mercury contamination, parasites**)



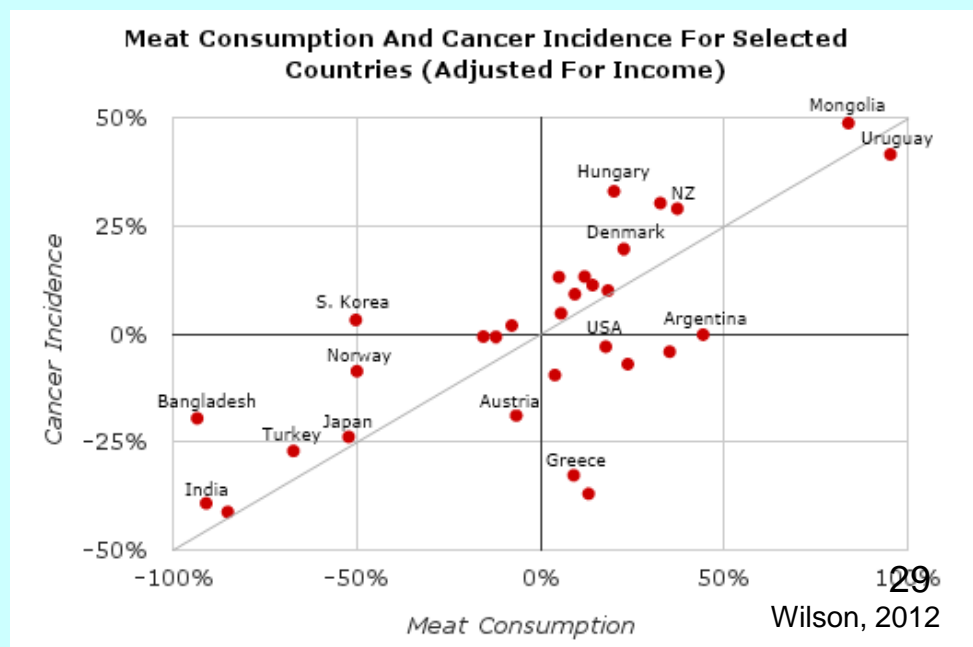
# **MEAT and CIVILIZATION DISEASES**



# Meat and cancer

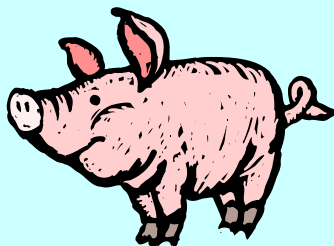
- **Meat** can protect against cancer of stomach, esophagus and liver (Hirayama, 1990, Azevedo et al., 1999)
- **Meat** is suggestive of tumors causality of the colon, rectum, as well as breast or prostate (Black et al., 1997)
- **70 g** culinary threatened red (!!!) meat / person / day and **500 g** / person / week is considered as maximum (IARC, 2015)

E.g.  
**Average meat consumption in CZ (2003-4): age 18 - 59 y men 161g/day, women 124g/day (SISP04).**



