**ACADEMIA ROMÂNĂ - SCOSAAR**

**SCOALA DOCTORALĂ STIINTELE VIETII**

**COURSE OUTLINE**

**DISCIPLINE NAME: Mechanisms of intracellular control and transport of proteins**

**Head of lecture activities: Stefana-Maria Petrescu**

Year study: I

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| **Weekly hours/ Exams/Credits** |
| **Lecture/Laboratory** | **Examination form** | **Credits** |
| 4(3/1) | Examen | 15 |

1. **DISCIPLINE OBJECTIVES** (Obiectivele sunt formulate în termeni de competenţe profesionale):

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| * General discipline objective
 | * Knowledge and study of cellular control mechanisms and education of the abilities to approach biological problems in the scientific research.
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| Specific discipline objectives: | * Definingthe mechanisms of intracellular control and transport of proteins
* Methodologic innovation in protein biochemistry
* Approach of research projects involving proteins functions at a cellular level.
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1. **CONDITIONS** (acolo unde este cazul)

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| for lectures | * + **Lecture and laboratory devoted spaces**
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1. **SPECIFIC COMPETENCES AQUIRED (**Vizează competenţele asigurate de programul de studiu din care face parte disciplina)

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| Professional Competences | * Understanding the complexity of the folding and degradation of proteins within the endoplsmic reticulum
* Understanding the processes associated with the intracellular transport of proteins
* Knowledhe of the extracellular secretory pathways of proteins
* Knowledge of the biochemical processes at the subcellular level and their connexions at cell level.
* Acquiring of advanced biochemical methods for the investigation of synthesiis and transport of proteins
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| Transversal Competences | * Capacity of using international data bases and of synthesizing the informations within complex scientific projects
* Development of conceptualising capacity related to the personal scientific results in the context of education by research concept
* Achievement of research projects with responsability in compliance with professional ethics.
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1. **DISCIPLINE CONTENT**

***a) Course***

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| **CHAPTER** | **CONTENTS** | **HOURS** |
| 1. Chapter 1. Protein Synthesis | Synthesisi of proteins destined to the secretory pathway  | 3 |
| 2. Chapter 2. Protein Transport  | Endoplasmic Reticulum to Golgi protein transport and extracellular transport | 2 |
| 3. Chapter 4. Protein Degradation (I) | Protein degradation at the endoplsmic reticulum | 2 |
| 4. Chapter 5. Molecular Chaperones  | Role of chaperones in protein quality control | 3 |
| 5. Chapter 6. Protein Degradation (II) | Lysosomes and protein degradation | 2 |
| 6. Chapter 7. Experimental approach in protein biochemsitry | Principles of investigation methods in protein folding and degardation and subcellualr localisation  | 2 |
|  | **Total hours** | **14** |
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***b) Laboratory***

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| **CHAPTER** | **CONTENTS** | **HOURS** |
| 1. Laboratory practice 1 | Methods to manipulate cells-gene expression  | 2 |
| 2. Laboratory practice 2 |  Protein labeling, pulse-chase and imunoprecipitation | 2 |
| 3. Laboratory practice 3 |  Ultracentrifugation -protein complexes | 2 |
| 4. Laboratory practice 4 |  Ultracentrifugation - organelles separation | 2 |
| 5. Laboratory practice 5 | Confocal microscopy co-localization of proteins with biomarkers | 2 |
| 6. Laboratory practice 6 |  Identification of interactors by mass spectrometry  | 4 |
|  | **Total ore** | **14** |

1. **EVALUATION** (Se precizează metodele, formele de evaluare şi ponderea acestora în stabilirea notei finale. Se indică standardele minime de performanţă, raportate la competenţele definite la punctul **A. Obiectivele disciplinei**)

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| **ACTIVITY** | **EVALUATION CRITERIA** | **EVALUATION METHODS** | **PERCENT FINAL MARK** |
| CourseSeminarLaboratory | -Clarity and quality of the exam subjects - Applying the course aquired knowledge upon study cases- Accuracy of experimental approach  | Oral ExamOral ExamResults validation | 50%25%25% |
| Results of discipline evaluation are graded with marks from 1 to 10. Marks in the range 6 to 10 will allow the credits granting.  |

1. **METHODOLOGICAL HIGHLIGHTS**

Lecture and dialogue. State of the art teaching support(ppt).Course support. Experimental approaches in highly specialised labs.

