

# Development of pharmacogenetics skills for pharmacists from the Republic of Macedonia



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# Republic of Macedonia



- **Full name:** Republic of Macedonia
- **Population:** 2.1 million
- **Capital:** Skopje
- **Area:** 25,713 sq km (9,928 sq mil)
- **Major language:** Macedonian
- **Major religion:** Christianity

- **3 Faculties for pharmacy (Skopje, Tetovo and Stip)**
- **280 pharmacy students per year**

# UKIM, Faculty of pharmacy

Graduate studies (550)  
Master of Pharmacy (1<sup>st</sup> and 2<sup>nd</sup> cycle, 5 yrs)

Postgraduate studies (120)  
**Academic**

Postgraduate studies (80)  
**Professional**

30

Master of Science  
(2<sup>nd</sup> cycle, 2 yrs)

- Pharmacoeconomics & Health Management
- Cosmetology
- Phytotherapy
- Industrial pharmacy

50

Specialist studies  
(2<sup>nd</sup> cycle, 1 yr)

- Pharmacoeconomics & Health Management
- Pharmaceutical regulative
- Cosmetology
- Phytotherapy
- Industrial pharmacy

40

PhD Studies  
(3<sup>rd</sup> cycle, 3 yrs)

80

Health specialist studies

- Drug quality control
- Sanitary chemistry
- Pharmaceutical technology
- Pharmacognosy
- Clinical pharmacy
- Drug information
- Toxicological chemistry
- Pharmacy practice
- Laboratory medical genetics

# UKIM, Faculty of pharmacy



**1977 - Four-year study program  
for graduate pharmacists**



**1992/93 - Five-year study  
program**

# Study Program 2009/10



- **Law on Higher Education, the directives of EU for the education of licensed pharmacists and the implementation of the Bologna Declaration recommendations**
- **Tempus project JEP-18016-2003**  
**University of Pharmaceutical Sciences in Copenhagen**  
**Faculty of Natural Sciences in Stockholm**

