

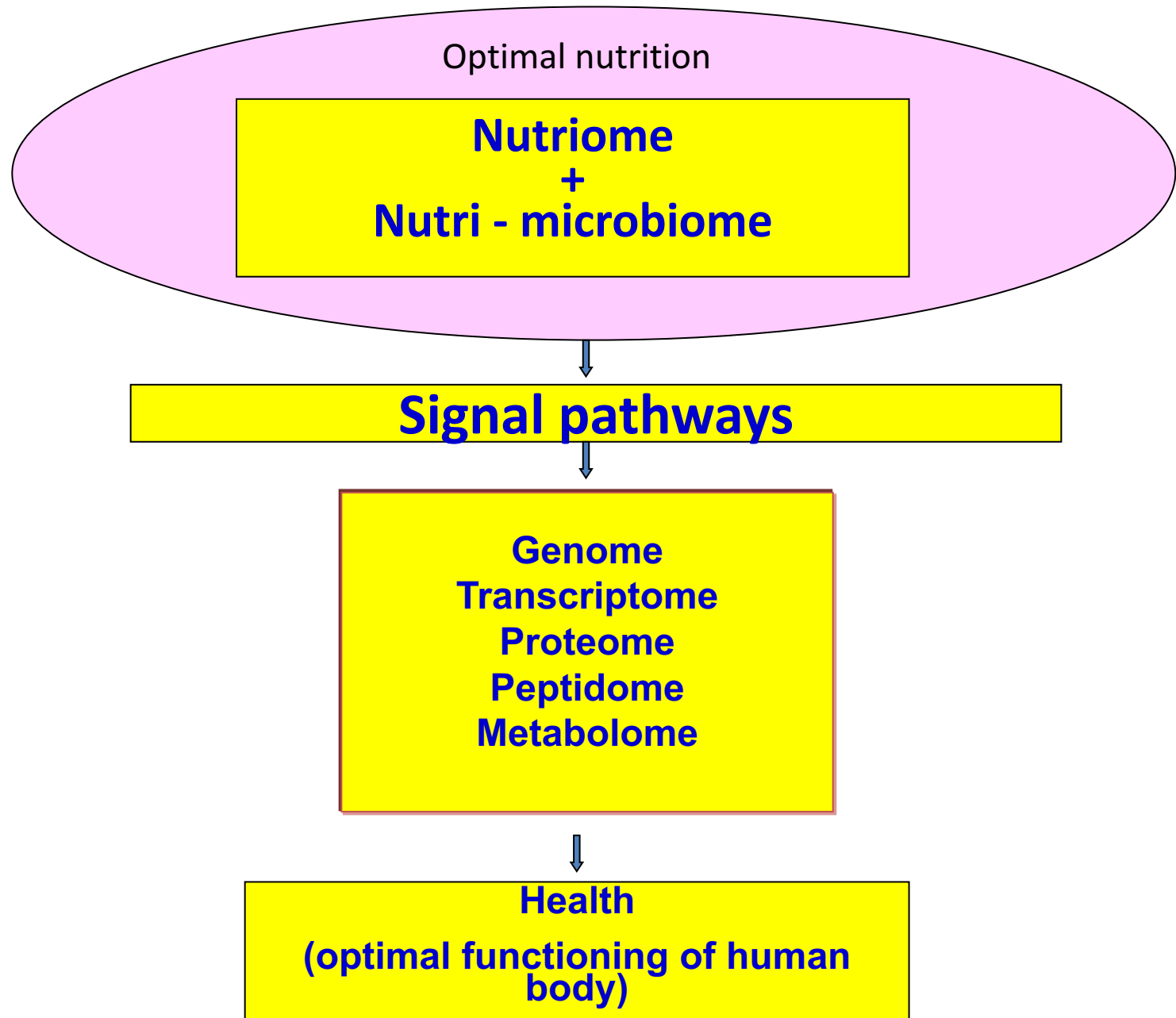
Role of Micronutrients and Botanicals in Enhancement of Human Adaptive Potential

Dr., Prof. Victor Tutelyan

**Federal Research Centre of Nutrition, Biotechnology and Food Safety
Moscow, Russia**

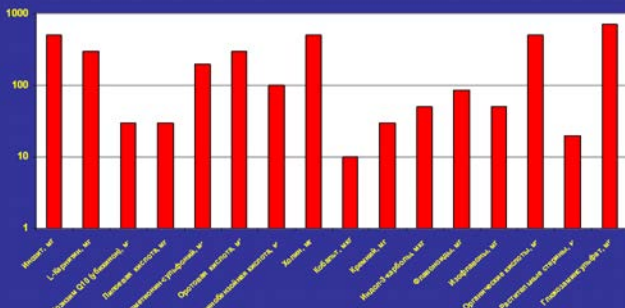
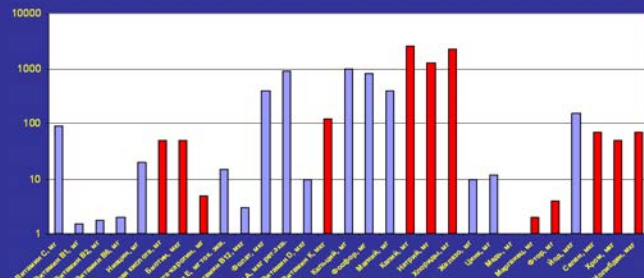
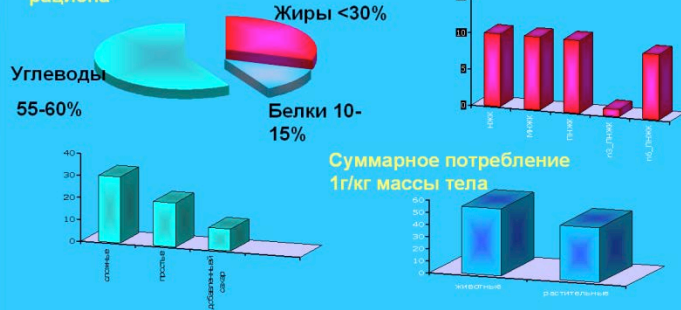
Seoul, 16th of May17





Optimal nutrition formula - *NUTRIOME*

доля основных пищевых
веществ в калорийности
рациона



Chemical compounds
of food (hundreds)

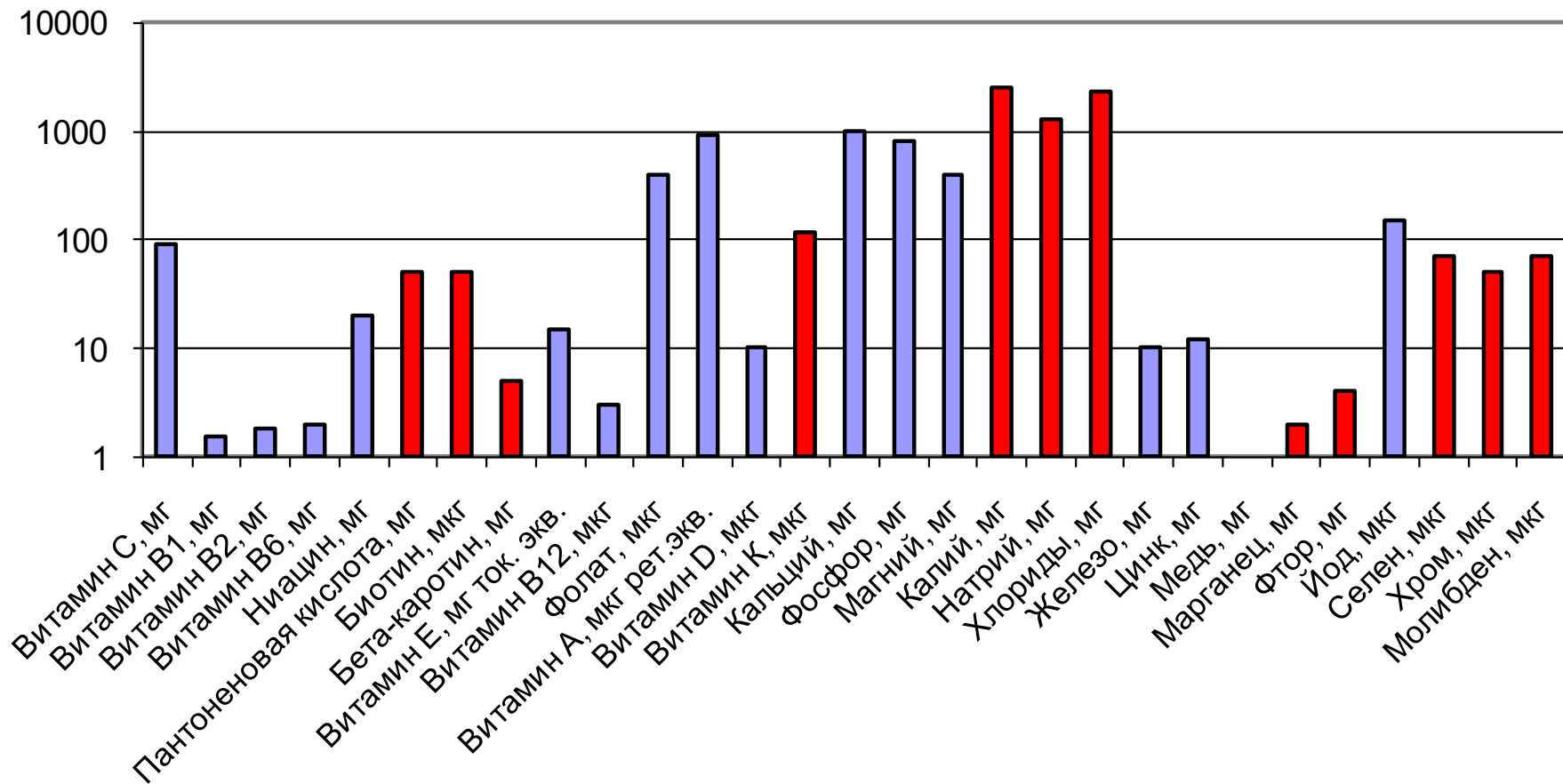


Foods and dishes
(∞ stands for infinity)

Optimal Nutrition Formula - ***NUTRIOME***

Males older than 60 years, energy value - 2390 kcal)

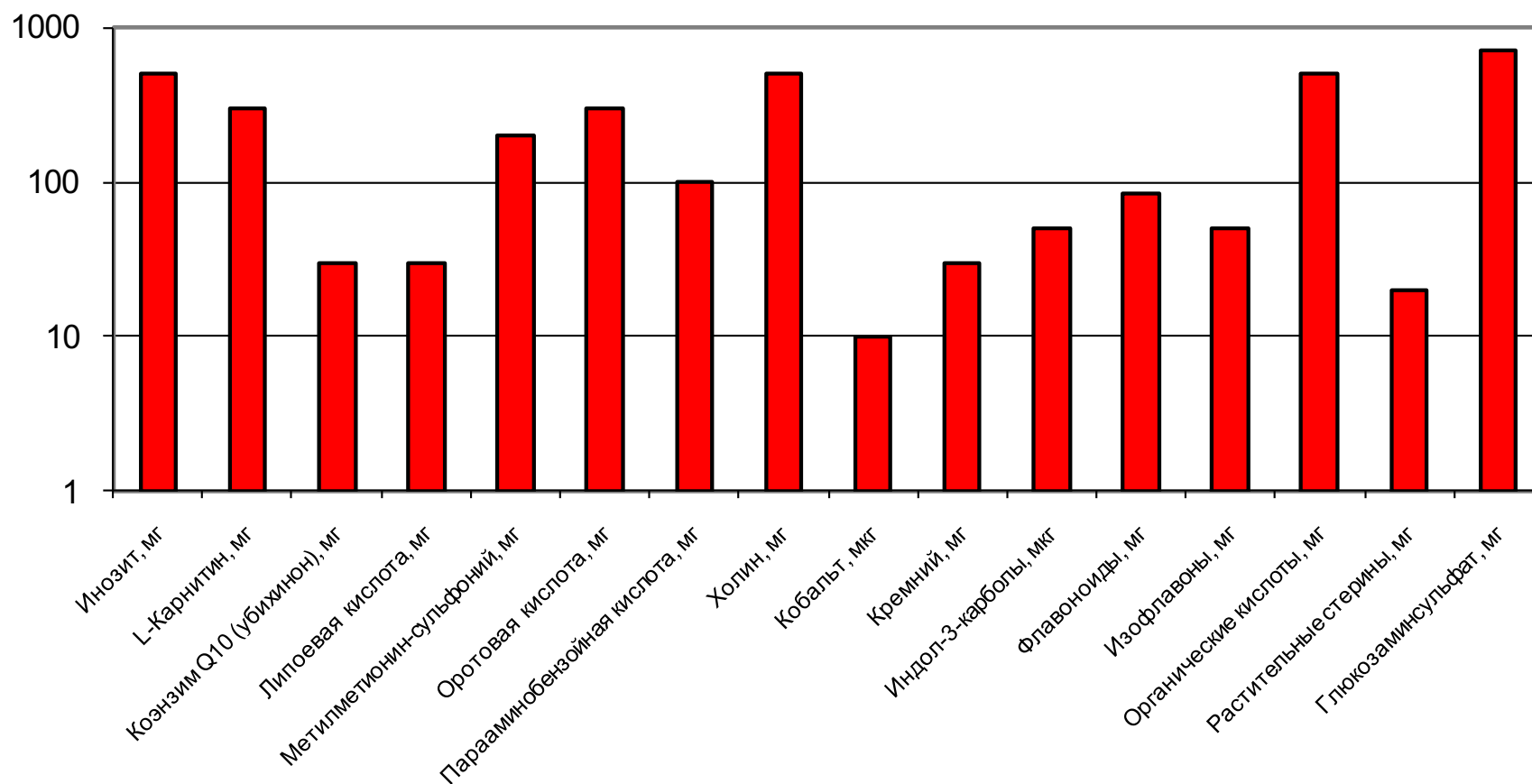
Micronutrients



Optimal Nutrition Formula - ***NUTRIOME***

Males older than 60 years, energy value - 2390 kcal)