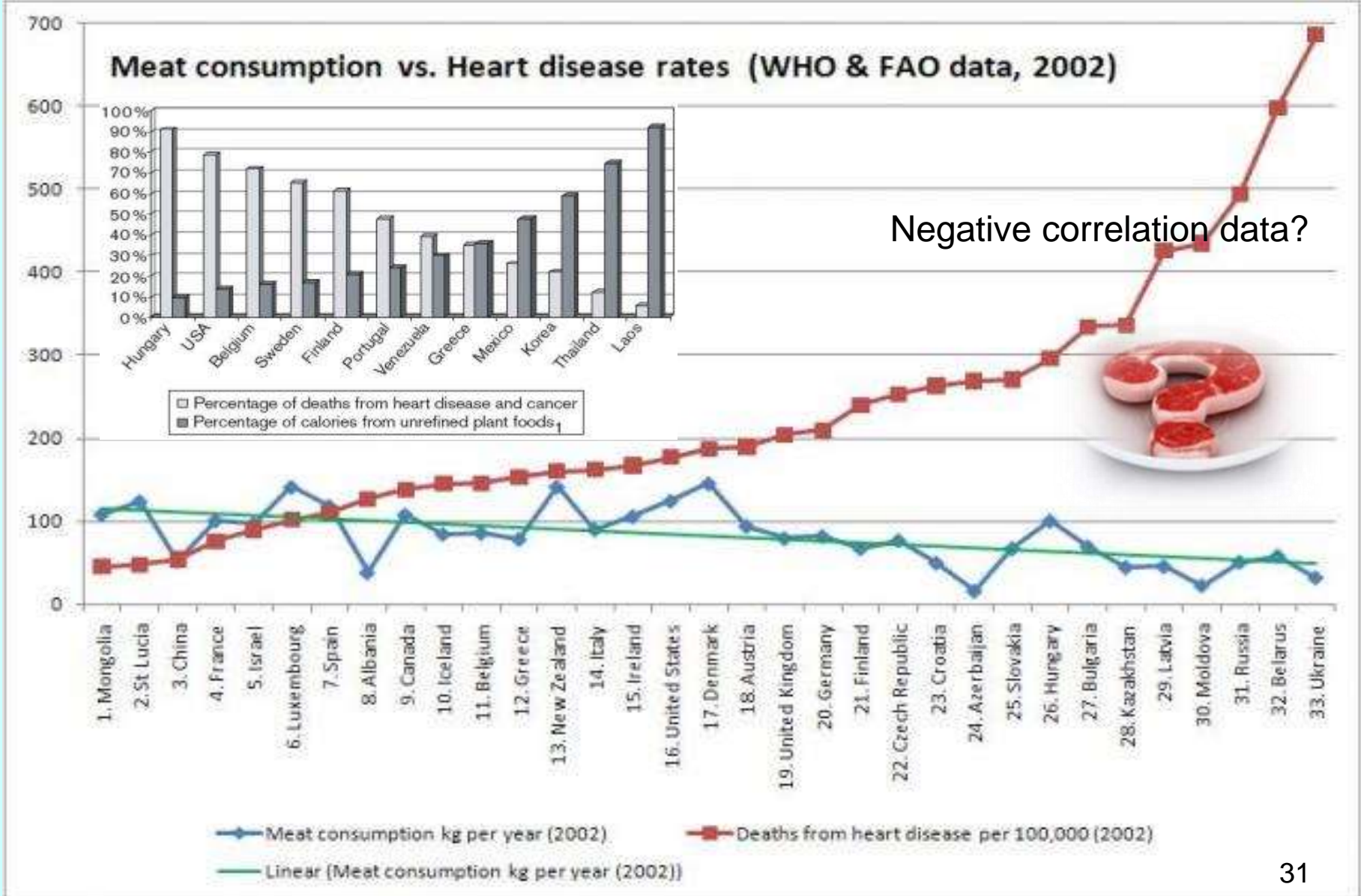
# Meat and cardiovascular diseases (CVD)

- **CVD** is still the cause of more than 40% of deaths
- Regular consumption of red meat is epidemiologically associated with **increased risk of CVD** due to composition and fat content
- Meat is a source **arachidonic acid** which is associated with increased thrombotic tendency (too simplistic assertion)
- Approximately **1/3 of cholesterol in the diet comes from red meat** (CPA 97) - content is not higher in fat meat - the number of muscle fibers is higher in red muscle (DRI < 300 mg daily, recommended blood levels of 5 mmol / l)
- **Lean beef, chicken or fish added to the low-fat diet in the same manner reduced the level of plasma cholesterol and LDL-cholesterol in subjects'**



What to do with fat in production?