# Structure of the MPharm Curriculum

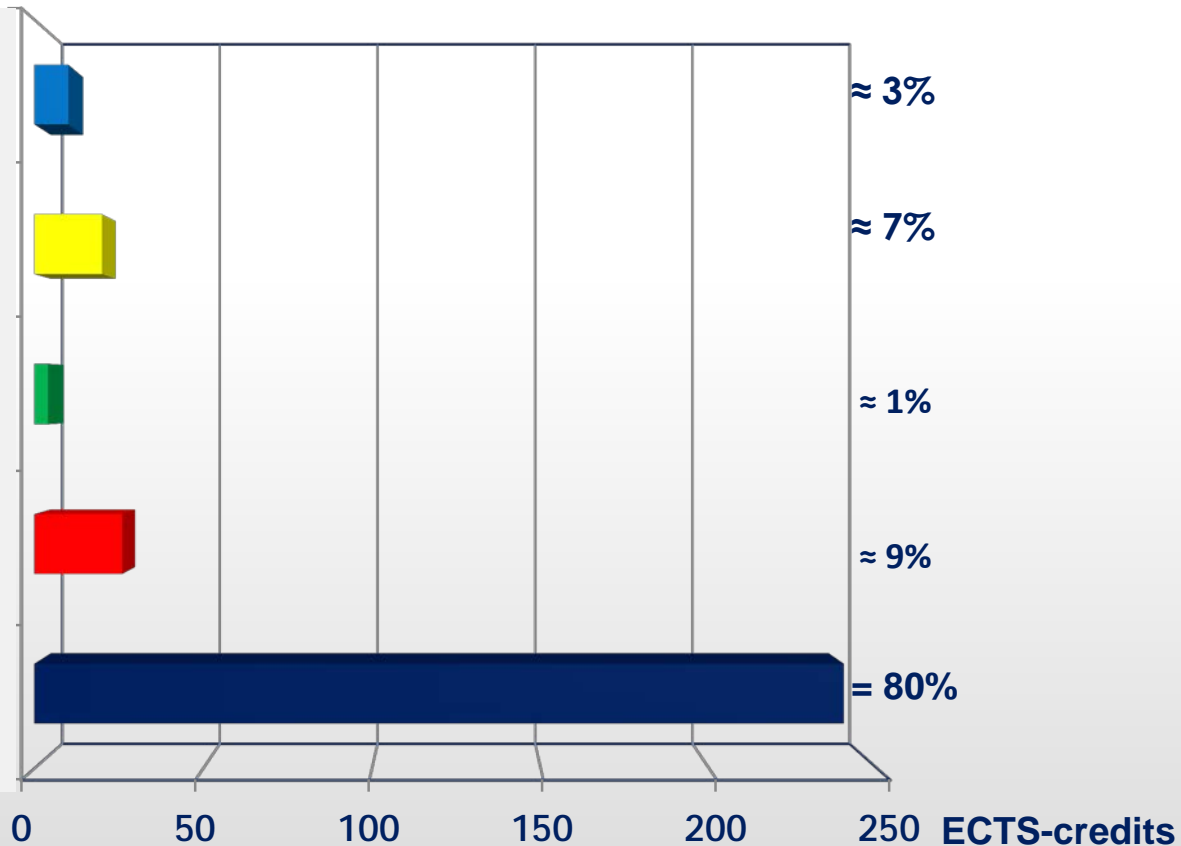
Master thesis

Professional practice

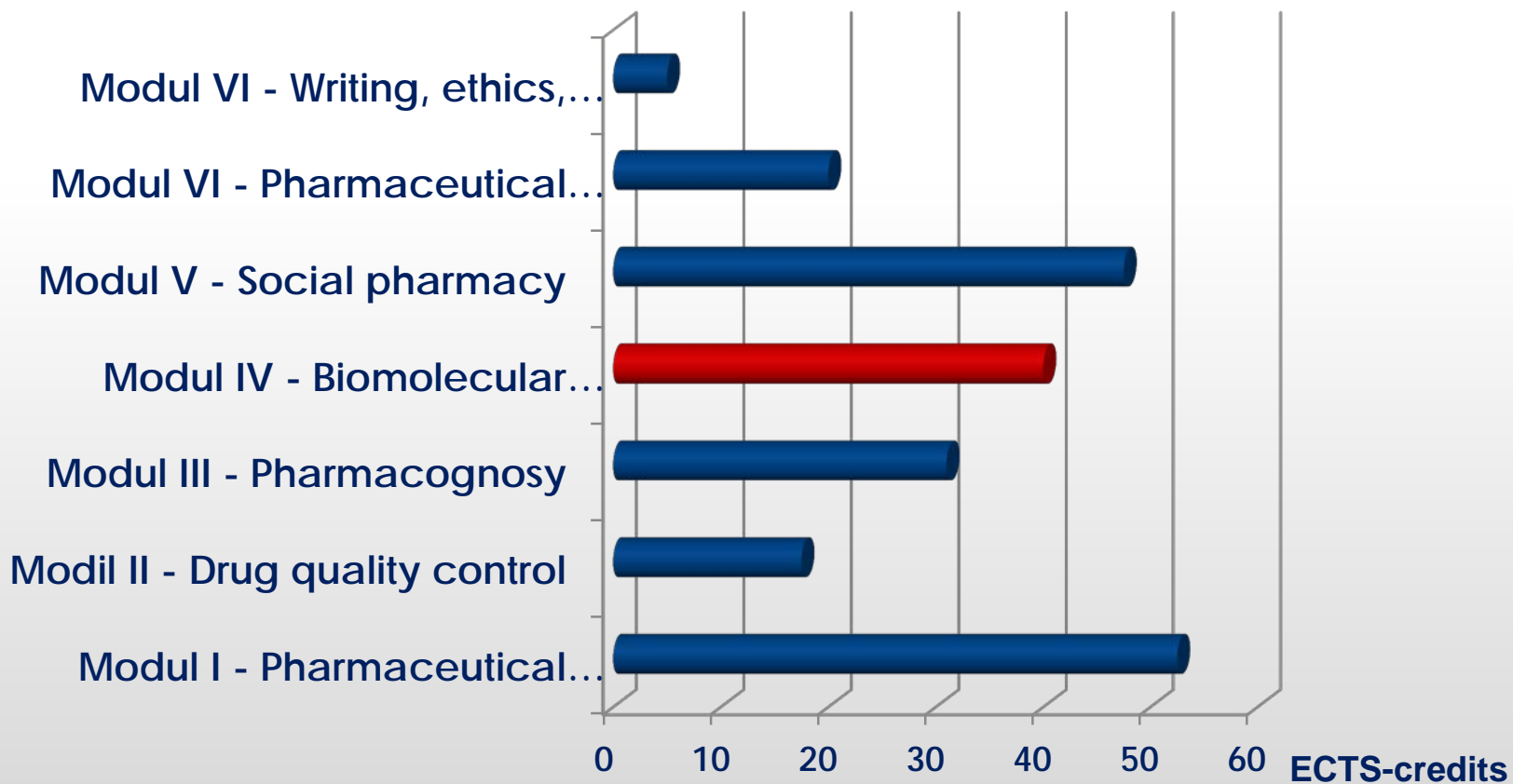
Individual projects

Optional subjects

Compulsory subjects



# ECTS – credits for elective courses in MPharm curriculum within modules





## Pharmacogenetic UKIM, Faculty of pharmacy - Skopje

- ❑ Elective course in five year study programs 2002/2003 and 2009/2010

- ❑ Optional subject for PhD students from our University

- ❑ **Prof. Aleksandar Dimovski**

- ❑ Professor of Cell and molecular biology,  
Genetics and Immunology

- ❑ Head of the Center for the Biomelecular  
Pharmaceutical Analysis







# Personalized Health Care - Education

## **Recommendation:**

**2002 - American Association of Colleges of Pharmacy (AACP)  
Academic Affairs Committee**

**2005 - International Society of Pharmacogenomics (ISP)  
Education Forum**

**2007 - Accreditation Council for Pharmacy Education (ACPE)  
Accreditation Standards and Guidelines**

**2010 - American Association of Colleges of Pharmacy (AACP)  
Academic Affairs Committee**



## Why pharmacogenetic?

- **After decades of research, pharmacogenetics today is a part of routine clinical practice**
- **More than 100 drug labels now provide pharmacogenetic information**
- **Pharmacists will have an ‘essential role’ to play in future genetically-informed prescribing practices**
- **Improvement of outcome therapy**



## Pharmacogenetic - course

- The course gives introduction into various genetic profiles of response to drug substances, with interaction on the level of drugs and genes, DNA polymorphism and molecular pharmacogenetics.