Micronutrients and Botanicals with target physiological activity



1183

Государственное санитарно-эпидемиологическое нормирование
Российской Федерации

2.3.1. РАЦИОНАЛЬНОЕ ПИТАНИЕ

**Нормы физиологических потребностей
в энергии и пищевых веществах
для различных групп населения
Российской Федерации**

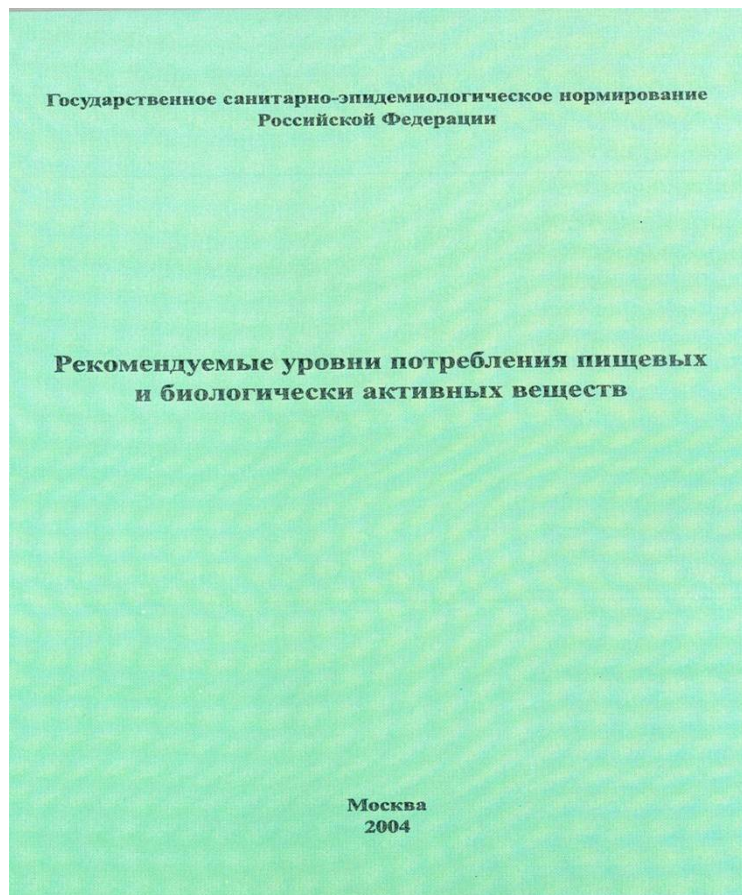
Методические рекомендации
МР 2.3.1.2432—08

Издание официальное

Москва • 2009

Fundamental research in the field of evaluation of human requirements in various nutrients allows to make **Physiological levels of energy and essential nutrients for various population groups in the Russian (MP 2.3.1.2432-08)** more precise.

This document provides a basis for numerous practical applications.



**Recommended daily
allowances of over 100
nutrients and 60
biologically active
substances for adults**

Nutrients and biologically active substances	Traditional food sources (food products and raw materials)	Alternative sources of nutrients and BAS identical to natural	Adequate consumpti on level	Maximum consumpti on limit
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Adaptive Potential

Antioxidant defense system

- Antioxidant activity of blood plasma
- Glutathionperoxidase
- Glutathione reductase
- Catalase
- *Ex vivo* microsomal lipid peroxidation
- Malondialdehyde content
- Xanthine oxydase

System of xenobiotic metabolism enzymes

- CYP1A1
- CYP1A2
- CYP2B1
- Glutathione transferase
- Chinoïn reductase
- UDP-Glucoronosyltransferase
- Epoxy hydrolase

Immune system

- Cytokines
- Interleukin 2
 - Interleukin 4
 - Interferon-gamma

Apoptosis regulation

- Lysosom membrane stability disorders
- Release of hydrolases
- Activation of caspases

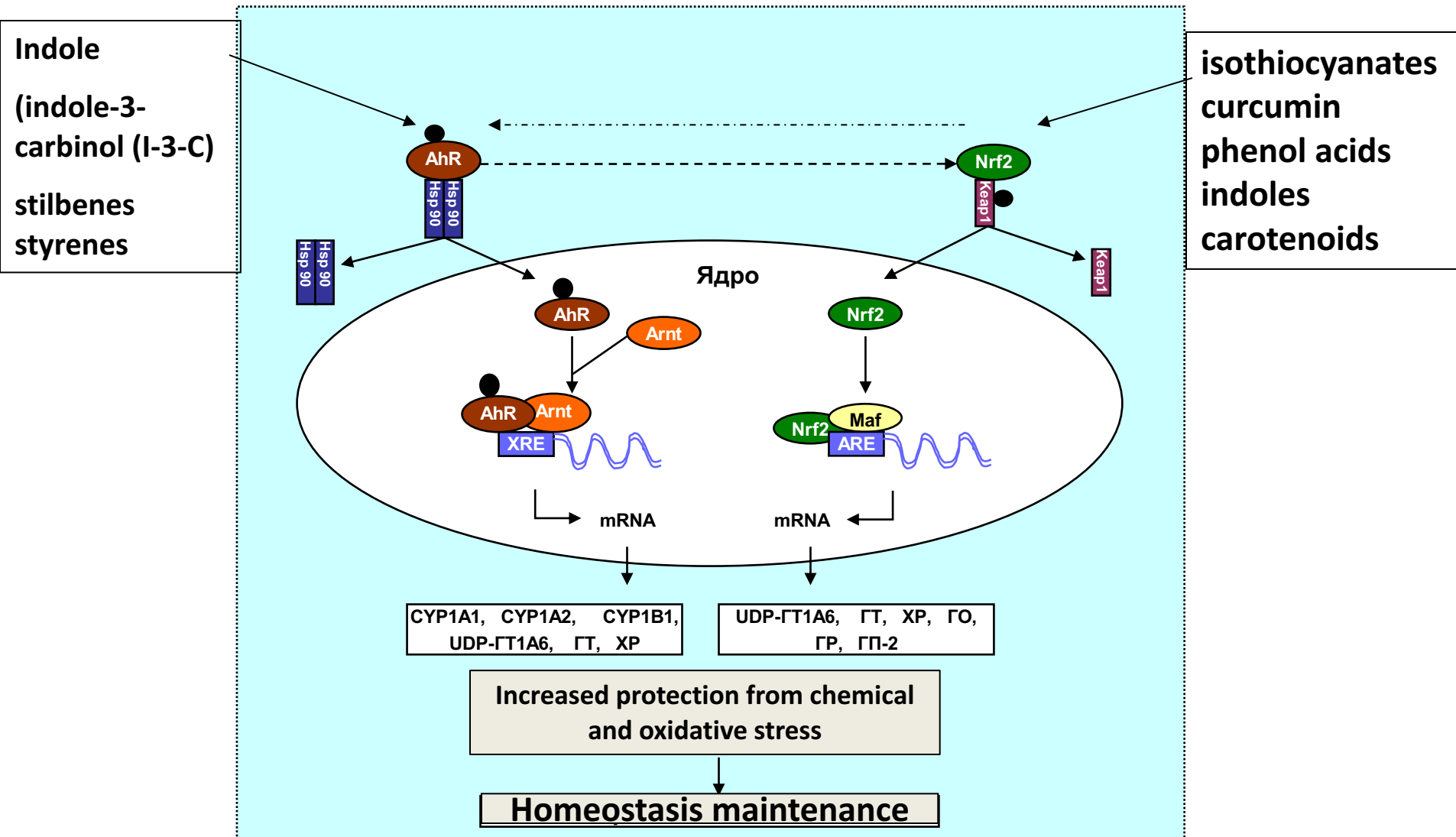
Cell protection from oxydative and chemical stress

Forming of immunity barrier

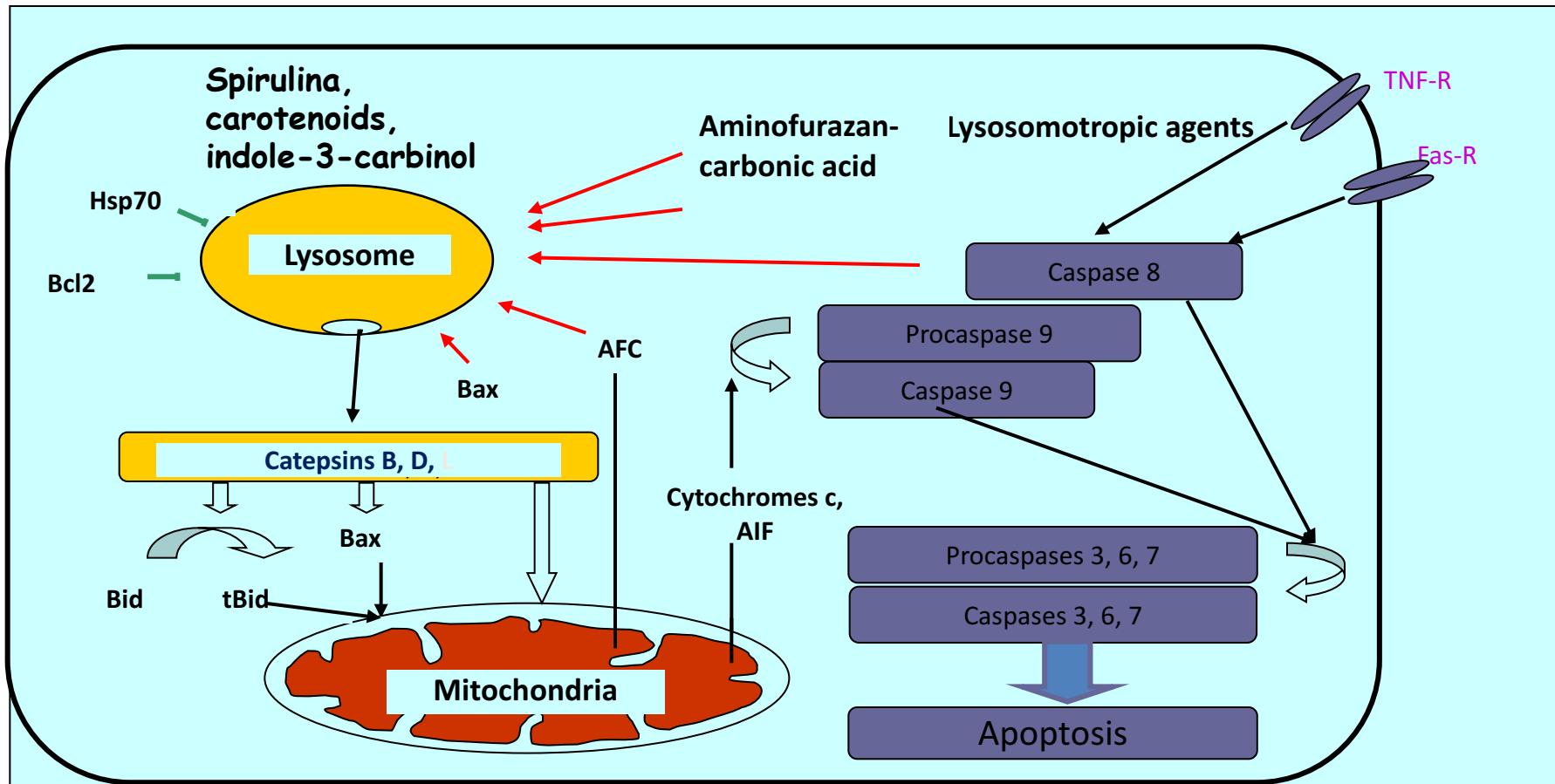
Cell survivability?

