Defining the optimal protein intake – science as politics

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Categories of food policy

- ***Food security:*** **Supply of sufficient amounts of food/nutrients**
- ***Food safety:*** **Provision of food free from contamination**
- ***Nutritional quality:*** **Provision of a healthy diet available to all**

Lobstein, Proc Nutr Soc 2002

Categories of food policy – protein-N/amino acids

Major problem:

- **To quantitatively and qualitatively meet man`s dietary needs on the basis of sustainable food systems**

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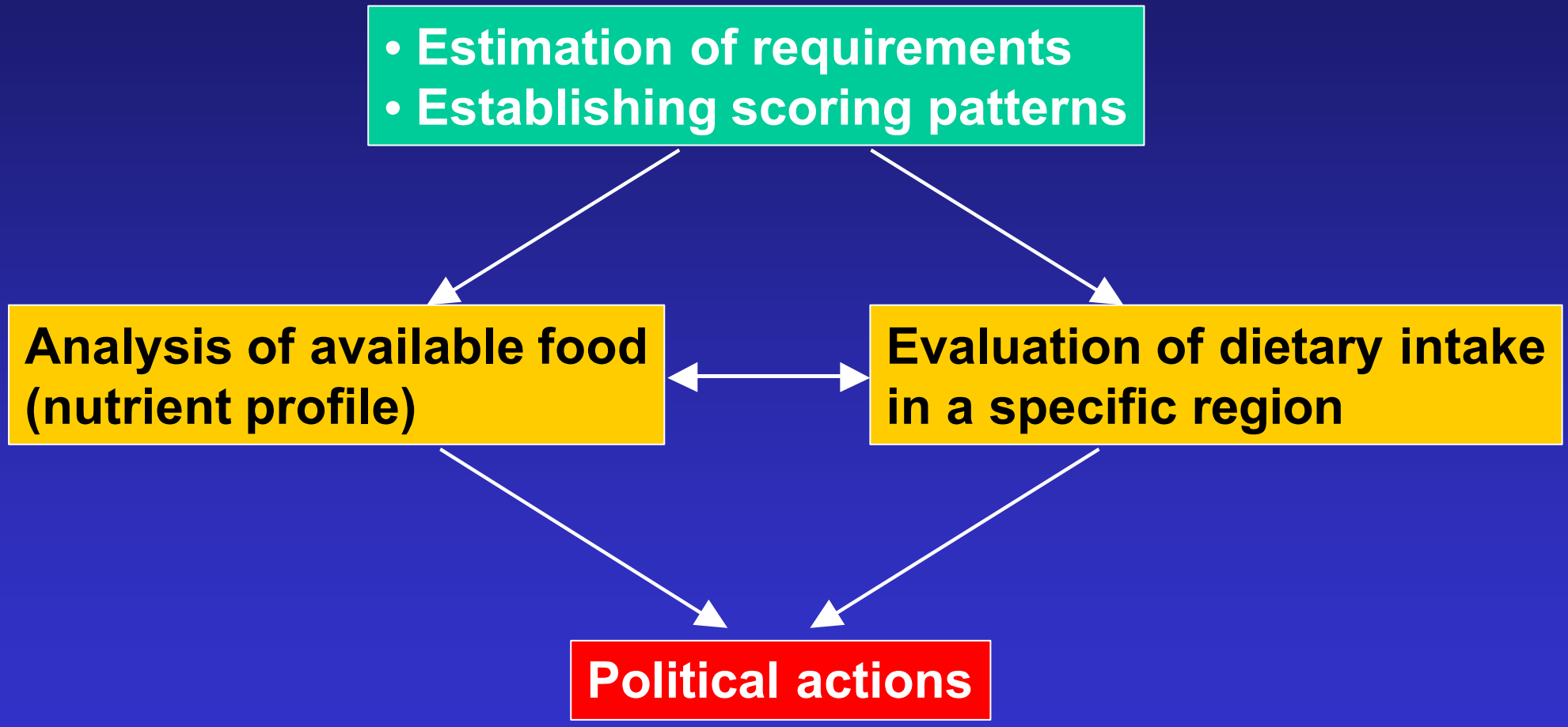
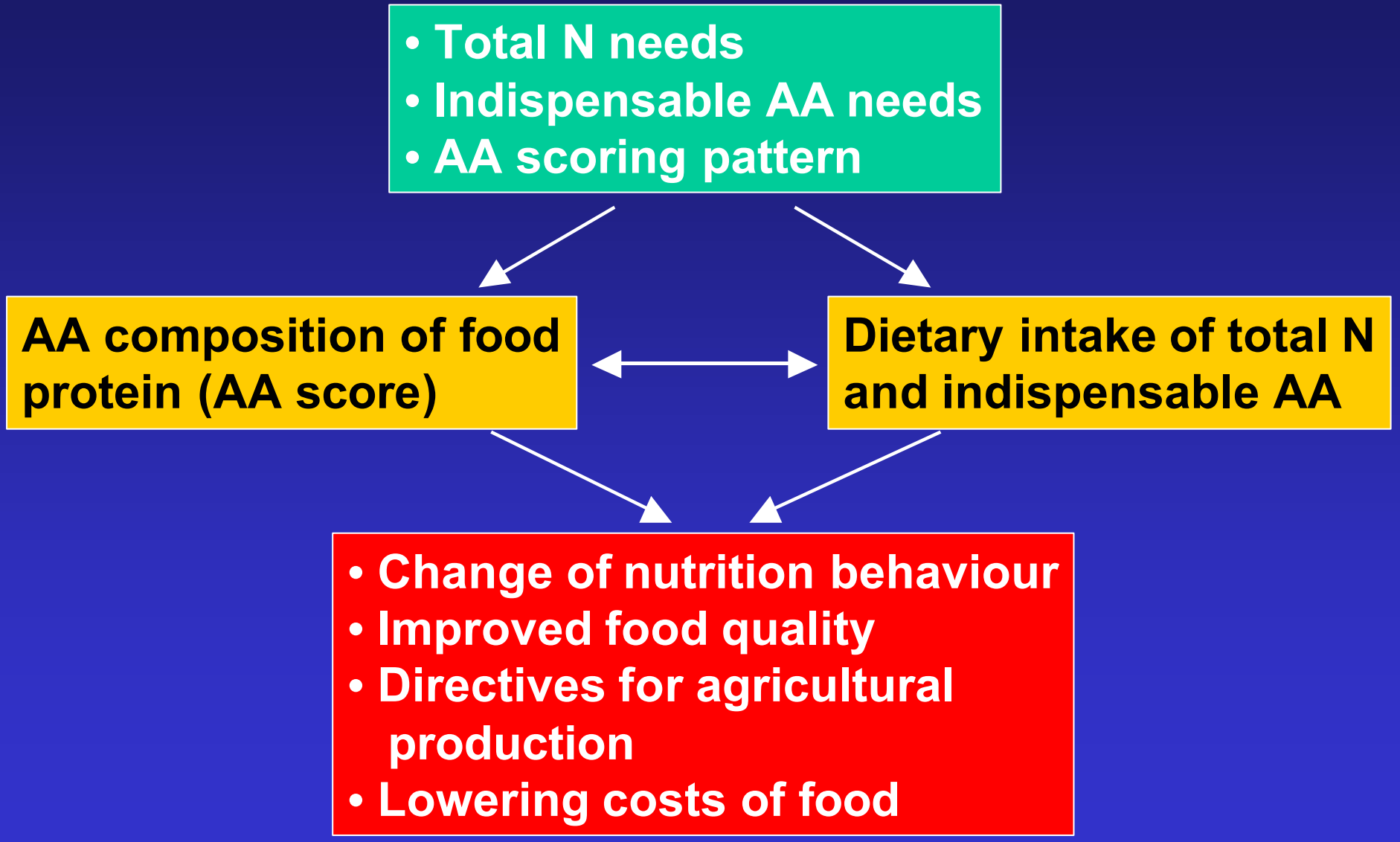
Focus of political actions on food/nutrient security