# Meat and cardiovascular diseases (CVD)



# Meat and satiety – relationship to obesity

- The **prevalence of overweight** (BMI> 25) and obesity (BMI> 30) in the population continues to grow>>> in the CR is about 50% of obese women and 30% of men
- **Feeling hungry** regulates the number of meals
- **Satiety** regulates the size of the food consumed
- Satiating ability is highest in **protein**>>> carbohydrates>>> fat
- The **mechanism satiety effect of protein is not known**>>> probably influence the hormonal system (AA, glucose, insulin, cholecystokinin, serotonin precursors, norepinephrine, dopamine)
- After a **meal with meat hunger comes later than the vegetarian diet** (Barkeling et al., 1990). Varies according to type of meat (depending on the composition and digestibility AA)
- The answer, whether the meat is a valuable assistant, or more harm in the fight against obesity - we unfortunately do not know





# Meat and vegetarianism



- Meat is the **richest source of protein** in the "Western-type diet,,
- Some epidemiological studies show a **reduction in the relative risk of death** in people with "lower consumption of meat,,
- **Confounder factor "healthier lifestyle"** among vegetarians supposedly (Singh, 2001) plays an important role
- **Lack of evidence of specific metabolic positives** of diet low in meat (Singh, 2001)
- The whole situation must be studied in context - **a holistic approach**>>> age, gender, lifestyle, environment, genotype and phenotype of human>>> **change throughout life?**

# **MEAT**

## **RICH SOURCE of ENERGY**

### **and NUTRIENTS**



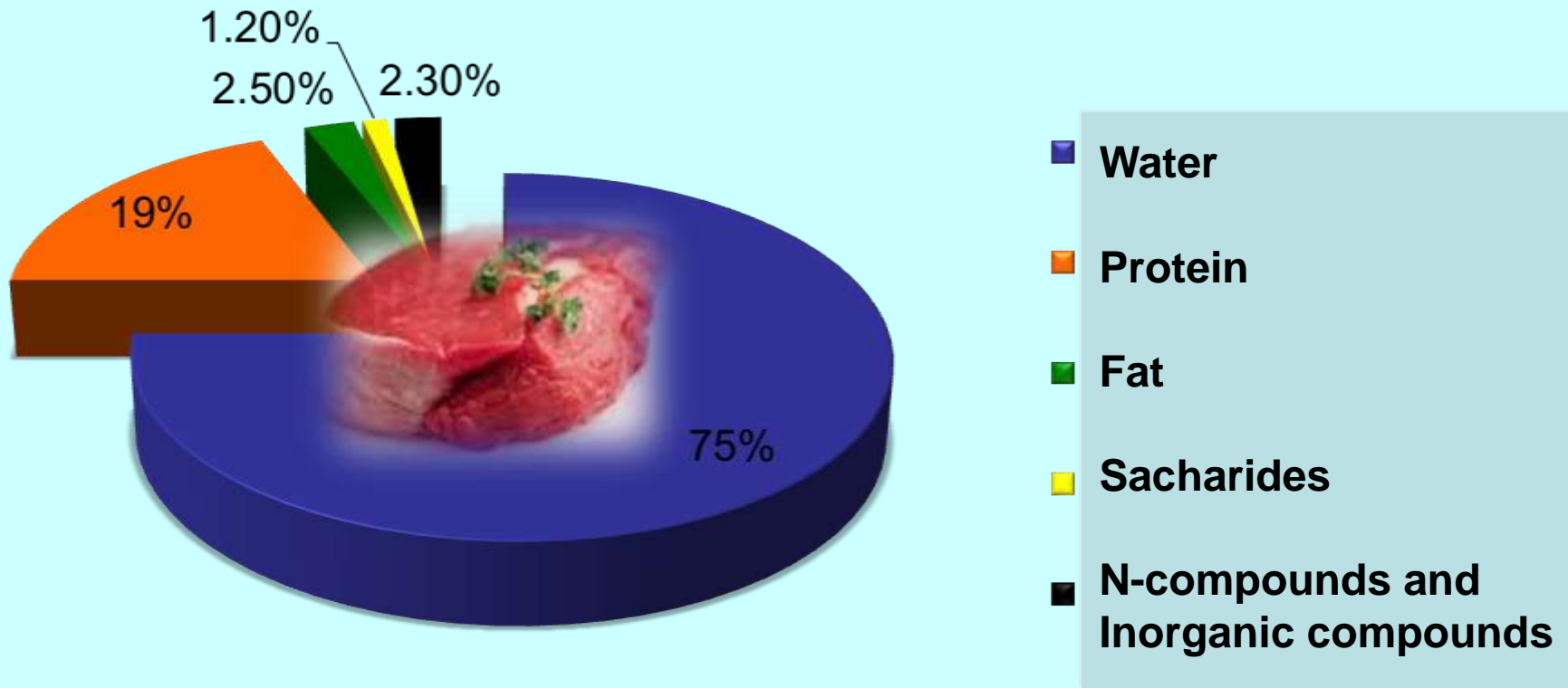
# Meat = rich and very universal source of bioavailable nutrients