Homeostasis maintenance

Role of Botanicals in Regulation of Activity of Xenobiotic Metabolism Enzymes and Antioxidant Defense



Possible Role of Lysosomes in Apoptosis



	Control	I-3-C
Penetrability	100%	60%
Catepsin B	100%	75%
Apoptosis cells	6,9±0,5 (100%)	4,1±0,3* (60%)

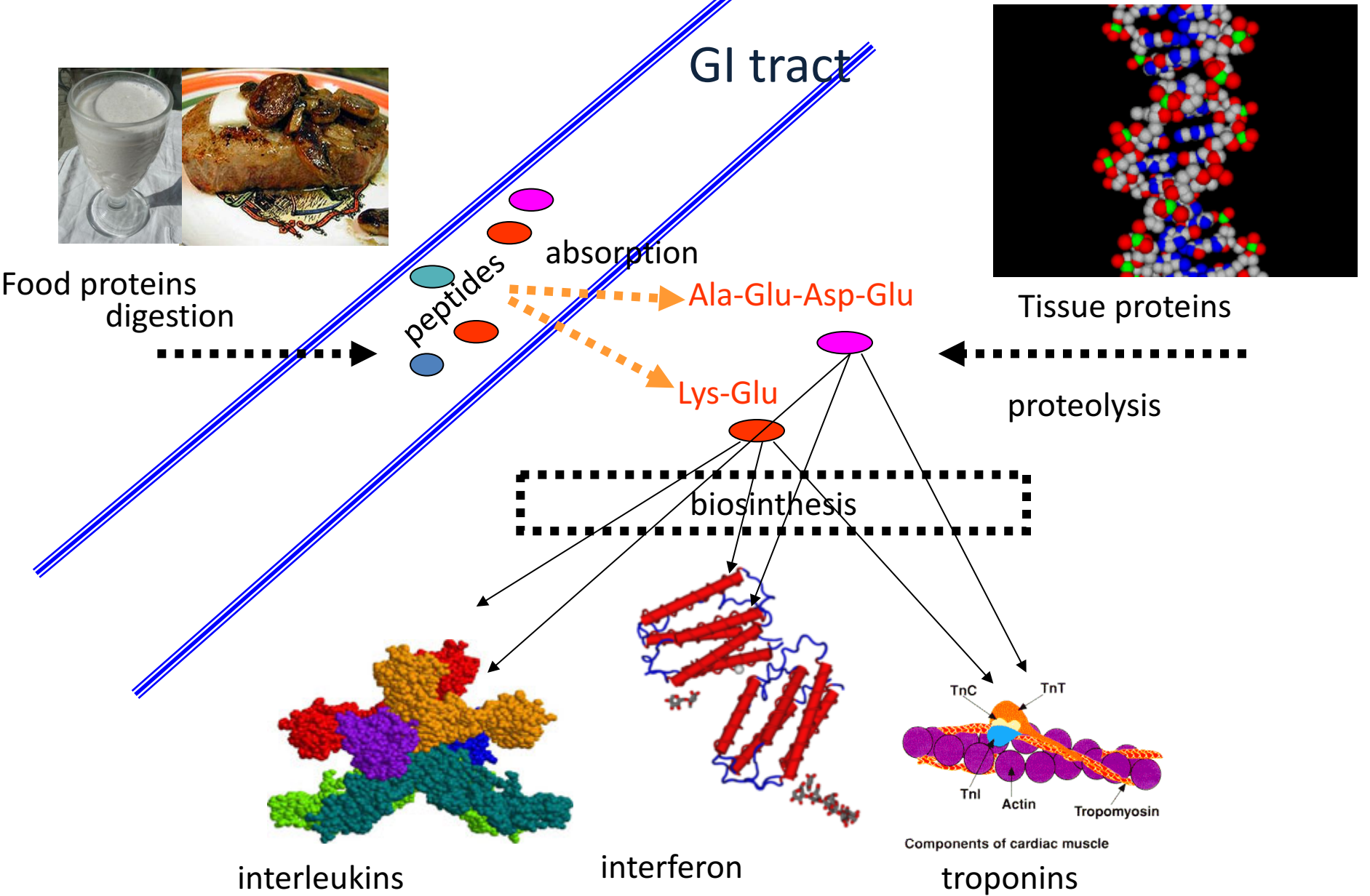
↓ - membrane stabilizer
 ↑ - membrane destabilizer

Bcl2 – anti-apoptotic protein

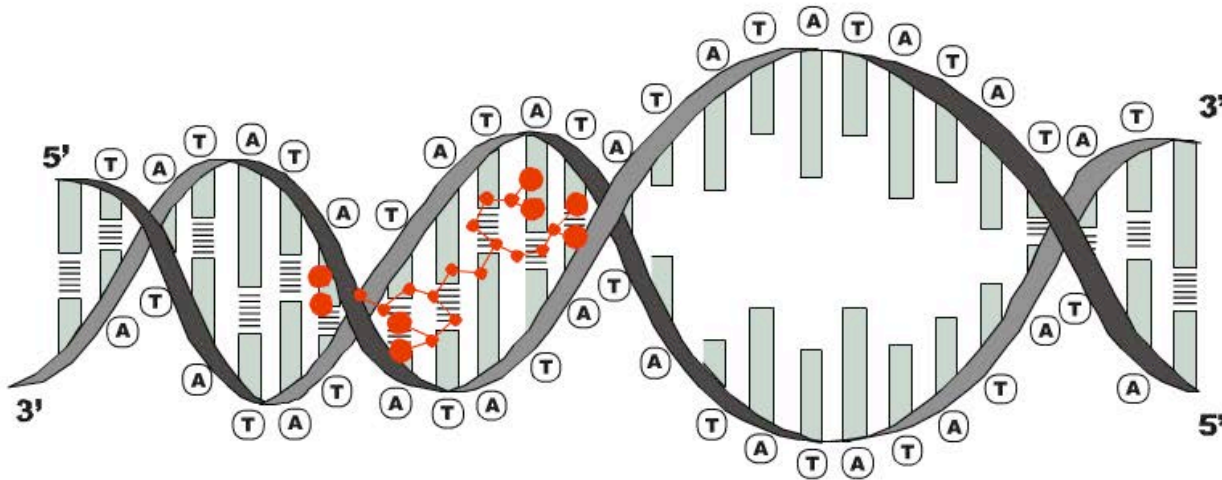
Bax, Bid – pro-apoptotic proteins

TNF-R, Fas-R – apoptosis receptors

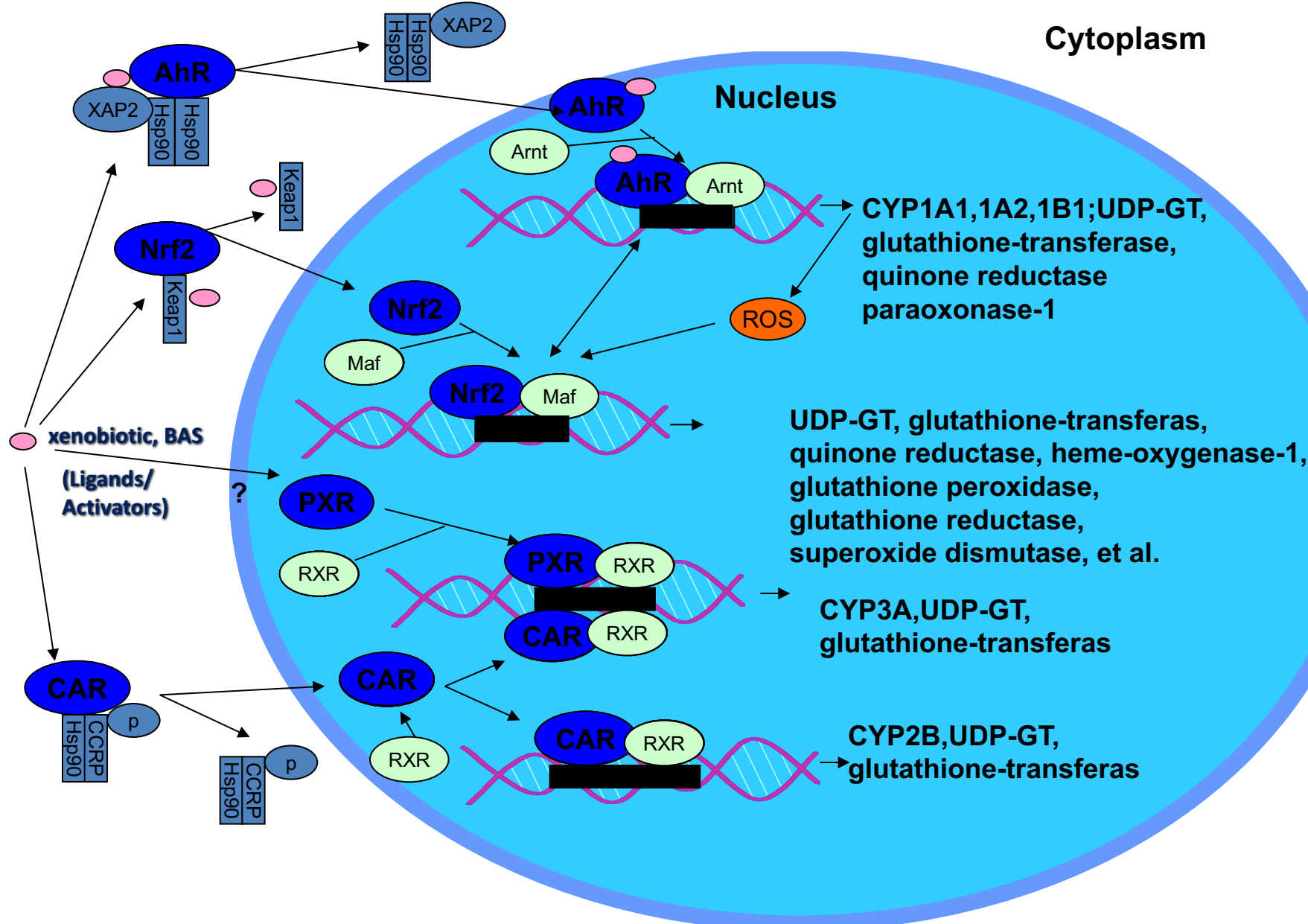
Exogenous Peptides in Regulatory Proteins Synthesis



Scheme of Local Separation of Chains due to Binding Regulatory Peptide Ala-Glu-Asp-Gly in Large Groove of DNA Double Helix

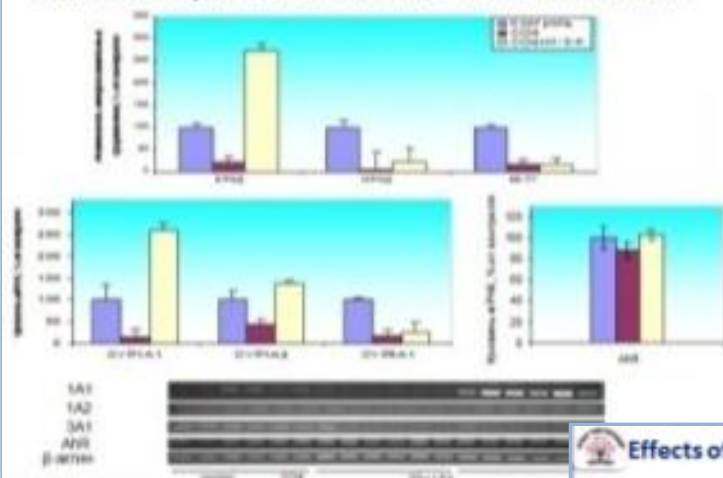


≡ - hydrogen bond between adenine and thymine (Watson-Crick model)

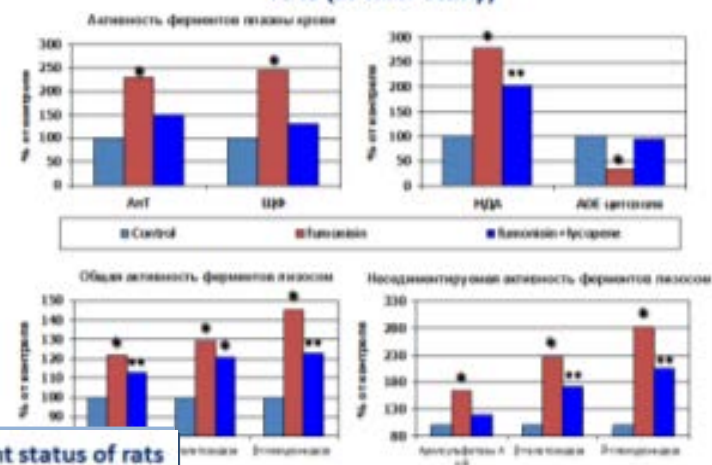


Results of *in vitro* research on cell cultures

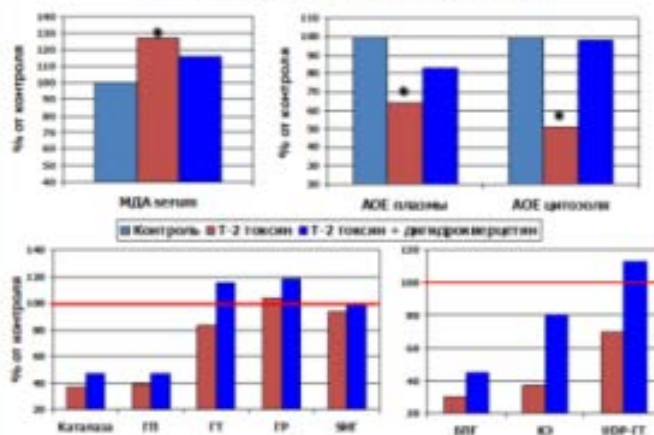
Treatment with I-3-C Resulted in Recovery of Activities and Gene Expression of CYP1A1, CYP1A2 and CYP3A1