Food/nutrient security – general approach



Food/nutrient security – protein-N/amino acids



Science and politics – potential interactions

food/nutrient security

Scientific progress in

- *amino acid analysis*
- *performance of clinical studies (tracer technologies, long-term studies)*
- *food biotechnology (incl. genetics)*

is associated with

- **improved data on food protein/amino acid composition**
- **altered evaluation of amino acid indispensability (revised needs)**
- **production of new food with optimized amino acid pattern**

Þ Implications on international dietary planning

Science and politics – potential interactions

Examples

- Recent revision of requirements for indispensable amino acid analysis
- Production of new plant food with improved protein content/amino acid pattern

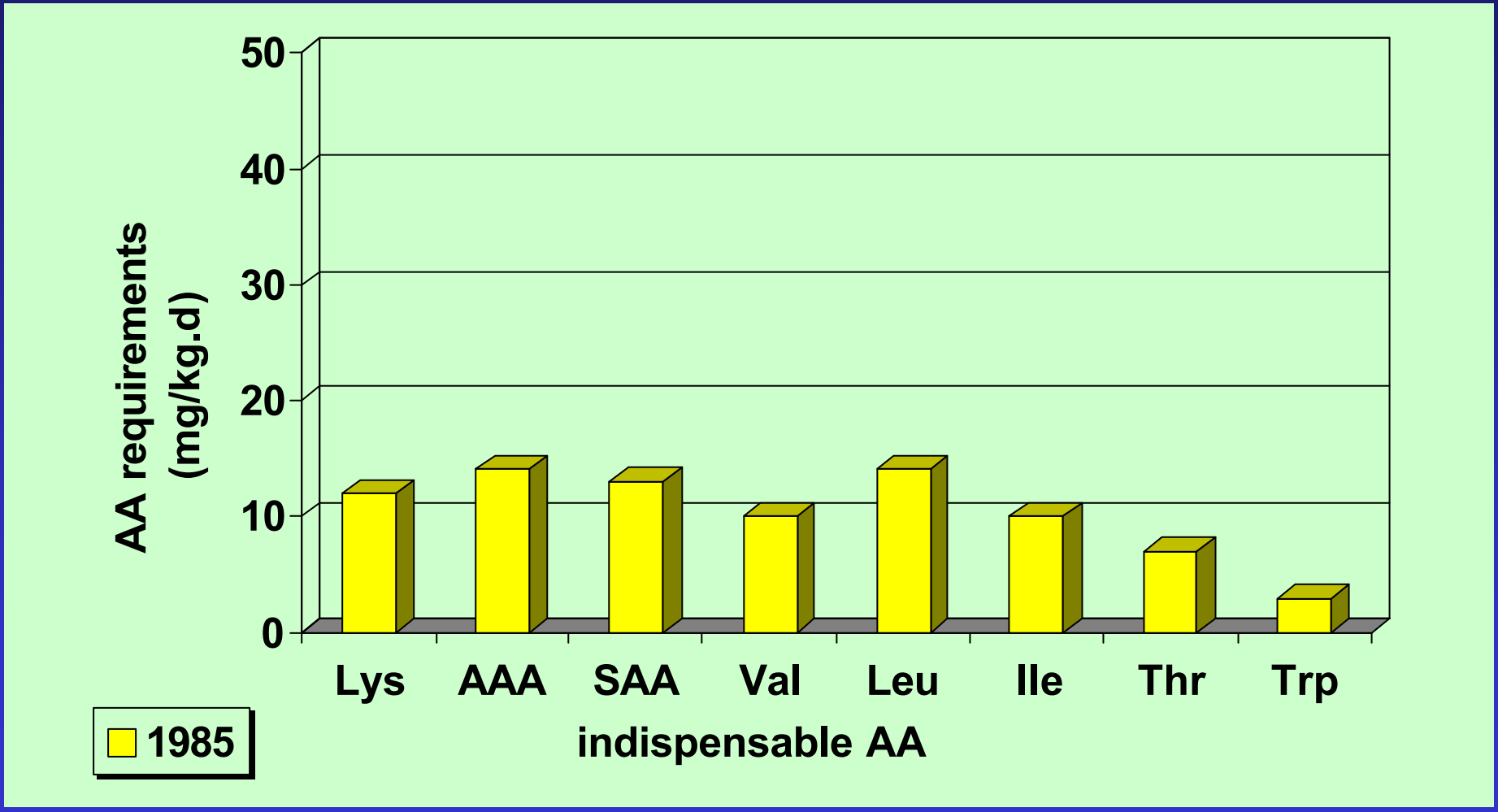
Indispensable amino acid requirements

FAO/WHO/UNU 1985:

- International recommendations for infants, young children, and adults
- Data based on nitrogen balance studies
  - requirements for adults considerably lower than for children

Amino acid requirements as proposed by FAO/WHO/UNU for adults

(protein intake: 0.66 g/kg.d)