- The primary importance lies in the meat protein content in particular = contains all the essential amino acids (growth and recovery of cells of the body)
- Meat is also relatively concentrated source of essential micronutrients:
  - Vitamins A, D, E (adipose tissue and liver)
  - Vitamin **B 12** (only animal food - haemopoiesis!)
  - Other B group vitamins
  - Even low doses of Vitamin C (liver and fresh blood)
  - Minerals:
    - 1% by weight of meat
    - K, Ca, Mg, **Fe** - high availability 35%
    - **Zn** - especially beef
    - I - seafood

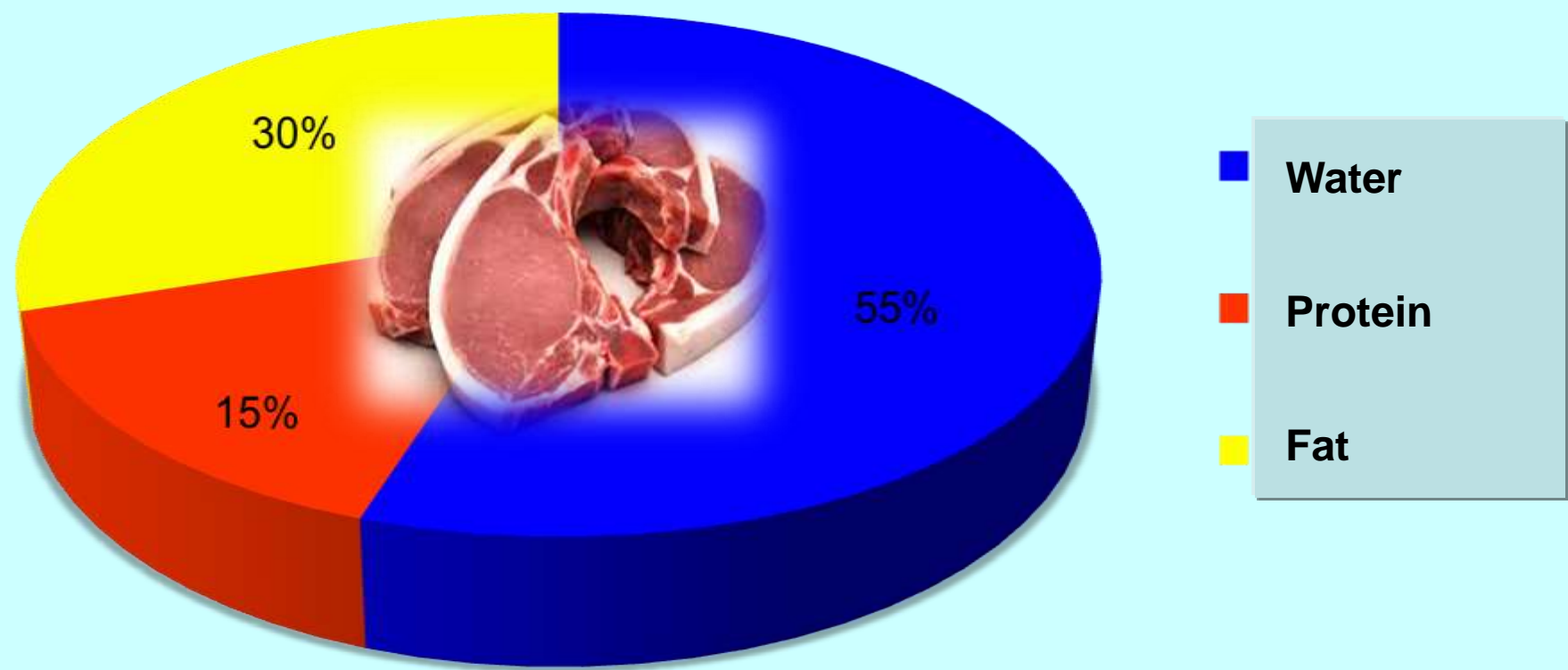


# Meat composition – mammalian muscle

- ≈ type of meat, intravital influences, technological and of cooking factors



# Meat composition – pork



Big difference among content of fat in various kinds of pork!

## One portion of beef (85g) gives you:

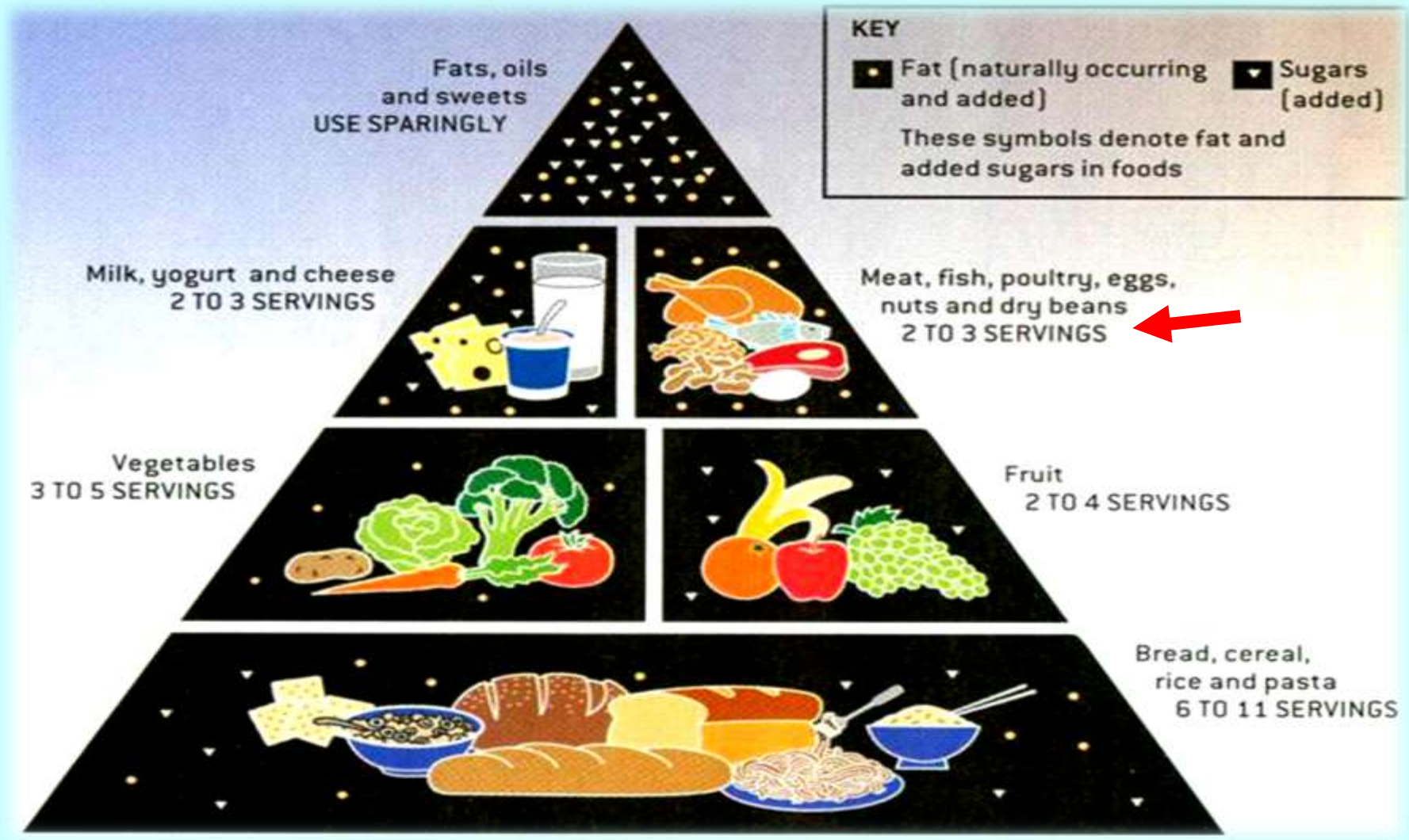
Nutrient	Content	%DRV
Protein	21 g	46
Riboflavin (B <sub>2</sub> )	0.18 mg	11
Niacin	4.4 mg	22
Vitamin B <sub>12</sub>	2.0 ug	33
Fe	1.8 mg	10
Zn	4.6 mg	31