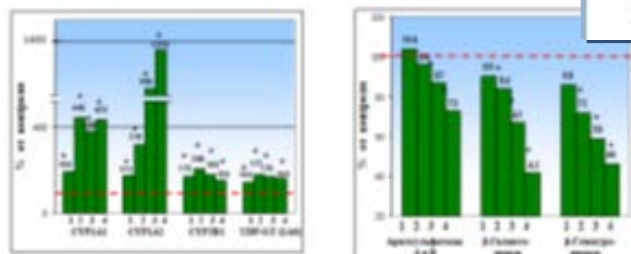
Effect of lycopene on fumonisin hepatotoxicity in rats (*in vivo* study)



Effects of dihydroquercetin on antioxidant status of rats at T-2 mycotoxigenesis (*in vivo* study)



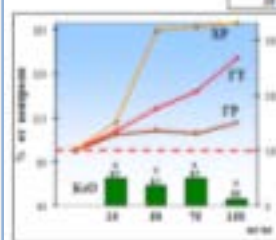
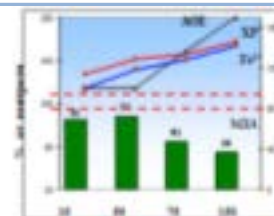
in vivo Activity of xenobiotics metabolizing enzymes liver of rats received diets with indole-3-carbinol



Unsedimentable activities of liver lysosomal enzymes of rats received diets with indole-3-carbinol

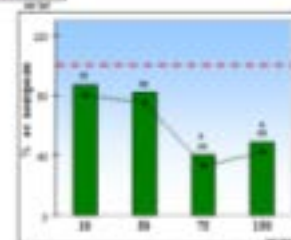
1 - 10 mg/kg
2 - 50 mg/kg
3 - 75 mg/kg
4 - 150 mg/kg

Antioxidant capacity of the blood plasma of rats received diets with indole-3-carbinol



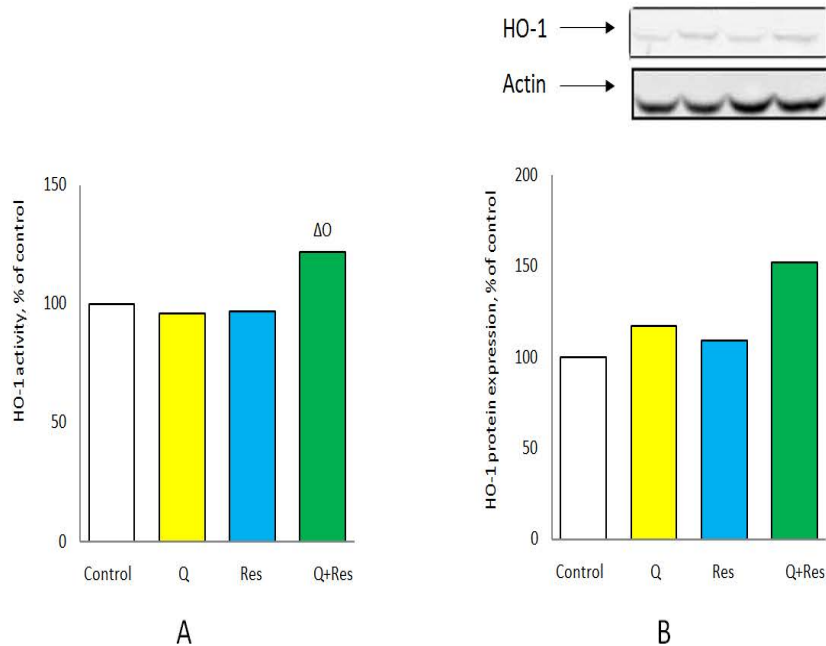
Antioxidant potential of liver of rats treated with indole-3-carbinol

SP - superoxide
GP - glutathione peroxidase
GP - glutathione peroxidase
GP - glutathione peroxidase



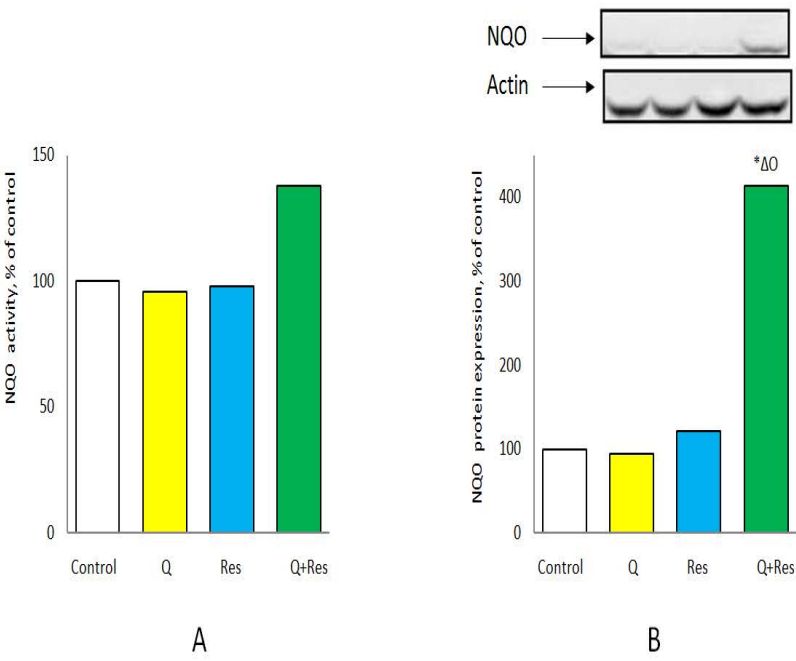
Effect of indole-3-carbinol *EX VIVO* on lipid peroxidation of microsomes

Increased activity (A) and protein expression (B) of the enzyme hemoxygenase-1 in the liver of rats after separate and combined action of Quercetin and Resveratrol



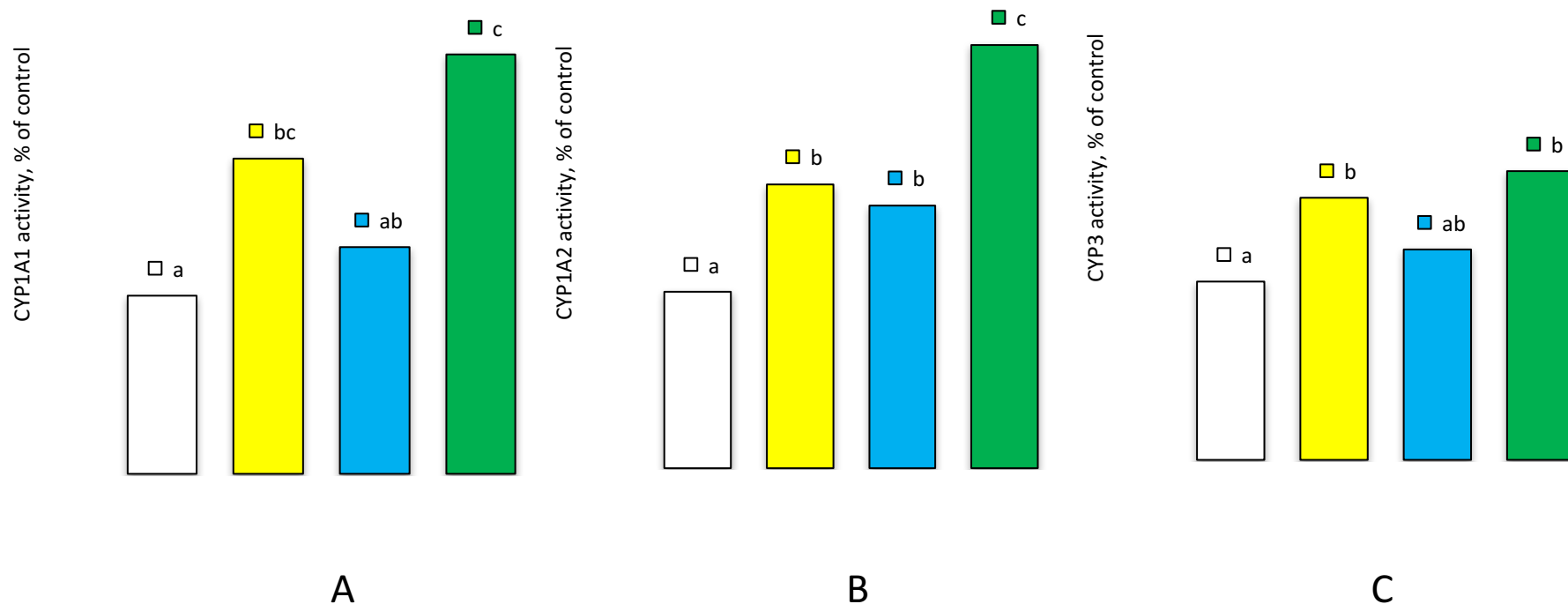
Notes: Δ-statistically significant difference ($p<0.05$) in comparison with Quercetin group, O – Resveratrol group.

Increased activity (A) and protein expression (B) enzyme NAD(P)H-quinone oxidoreductase in the liver of rats after separate and combined action of Quercetin and Resveratrol



Notes: * - statistically significant difference ($p<0.05$) compared to control group, Δ – Quercetin group, O - Resveratrol group.

Increased activity of CYP1A1 (A), CYP1A2 (B) and CYP3A (C) in the liver of rats after separate and combined action of Curcumin and Quercetin



Notes: Values marked with different letters (a, b, etc.) have statistically significant differences ($p \leq 0.05$).

Research of Chemical Composition for 29 29 Vegetables and Fruits

(joint research programme with Science City Michurinsk)



Vegetables

Tomato
Topinambur
Pumpkin
Pumpkin seeds
Garlic
Hot pepper
Serpent root
Sweet pepper



Fruits

Apples
Cherry
Prunus
Pear
Apricot
Cherry plum



Berries

Raspberry
Hawthorn
Black currant
Garden strawberry
Gooseberry
Actinidia
Honeyberry
Seabuckthorn
Arrowwood
Cornelian cherry
Red currant
Rose hip
White currant
Blackberry
Sun Berry

Food Chemical Composition Database www.ion.ru

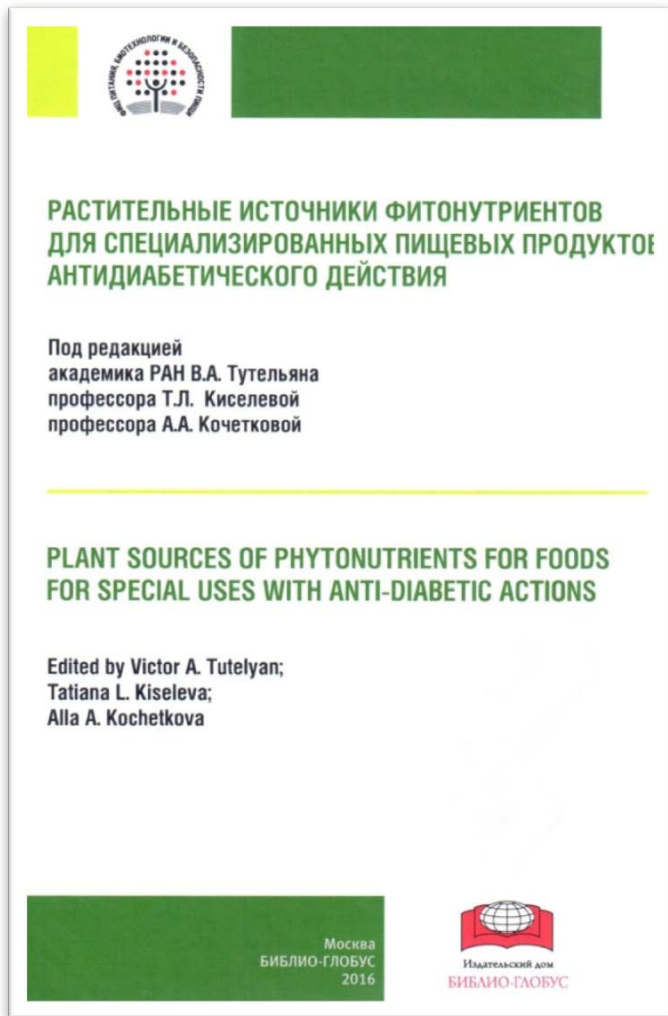
ИНФОРМАЦИОННО-АНАЛИТИЧЕСКАЯ СИСТЕМА

БАЗА ДАННЫХ "ХИМИЧЕСКИЙ СОСТАВ ПИЩЕВЫХ ПРОДУКТОВ, ИСПОЛЬЗУЕМЫХ В РОССИЙСКОЙ ФЕДЕРАЦИИ"