Indispensable amino acid requirements

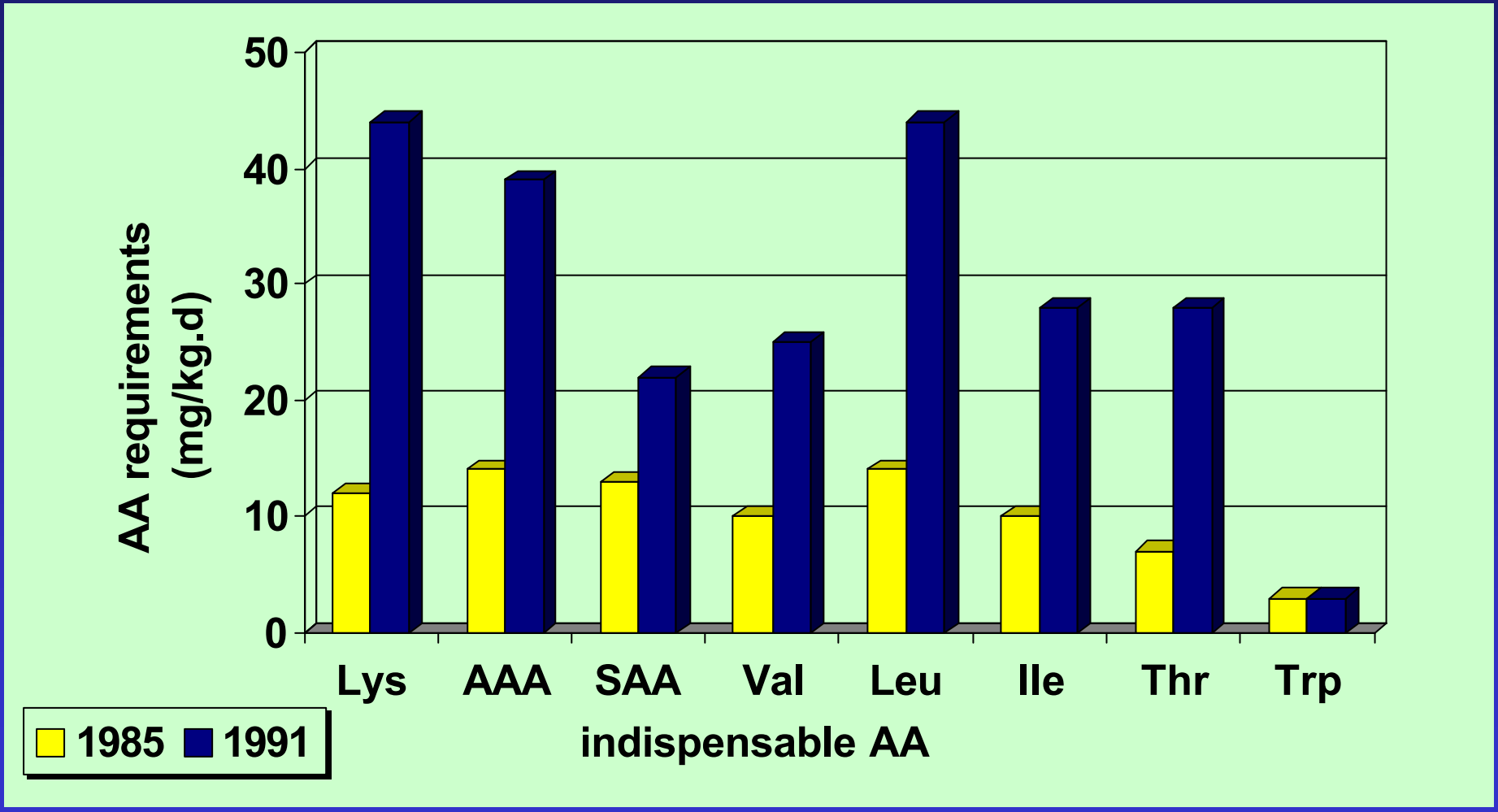
FAO/WHO/UNU 1991:

- **IAA requirements for adults should be set equal to those of preschool children as outlined in the 1985 report**
- **Decision based on new knowledge about the physiological functions of amino acids:**
  - **after 2 years of age quantitative requirement for growth is negligible compared with that for body maintenance**

Young et al 1998

Amino acid requirements as proposed by FAO/WHO/UNU for adults

(protein intake: 0.66 g/kg.d)



Indispensable amino acid requirements

Actual working group of FAO/WHO/UNU (draft 2001*):