- The subject also encompasses specific examples of pharmacogenic interactions in cardiology, neurology, oncology and other medical branches.
- Expected outcomes - to have competencies not only for the basic skills of this discipline, but also for the understanding on why, when, and how that knowledge should be applied to improve personalized therapies for our patients.



# Pharmacogenetic - course

Genetics, molecular biology, terminology, and technology

Influence of polymorphic genetic variation as they pertain to drug metabolism, drug transport, and drug target receptors

Molecular profiling of disease related to clinical impact of pharmacogenetic on patient care

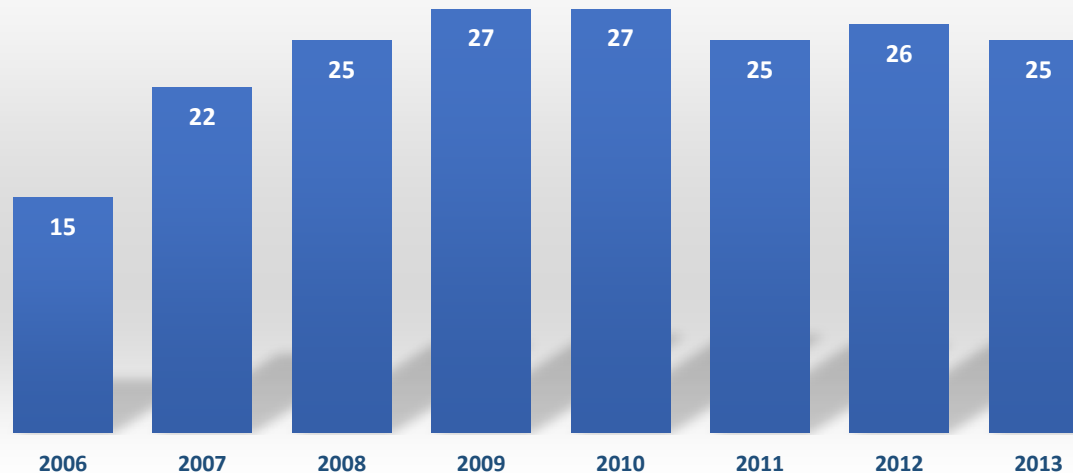
# Center for Biomolecular Pharmaceutical Analyses (CBPA)

**This Center is one of 6 applicative centers at our faculty which aims at making basic, applied and developmental research of biomolecules, which can be applied in the modern therapy of most common diseases**



# Pharmacogenetic - students

Number of students



**Diploma thesis: 30 students**

**Master thesis: 5 students**

**PhD thesis: 3 students (12 in preparation)**



## Conclusions

- **As drug therapy experts, pharmacists are in a unique position to push the frontiers of pharmacogenetics in both the research and clinical practice environments.**
- **PGx is framed as a mechanism through which pharmacists can work more collaboratively with other healthcare professionals and researchers.**
- **The introduction of PGx as an optional subject in our curriculum has resulted in the creation of a critical mass of students, researchers and health care professionals who have a vision for translation of this knowledge in future practice in personalized medicines.**



THANK YOU