- [-] Молоко и молочные продукты
- [-] Яйцепродукты
- [-] Мясо и мясные продукты
- [-] Рыба. Нерыбные объекты промысла и продукты из них
- [-] Жировые продукты (жирностью более 50%)
- [-] Зерно и продукты его переработки
- [-] Бобовые, орехи
- [-] Овощи, грибы и продукты их переработки
 - [-] Овощи
 - [-] Листовые
 - [-] Капуста
 - [-] Белокочанная
 - [-] Брюссельская**
 - [-] Кольраби
 - [-] Краснокочанная
 - [-] Цветная
 - [-] Луковые
 - [-] Картофель
 - [-] Корнеплоды
 - [-] Другие овощные культуры
 - [-] Грибы
- [-] Фрукты, ягоды и продукты их переработки
- [-] Кондитерские изделия
- [-] Напитки
- [-] Вспомогательные пищевые продукты и улучшители вкуса

Наименование	Значение
Вода, в %	86
Белок, в %	4,8
Жир, в %	0,3
НЖК, в %	0,1
Холестерин, в %	0
МДС, в %	2,7
Крахмал, в %	0,4
Углеводы, в %	3,1
Пищ вол, в %	4,2
Орган кисл, в %	0,3
Зола, в %	1,3
Натрий, в мг%	7
Калий, в мг%	375
Кальций, в мг%	34
Магний, в мг%	40
Фосфор, в мг%	78
Железо, в мг%	1,3
Ретинол, в мкг%	0
Каротин, в мкг%	300
Ретин экв, в мкг%	50
Токо экв, в мг%	1
Тиамин, в мг%	0,1
Рибофлавин, в мг%	0,2
Ниацин, в мг%	0,7
Ниацин экв, в мг%	1,5
Аскорб кисл, в мг%	100
Энерг ценн, в ккал.	35

Medicinal and Edible Plants as a Source of Botanicals



Ethnobotanical approaches to the selection of medicinal and edible plants which are promising sources of phytonutrients

En example of development of Food supplements and foods for special dietary uses for patients with type 2 diabetes



The analysis of **200** prescription reference books of Russia, Ukraine, Belarus has been done.



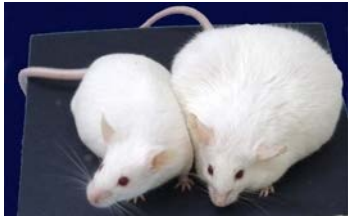
There are **66** reference books containing **550** antidiabetic prescriptions, which includes **237** medicinal plants in different combinations.

Among them:

- Leaves of blueberry– **100%** of prescriptions (flavonoids)
- Beans shell – **73%** of prescriptions (guanidines)
- Leaves of nettle – **65%** of prescriptions (complex of vitamins, flavonoids and phytosterols)



Analysis of allergy risks of inclusion of extracts from these plants in dietary supplements and specialized foods has been done.
It is shown that the extract of blueberry leaves has minimal risk.



The efficacy of the extract of blueberry leaves has been demonstrated on the streptozotocin induced diabetes model (*in vivo*). Beneficial effects are hypoglycemic and antioxidant.

Formulations of foods for special dietary uses with modified carbohydrate profile have been developed.

The efficacy of these products intended for patients with type 2 diabetes mellitus is shown in clinical trial .

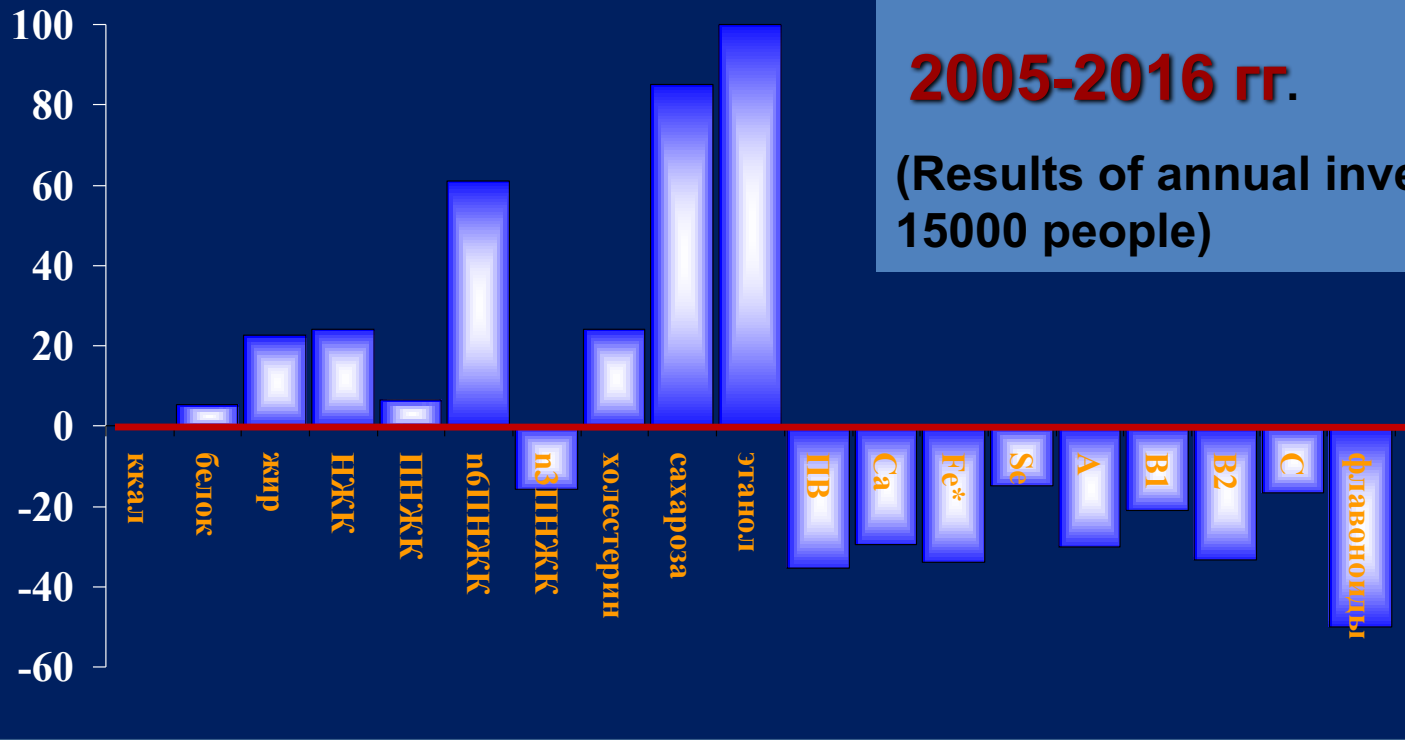
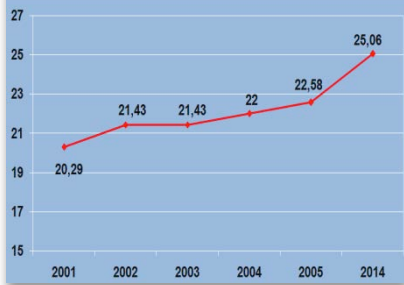
This clinical trial has been carried out in Clinic of Federal Research Centre of Nutrition, Biotechnology and Food Safety



Food consumption patterns in Russian population

*Overconsumption of high energy foods and vitamins and micronutrients deficiency lead to growth of **obesity** prevalence between adults (up to 23%) and children (up to 7%) as well as decreasing **adaptive potential** of the popular majority in the Russian Federation*

Распространенность ожирения среди взрослого населения Российской Федерации



Malnutrition in the RF population,

2005-2016 гг.

(Results of annual investigation of 15000 people)