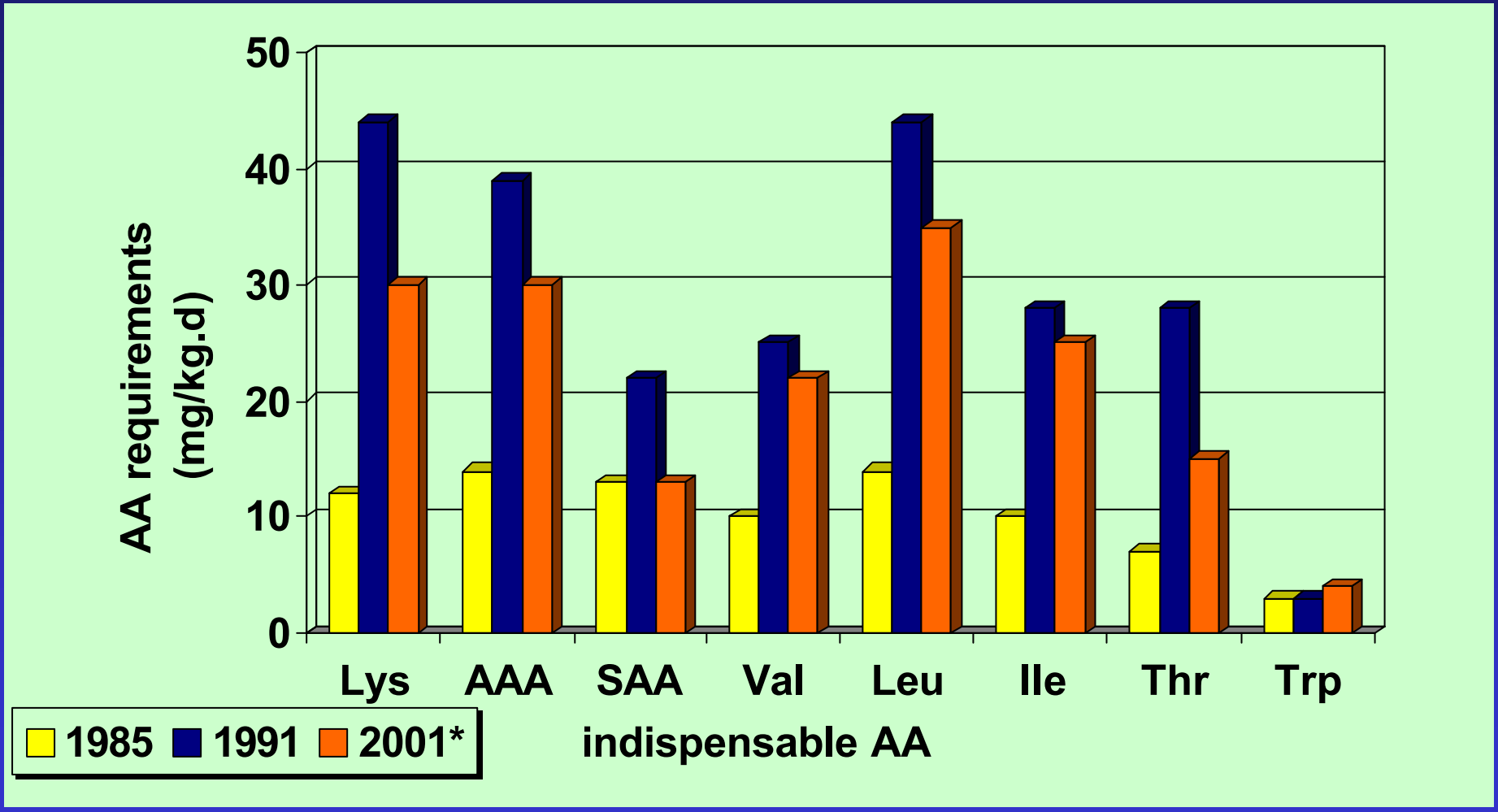
- **IAA requirements for adults have to be revised**
- **Decision based on recent results from clinical studies using novel tracer technology developed at MIT (24h infusion of a ^{13}C labeled amino acid and measurement of $^{13}CO_2$ output (carbon balance)**