# **A NEW LOOK at MEAT in HUMAN NUTRITION**



# „Food pyramide“ – Food Based Dietary Guidelines





# New targets and trends in meat production

- The basic public health challenges early in the 21st century
  - CVD
  - hypertension
  - obesity
  - diabetes
  - osteoporosis
- The pressure to meat production:
  - reasonable to reduce the fat content
  - Fatty Acids - fat composition
  - increased content of n-3 PUFA (cardio protective, etc.)
  - *increase the content of conjugated linoleic acid (CLA) ??? (anti-tumorogenic, normalizes blood glucose, reportedly leading the growth of muscle mass at the expense of fat) **NEW SAFETY VIEW in 2011 – CLA as t-FA???***
- Increased micronutrient content:
  - such as selenium, iodine, vitamin A - dangers of excessive intakes



# MEAT versus MEAT PRODUCTS



≠



Fresh meat and meat product are not equal in terms of nutritional value.

# Meat on our plate (meal)

- **Meat storage?**

- Meat fresh, frozen
- Storage time / spoilage (decomposition products)



- **Meat processing?**

- What ingredients were used
- What heat treatment was used
- Smoking practices



# Meat products for direct consume

- **What kind of meat product?**
  - The composition of the product in terms of fat and muscle
  - What other ingredients were used (vegetable protein, spices, additives, micro-organisms ...)
- **How the meat product was further processed?**
  - Categorization into groups of meat products differs in various countries (E.g. in CZ 8 groups according to the Decree No. 264/2003 Coll.)
  - Cooked meat products
  - Smoked meat products
  - Fermented meat products (probiotic??)
  - Raw meat products (tartare, carpaccio, etc)



# Conclusions

1. Recently - degradation of the meat importance in diet and a bit naive conclusions about causality of civilization diseases
  2. A holistic approach used to solve problems of health, nutrition and lifestyle - rediscovery of meat importance in the evolution of human nutrition
  3. Lean meat = a natural functional food – when consumed within reasonable lifestyle and health status (!) - provides certain health benefits
- 
- A roasted chicken is shown in the background, garnished with fresh rosemary sprigs and lemon wedges. The chicken is golden-brown and appears to be served on a white plate.

# „ANTHROPOS“: the unique museum of prehistory in Brno