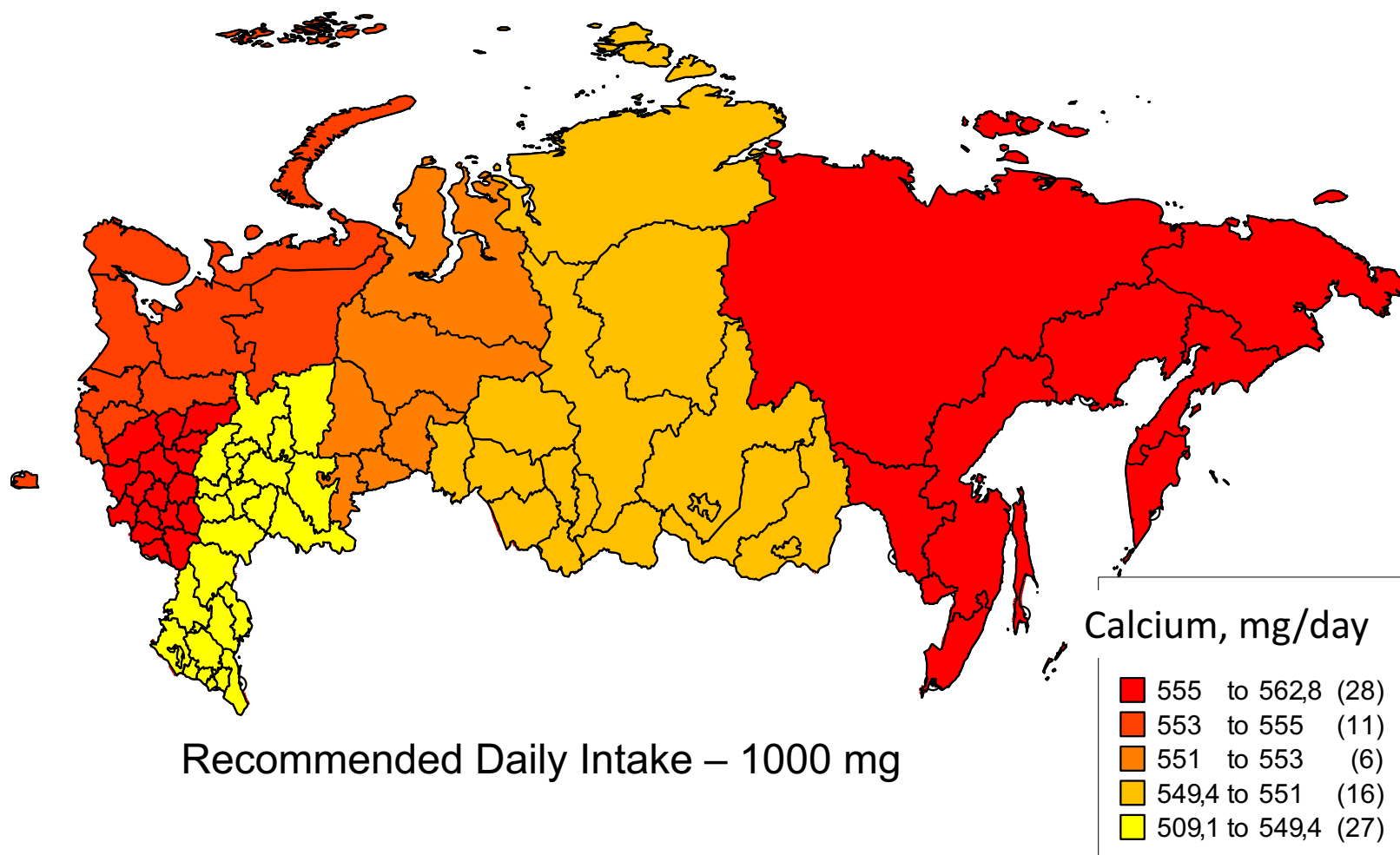
Requirements

Micronutrients deficiency



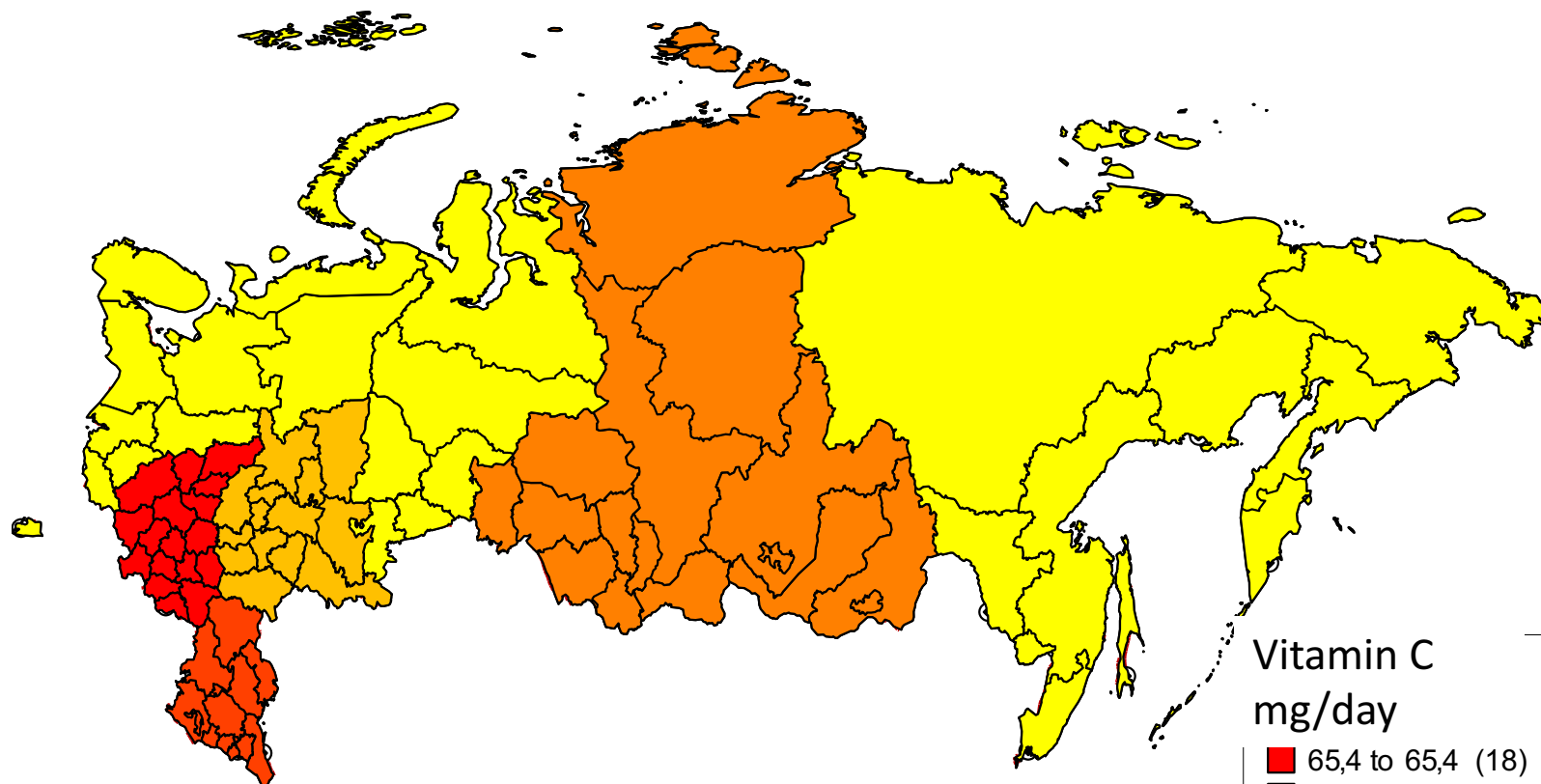
Calcium Intake in the Russian Adult Population in 2016:

510-560 mg per day



Vitamin C Intake in the Russian Adult Population in 2016:

50-65 mg per day



Recommended Daily Intake – 100 mg

Vitamin C
mg/day

Red	65,4 to 65,4	(18)
Dark Orange	58,9 to 65,4	(12)
Orange	57,9 to 58,9	(16)
Light Orange	54 to 57,9	(15)
Yellow	49,8 to 54	(27)

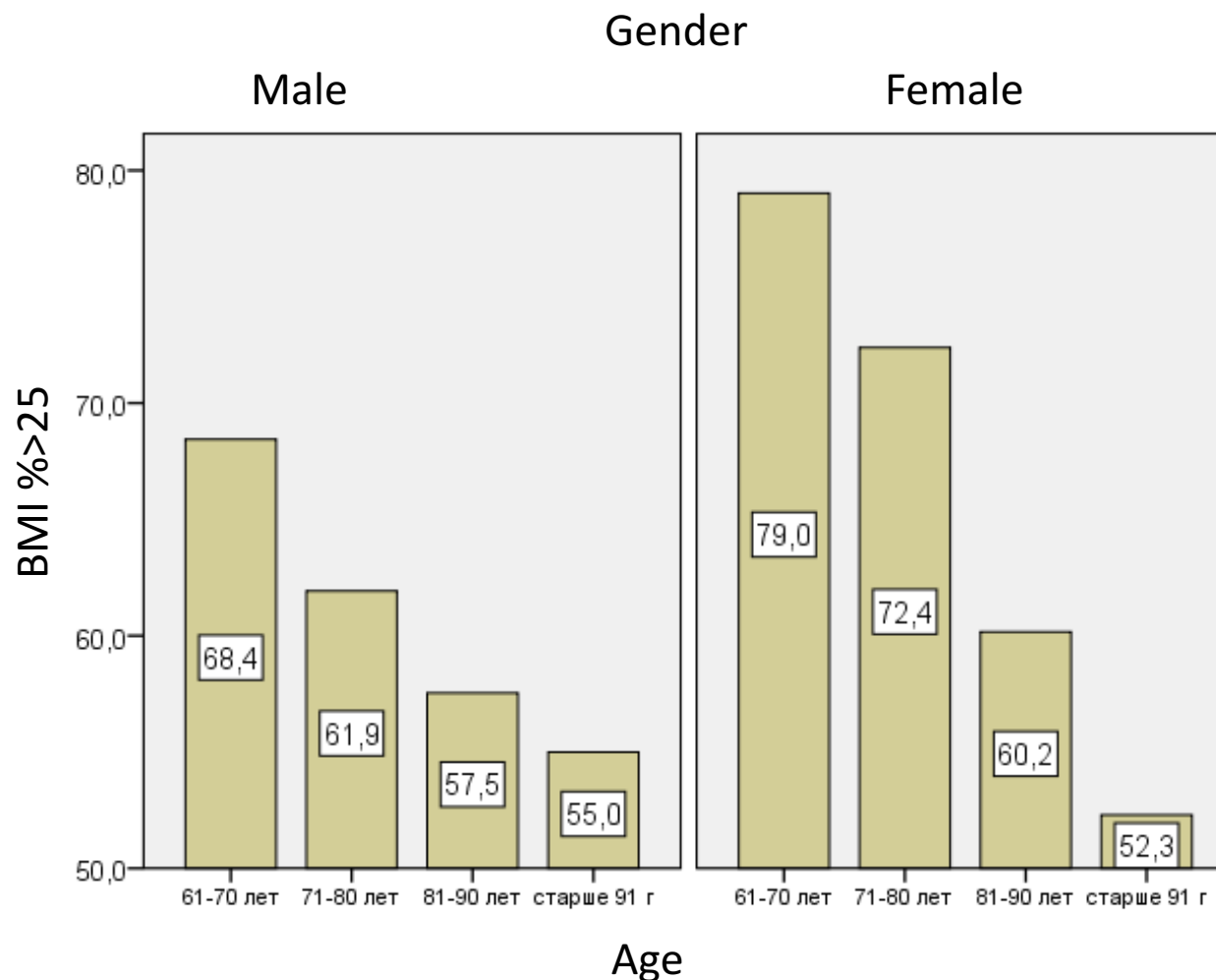
Intake of Various Nutrients in Population Aged 60 and Above

Daily Intake	Age				Requirements
	61-70 y.o.	71-80 y.o.	81-90 y.o.	91 and above	
	Actual Intake				
Protein, g	83,3	74,5	67,4	63,2	68
Protein ratio %E	14,1	14,1	13,94	13,8	11,8
Fat, g	100,0	81,5	72,1	67,9	77
Fat ratio %E	37,4	34,2	32,9	32,9	30
Carbs, g	286,5	273,1	258,35	243,3	335
Energy value, kcal	2 390	2 129	1 953	1 838	2300
vitamin A, mg	0,59	0,51	0,44	0,39	0,9
vitamin B1, mg	1,26	1,13	0,99	0,91	1,5
Vitamin B2, mg	1,40	1,32	1,23	1,17	1,8
vitamin C, mg	80,1	69,7	63,1	56,1	90
Calcium, mg	820,0	787,6	754,2	744,3	1200

Intake of Main Groups of Foods in Population Aged 60 and Above

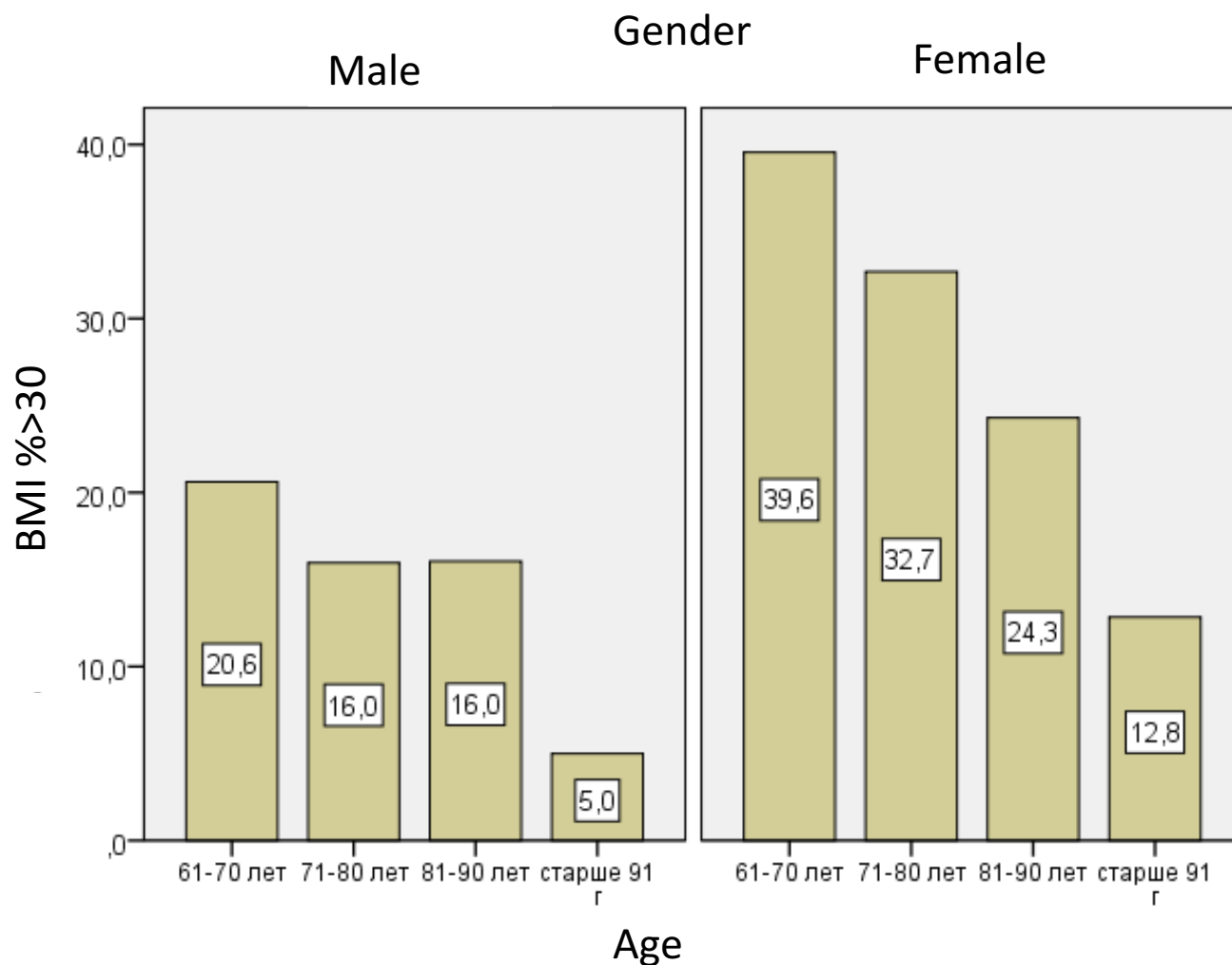
•	Daily Intake	Age			
		61-70 y.o.	71-80 y.o.	81-90 y.o.	91 and above
•					
•	Bread and Bakery	251,6	241,2	226,4	211,4
•	Vegetables	288,7	243,3	197,5	168,1
•	Potato	188,8	170,8	152,7	127,8
•	Sugar	65,6	61,9	60,8	61,7
•	Meat and Meat Products	217,9	171,4	146,4	133,3
•	Fish and Sea Food	73,6	57,71	45,6	44,7
•	Milk and Dairy products	800,0	776,634	777,9	762,5
•	Batter	11,8	11,0	10,4	9,0
•	Egges	24,5	20,1	17,1	12,7
•	Vegetable oil	25,6	19,0	13,6	11,6
•	Fruits and Berries	199,8	177,6	175,0	164,2
•					

Overweight and Obesity Prevalence in Population Aged 60 and Above



Obesity Prevalence

in Population Aged 60 and Above



Detection Rate of Vitamin D Deficiency Associated with Various Diseases

(concentration of 25-OHD in blood serum)

Patients: ELDERLY PEOPLE	Region, year, quantity	Proportion of deficiency (inadequacy), %
chronic heart failure	St. Petersburg, n=209	(>75)
disseminated sclerosis	St. Petersburg, n=33	81 (15)
psoriasis and psoriatic arthritis	Irkutsk, n=123	(73,2)
obesity and arterial hypertension	Moscow, 2015 г., n = 93 чел.	51
tuberculosis	Kazan, 2015-2016 гг., n = 48 чел.	77
inflammatory disease of paradontium	Arkhangelsk, n=58	98,3
type 2 diabetes mellitus in postmenopause	Sverdlovskaya obl., 2015 г., n=15 femails	(93,3)



ICN2 Second International Conference on Nutrition
better nutrition better lives
19-21 November 2014, Rome, Italy



Food and Agriculture
Organization of the
United Nations



World Health
Organization

International research project «Cross-Cultural Quality of Life Survey. Health and Nutrition»

Partners:

- WHO
- Federal Research Centre of Nutrition, Biotechnology and Food Safety
(former Institute of Nutrition of the Russian Academy of Sciences)
- Vision International People Group

Background:

Implementation of the 2011 Moscow Declaration on NCDs, the 2011 Political Declaration on NCDs and the 2014 Rome Declaration on Nutrition

Aim:

To develop an Internet-based system to allow the quality of life, health, and nutrition management through monitoring of these across countries, detecting NCD risk factors, and providing personalized feedback with health promotion and disease prevention advice and recommendations.