  El-Khoury et al, 1994, 1995; Young & El-Khoury, 1997; Kurpad et al, 1997

  *** P. Fürst, personal communication**

Amino acid requirements as proposed by FAO/WHO/UNU for adults

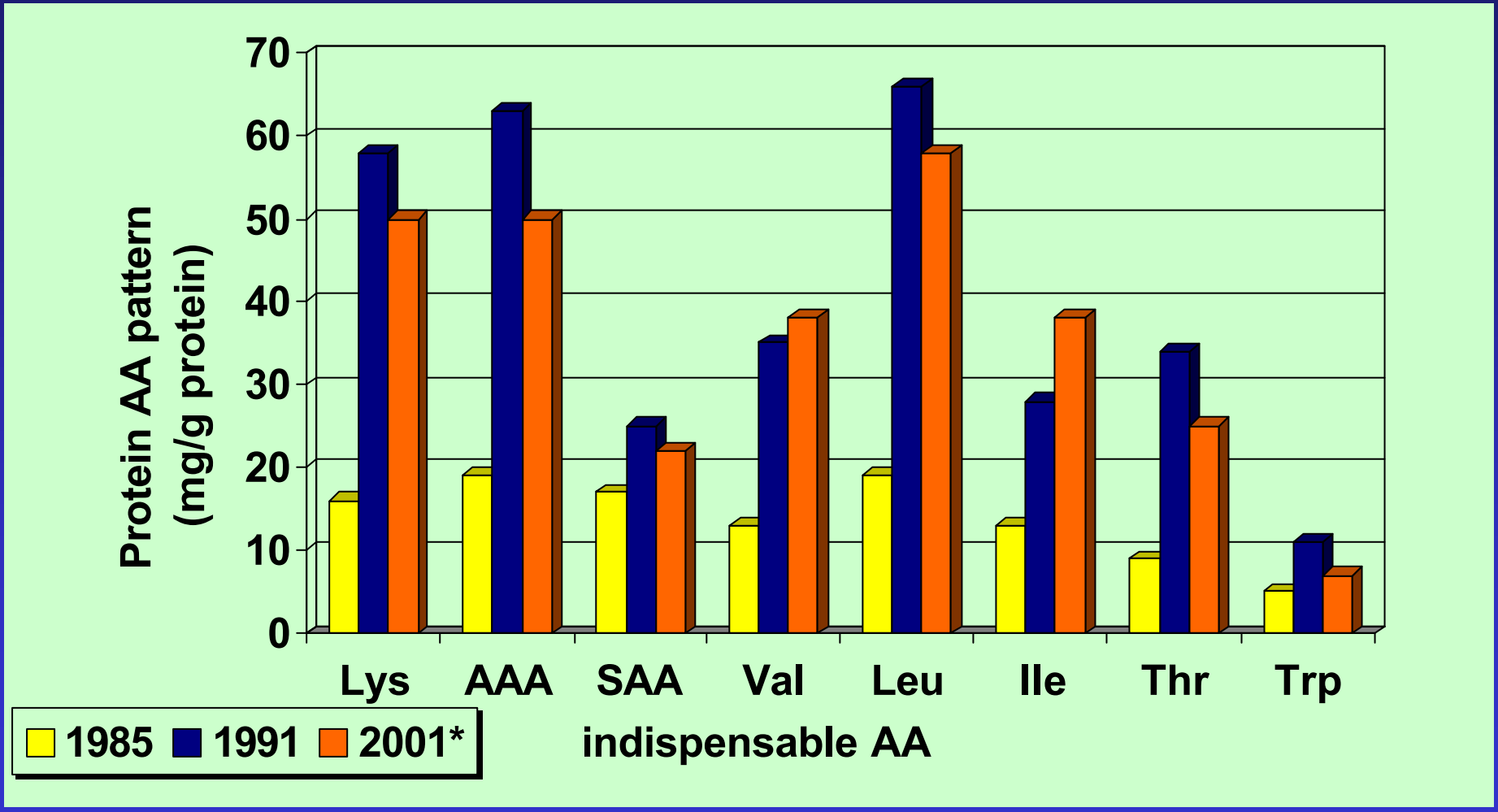
(protein intake: 0.66 g/kg.d)



* P. Fürst, personal communication

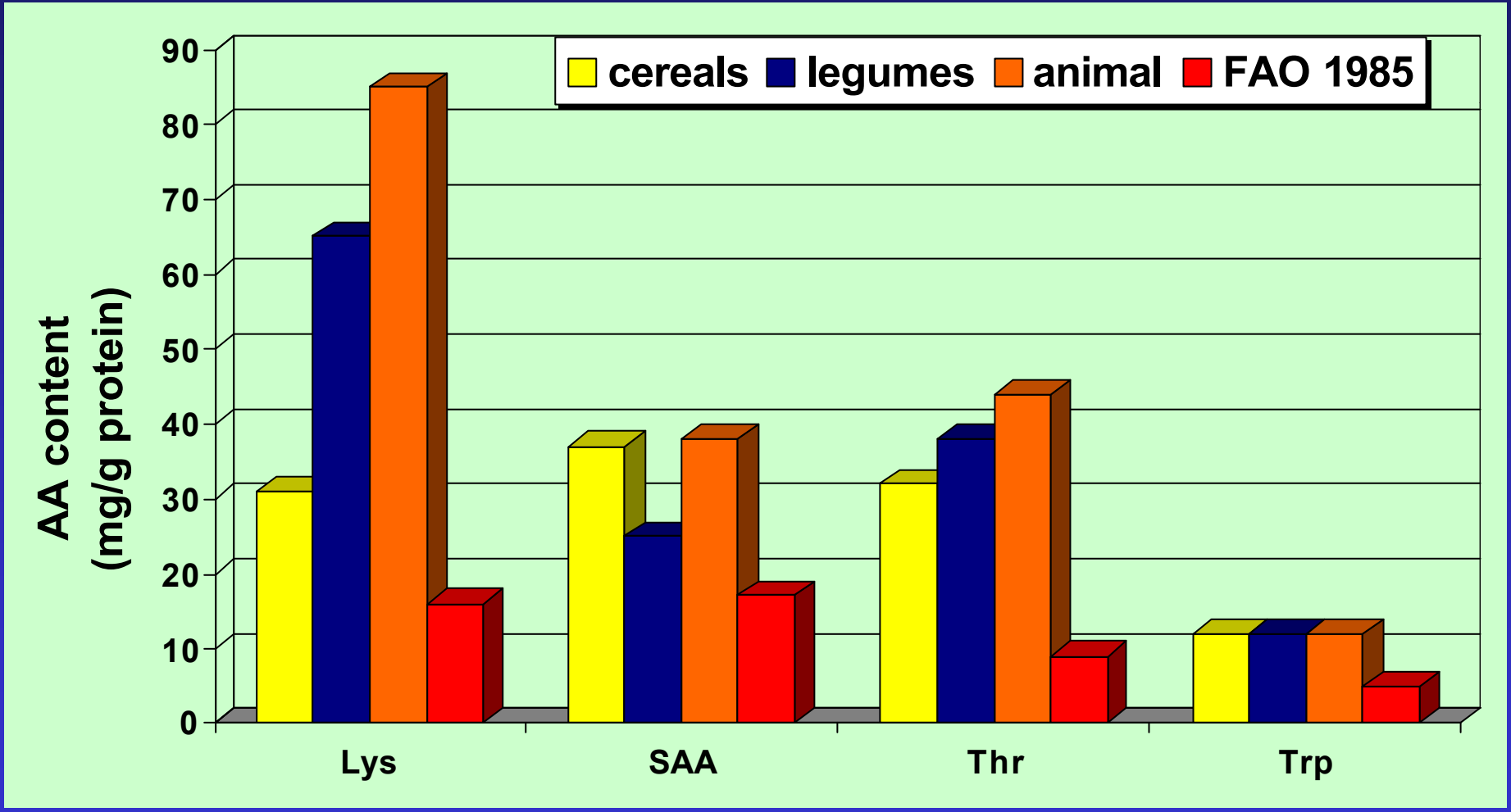
Protein amino acid pattern as proposed by FAO/WHO/UNU for adults