1. **COURSE OUTCOME**

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| * The course provides basic theoretical and practical knowdlege to understand the cell control towards protein traffic, emphasizing the innovative approach methods in protein biochemistry
* The course provides fundamental elements helping the PhD student to achieve the experimental part of the cell biochemistry and molecular biology areas of research
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1. **REFERENCES**

1.Lysosomal storage disorders: The cellular impact of lysosomal dysfunction Frances M. Platt, Barry Boland, Aarnoud C. van der Spoel, J.Cell.Biol.199 (5): 723 (2012)

2. [Tyrosinase and glycoprotein folding: roles of chaperones that recognize glycans](https://scholar.google.ro/citations?view_op=view_citation&hl=ro&user=SNYb2WQAAAAJ&citation_for_view=SNYb2WQAAAAJ:W7OEmFMy1HYC) SM Petrescu, N Branza-Nichita, G Negroiu, AJ Petrescu, RA Dwek, Biochemistry 39 (18), 5229-5237(2000)

3. [Soluble tyrosinase is an endoplasmic reticulum (ER)-associated degradation substrate retained in the ER](https://scholar.google.com/citations?view_op=view_citation&amp;hl=en&amp;user=SNYb2WQAAAAJ&amp;cstart=20&amp;citation_for_view=SNYb2WQAAAAJ%3A_FxGoFyzp5QC) [by calreticulin and BiP/GRP78 and not calnex](https://scholar.google.com/citations?view_op=view_citation&amp;hl=en&amp;user=SNYb2WQAAAAJ&amp;cstart=20&amp;citation_for_view=SNYb2WQAAAAJ%3A_FxGoFyzp5QC)in CI Popescu, C Paduraru, RA Dwek, SM Petrescu Journal of Biological Chemistry 280 (14), 13833-13840(2006)

4. [Tyrosinase degradation is prevented when EDEM1 lacks the intrinsically disordered region](https://scholar.google.com/citations?view_op=view_citation&amp;hl=en&amp;user=SNYb2WQAAAAJ&amp;cstart=20&amp;citation_for_view=SNYb2WQAAAAJ%3AZph67rFs4hoC), MB Marin, S Ghenea, LN Spiridon, GN Chiritoiu, AJ Petrescu, SM Petrescu PloS one 7 (8), e42998 (2012)

5. [Affinity proteomics and deglycoproteomics uncover novel EDEM2 endogenous substrates and an integrative ERAD network](https://scholar.google.ro/citations?view_op=view_citation&hl=ro&user=SNYb2WQAAAAJ&sortby=pubdate&citation_for_view=SNYb2WQAAAAJ:_B80troHkn4C) CVA Munteanu, GN Chirițoiu, M Chirițoiu, S Ghenea, AJ Petrescu, SMPetrescu Molecular & Cellular Proteomics 20, 100125 (2021)

6. Molecular Biology of the Cell . [Bruce Alberts](https://www.amazon.de/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&amp;text=Bruce%2BAlberts&amp;search-alias=books-de-intl-us&amp;field-author=Bruce%2BAlberts&amp;sort=relevancerank) et al. 2016

7. ERAD: the long road to destruction, [Birgit Meusser,](https://www.nature.com/articles/ncb0805-766#auth-1) [Christian Hirsch,](https://www.nature.com/articles/ncb0805-766#auth-2) [Ernst Jarosch](https://www.nature.com/articles/ncb0805-766#auth-3) & [Thomas Sommer,](https://www.nature.com/articles/ncb0805-766#auth-4)*Nature Cell Biology* volume 7, pages 766–772 (2005)

8. OS-9 and GRP94 deliver mutant α1-antitrypsin to the Hrd1–SEL1L ubiquitin ligase complex for ERAD, [John C. Christianson](https://www.nature.com/articles/ncb1689#auth-1) , [Thomas A. Shaler,](https://www.nature.com/articles/ncb1689#auth-2) [Ryan E. Tyler](https://www.nature.com/articles/ncb1689#auth-3) & [Ron R. Kopito,](https://www.nature.com/articles/ncb1689#auth-4) *Nature Cell Biology* volume 10, pages 272–282 (2008)

9. ERGIC-53 and traffic in the secretory pathway, H.P. Hauri, F. Kappeler, H. Andersson, C. Appenzeller, J Cell Sci 113: 587-596;(2000)

10. [Cargo capture and bulk flow in the early secretory pathway](https://www.annualreviews.org/doi/abs/10.1146/annurev-cellbio-111315-125016)C Barlowe, [A Helenius](https://scholar.google.ro/citations?user=YtTQLjEAAAAJ&amp;hl=ro&amp;oi=sra) - Annual review of cell and developmental biology, 32, 197-222, 2016

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| **LECTURER****Dr. Stefana-Maria Petrescu** | **DOCTORAL SCHOOL DIRECTOR** |
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