Food Consumption Patterns Across Age Groups

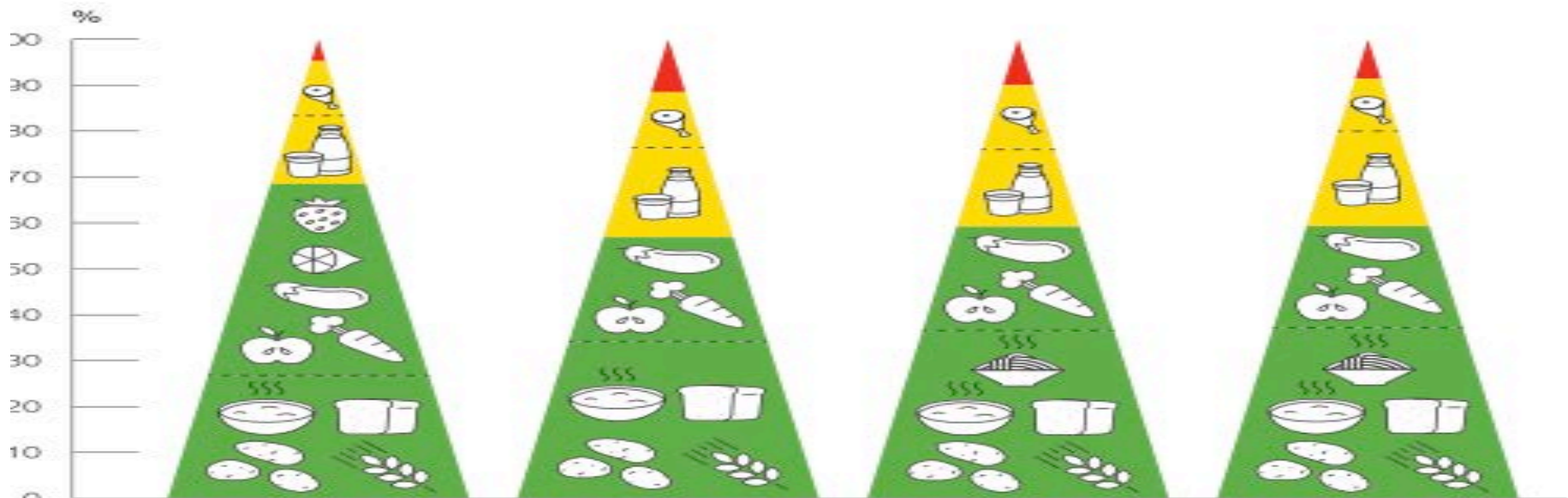
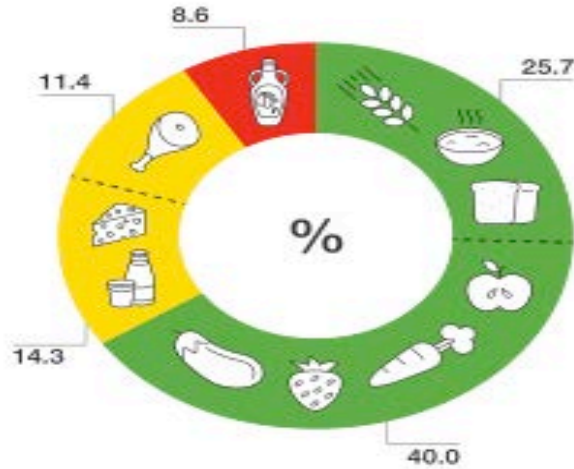
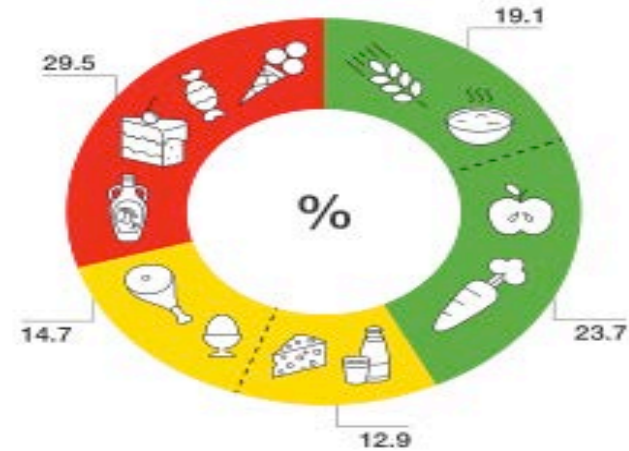


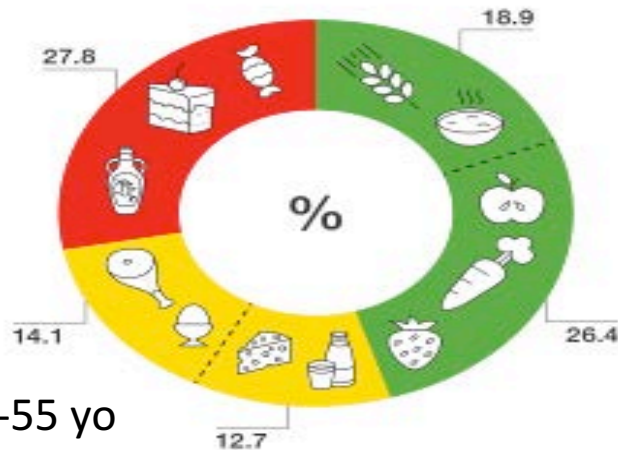
Plate: foods intake ratio across age groups



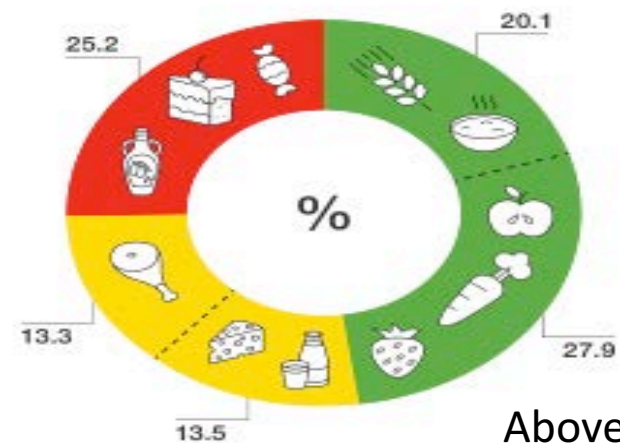
WHO guidelines



Under 35 years



35-55 yo



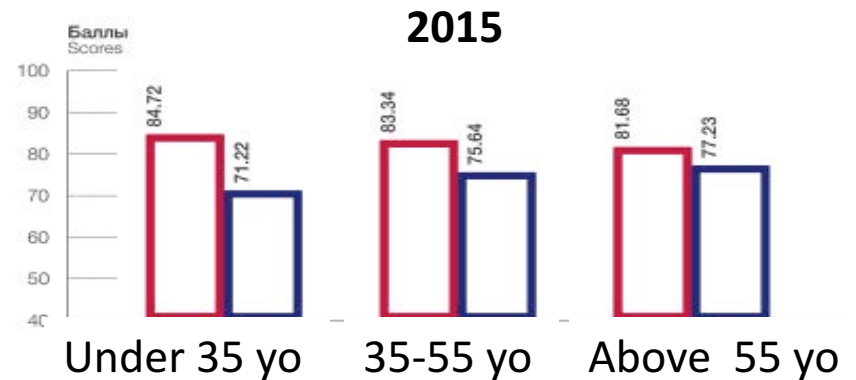
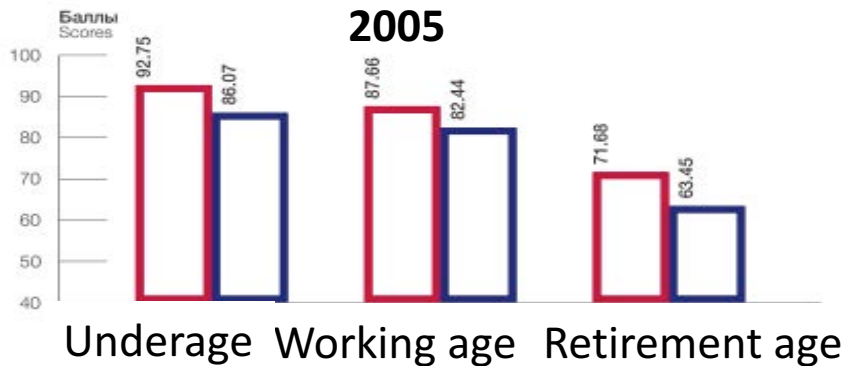
Above 55 yo

Diet Nutritive and Energy Value Across Age Groups

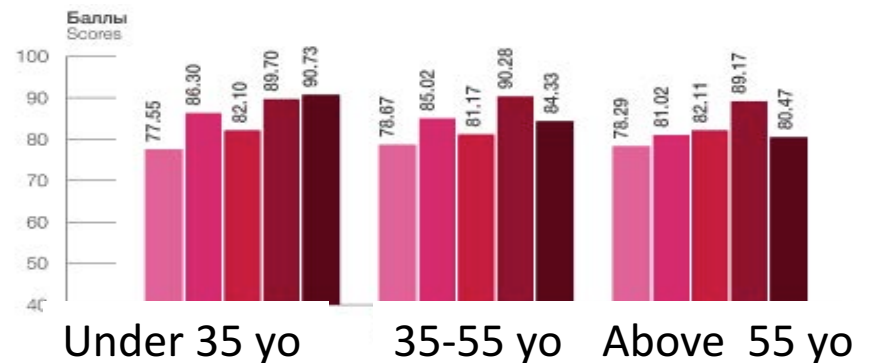
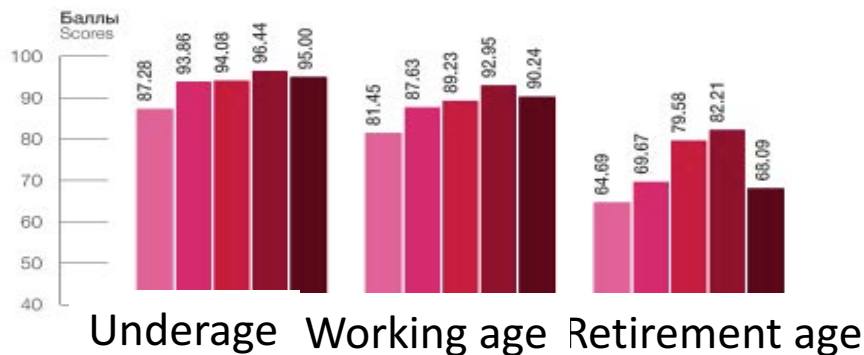


Health and Functioning Parameters Across Age Groups: 10 years improvement

Body functions and activity

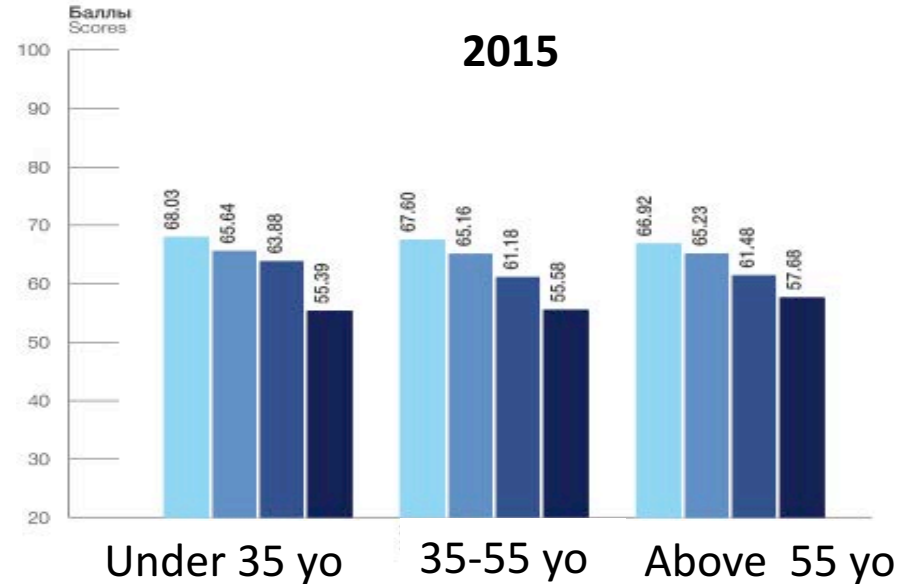
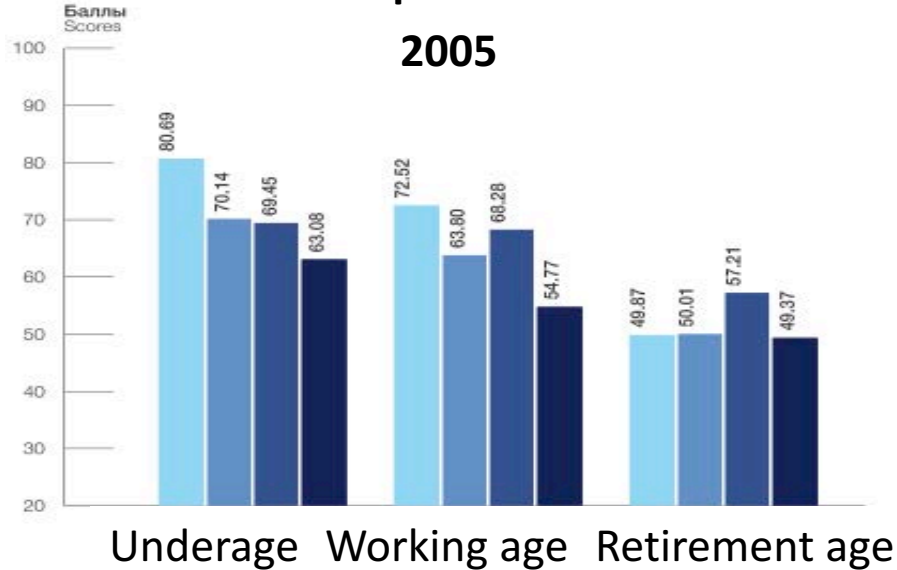