(protein intake: 0.66 g/kg.d)



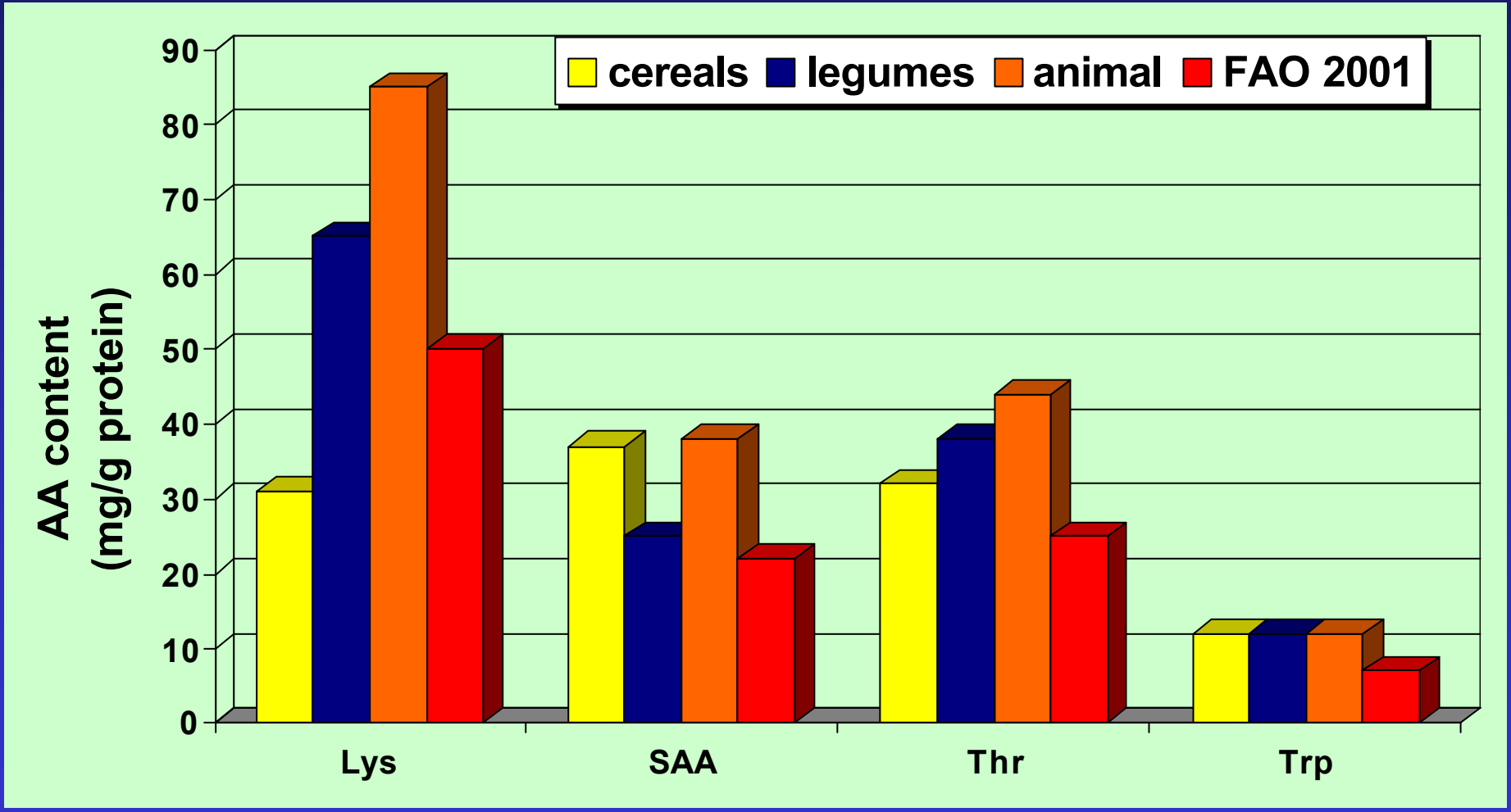
* P:Fürst, personal communication

AA content of food proteins compared with the pattern proposed by FAO/WHO/UNU 1985



FAO 1970, US Dep. Agriculture, Pellett & Young 1990, FAO/WHO/UNU 1985

AA content of food proteins compared with the pattern proposed by FAO/WHO/UNU 2001



FAO 1970, US Dep. Agriculture, Pellett & Young 1990, P. Fürst, personal communication

AA scoring patterns – influence on food security

Table 15.5 Protein Supplies per Caput per Day for Selected Regions

	Animal protein		Plant protein		Cereal protein		Total protein
	Total (g)	%	Total (g)	%	Total (g)	%	(g)
World	26	36	46	64	33	46	72
Developing Regions							
Africa	11	20	46	80	31	54	58
Asia	16	25	49	75	36	56	65
Latin America	32	45	39	55	25	36	70
Developed Regions							
North America	72	64	41	36	25	22	113
Western Europe	62	60	41	40	25	24	103
Oceania	71	69	32	31	19	19	102

Source: Data from FAOSTAT (1996).

Young et al 1998

AA scoring patterns – influence on food security

Table 15.6 Mean Values per Caput for the Availability of Specific Indispensable Amino Acids in Developed and Developing Regions

	Amino acid							
	Per day (mg)				Per g protein ($mg.g^{-1}$)			
Region[a]	Lys	Saa	Try	Thr	Lys	Saa	Try	Thr
Developing[b]	2947 (841)	2160 (583)	693 (205)	2204 (509)	49 (7)	36 (2)	11 (1)	37 (2)
Developed and transitional[c]	6149 (1172)	3619 (561)	1177 (195)	3799 (604)	64 (5)	38 (0.6)	12 (0.4)	40 (1)

SD in parentheses.

a. According to UNDP (1996) definitions.

b. Data for 61 countries

c. Data for 29 countries

WHO 2001:	50	22	25	7

Young et al 1998

AA scoring patterns – influence on food security

- „Lysine concentration of diets in several regions of the developing world appears to limit their protein nutritional quality.“
- „It now seems likely…that the poor nutritional value of the diets in some regions may be greater than our limited and somewhat crude analysis might suggest.“

Young, Scrimshaw & Pellett, 1998

Food security – protein-N/amino acids

- Changes in requirements and protein scoring patterns have strong political impact especially in the developing countries
  - Proportion of animal/pulse protein should be increased to cover needs (programmes to support livestock production; cultivation of pulse like soy)
  - Necessity to fortify food with lysine
- *alternatively:* cultivation of plant food with higher lysine content Þ a matter of science!!

Modified plants - quality protein maize (QPM)

- Compared with common hybrid maize adapted cultivars of QPM containing opaque-2 modifier genes contain increased amounts of lysine (4.4 – 4.6 g/100 g protein) and tryptophan while leucine content is decreased

  Zarkadas et al, 2000

- QPM as the sole source of dietary protein ensures equal growth rate in growing young children (Peru, Guatemala) compared with cow`s milk formula

  Graham et al, 1990; Young et al, 1998

Modified plants - quality protein maize (QPM)

- „If consumed in sufficient quantity, QPM can fully and efficiently meet adult human protein-N/amino acid requirements.“

Young, Scrimshaw & Pellett, 1998

Science and politics – summary

- Scientific progress in amino acid/protein research (RDAs, AA scoring pattern) essentially influence assessment of **food/nutrient security**

  ⇒ amino acid needs are not covered in developing countries

- Scientific progress can contribute to initiate successful **political measures** (e.g. by genetic modification of plants, large scale production of amino acids like lyseine at low costs)

Outlook

- Actual research is focussed on describing a health-promoting diet which should be available for all (*nutritional quality).*

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The future challenge for food/nutrition policy!