Various organ functions

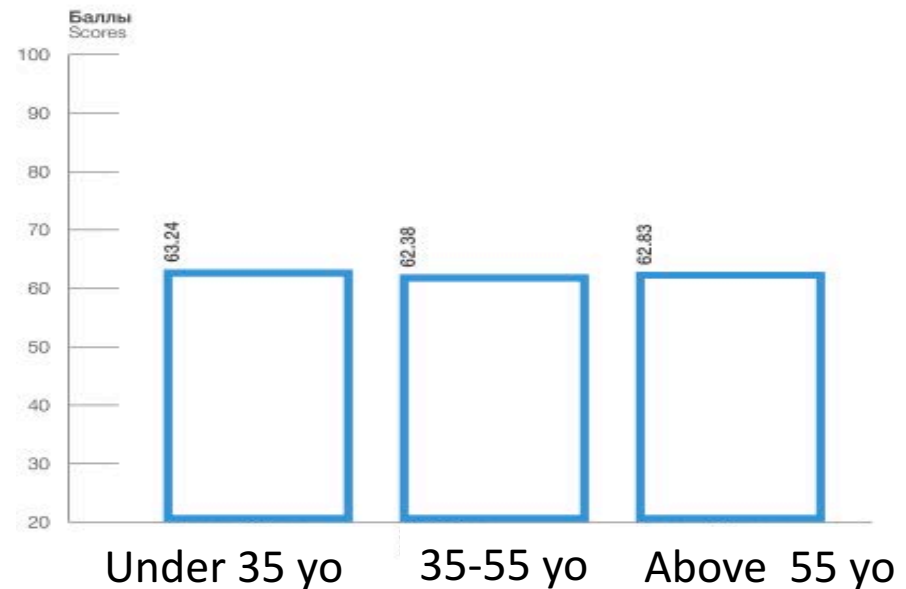
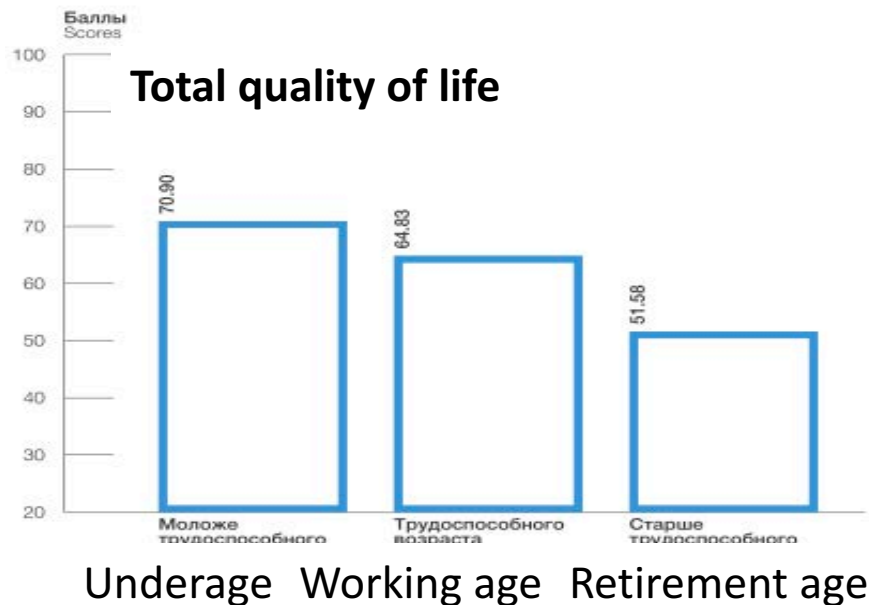


Quality of Life Parameters Across Age Groups

Various life parameters



Total quality of life



Global Challenges of 21ST Century

Obesity
v



**Micronutrients
deficiency**



Traditional (natural) Foods



Technological modified (natural) foods (Functional foods)



FOODS OF 21ST CENTURY

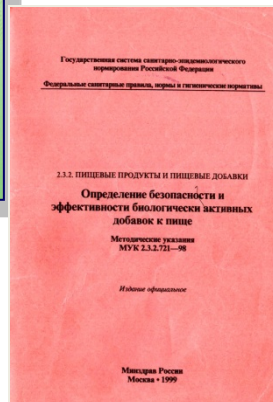
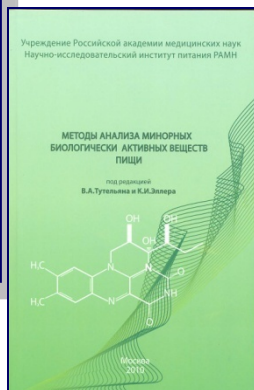
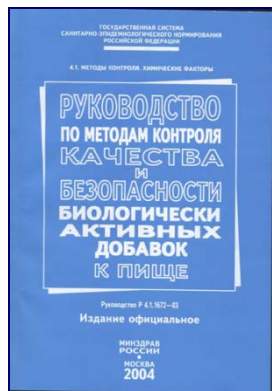
Genetically modified (natural) foods



Dietary Supplements (micronutrients + Botanicals)



Micronutrients and Botanicals – Methodological Background



A modern multilevel analytical base has been set up for spotting, identifying and finding out the quantitative content of macro- and micronutrients, biologically active substances and contaminants

160 methods of quality and safety control of food supplements have been developed, approved and implemented



Micronutrients and Botanicals for Optimisation of Preventive and Therapeutical Diets

Vitamins (C, D, group B)

Minerals(Ca, Fe)

PUFAS n-3, n-6

**Antioxidants (beta-carotene,
tocopherols)**

**Oligosaccharides and polysaccharide
(prebiotics)**

**Some species of beneficial microorganisms
(probiotics)**

**Flavanoids (resveratrol,
rutin, hesperidin, quercetine,
epigallocatechin-3-gallate)**

Indoles (indole-3-carbinol)

Phenolic acids

Caffeine

Fibers

Pilot Project «Efficiency Evaluation of Prophylactic Vitamin Supporting Patients in Hospitals in the Republic of Tatarstan»



Memorandum of Understanding
between the Ministry of Health of the
Republic of Tatarstan
and DSM Nutritional Products AG

Amsterdam, _____ 2013

1. Parties

The Ministry of Health of the Republic of Tatarstan, represented by the Minister of Health of the Republic of Tatarstan, Mr. Ayat Zakievich Farrakhov, acting on the basis of the Constitution of the Republic of Tatarstan and the Law of the Republic of Tatarstan dated 6 April 2005 No 64-ZRT "On the execution bodies of the Government of the Republic of Tatarstan",

hereinafter referred to as the "Ministry of Health"

and

DSM Nutritional Products AG, a company, incorporated and existing under the laws of Switzerland, with its registered office at: Wurmweg 576, CH-4303 Kaiseraugst, Switzerland, represented by Mr. Feike Sijbesma, Chief Executive Officer of Royal DSM N.V., acting for these purposes on the basis of a Power of Attorney,

hereinafter referred to as "DSM",

The Ministry of Health and DSM hereinafter jointly referred to as the "Parties" have entered into this Memorandum of Understanding (hereinafter referred to as the "Memorandum").

2. Introduction

2.1. Following the signing of the Joint Venture Agreement between the Energy Department of the Republic of Tatarstan and

Меморандум о сотрудничестве между Министерством
Здравоохранения Республики Татарстан и
ДСМ Нутришнэл Продактс АГ

г. Амстердам, _____ 2013г.

1. Стороны

Министерство здравоохранения Республики Татарстан в лице Министра здравоохранения Республики Татарстан г-на Айрата Закиевича Фаррахова, действующего на основании Конституции Республики Татарстан и Закона Республики Татарстан от 6 апреля 2005 г. № 64-ЗРТ «Об исполнительных органах государственной власти Республики Татарстан»,

далее именуемое «Министерство здравоохранения»

и

ДСМ Нутришнэл Продактс АГ, компания, учрежденная и действующая в соответствии с законодательством Швейцарии, с местонахождением по адресу: Урмисверг 576, CH-4303, Кайзерштуфт, Швейцария, в лице г-на Фейке Сейбесма, являющегося Президентом Правления Роял ДСМ Н.В., действующего на основании Доверенности,

далее именуемая «ДСМ»,

Министерство здравоохранения и ДСМ, далее именуемые «Стороны», заключили Меморандум о сотрудничестве (далее именуемый «Меморандум») о нижеследующем.

2. Введение

2.1. Вслед за подписанием Договора о создании совместного предприятия между Министерством энергетики Республики Татарстан и ДСМ в области

Согласовано на рукописи г-ном Т. Сидик



COMPONENTS OF HEALTHY DIET

- ***Food Availability***
(pocket)
- ***Foods Assortment of food products***
(counter)
- ***Knowledge and skills to build a healthy diet***
(education)





УКАЗ

ПРЕЗИДЕНТА РОССИЙСКОЙ ФЕДЕРАЦИИ

О совершенствовании государственной политики в сфере
здравоохранения

2. Правительству Российской Федерации совместно с органами исполнительной власти субъектов Российской Федерации:

а) обеспечить дальнейшую работу, направленную на реализацию мероприятий по формированию здорового образа жизни граждан Российской Федерации, включая популяризацию культуры здорового питания, спортивно-оздоровительных программ, профилактику алкоголизма и наркомании, противодействие потреблению табака;

б) разработать до 1 января 2013 г. с участием общественных организаций Стратегию лекарственного обеспечения населения Российской Федерации на период до 2025 года и план ее реализации;

в) утвердить до 1 июля 2012 г. план мероприятий по реализации Основ государственной политики Российской Федерации в области здорового питания населения на период до 2020 года;



Президент
Российской Федерации В.Путин

Москва, Кремль
7 мая 2012 года
№ 598

Education - the
most effective and
least expensive
way to optimizing
the Nation's health
through food and
nutrition



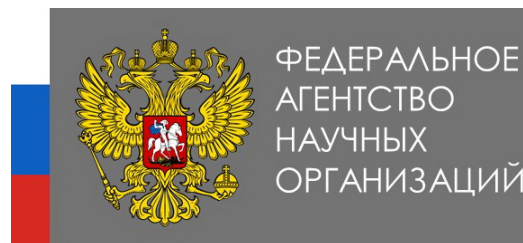
МИНИСТЕРСТВО
ЗДРАВООХРАНЕНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ



Российская Академия Наук



ФЕДЕРАЛЬНАЯ СЛУЖБА ПО НАДЗОРУ В СФЕРЕ ЗАЩИТЫ
ПРАВ ПОТРЕБИТЕЛЕЙ И БЛАГОПОЛУЧИЯ ЧЕЛОВЕКА

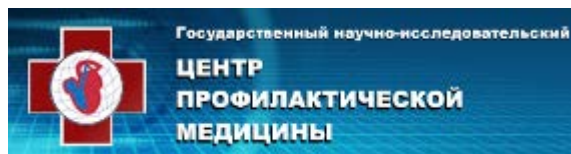


лига здоровья нации
ОБЩЕРОССИЙСКАЯ
ОБЩЕСТВЕННАЯ ОРГАНИЗАЦИЯ

Educational programmes for the population in the field of health nutrition по вопросам - Development of ideology



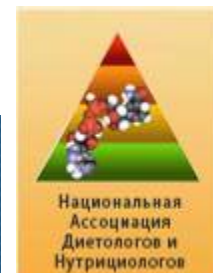
РМАПО



Российская академия образования



МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РОССИЙСКОЙ ФЕДЕРАЦИИ



***Thank you for your
attention!***

감사