**PRACTICAL LESSON 2**

**PHYSICAL AND CHEMICAL PROPETIES OF PROTEINS**

**The purposes of the lesson:**

1. to perform and assess color reactions for proteins and amino acids.

2. to learn physical and chemical properties of proteins: ionization, hydration, solubility.

3. to obtain knowledge about precipitation of proteins, general techniques for separation, purification and quantitation of the proteins.

**Necessary initial level**

**To know:**

1. classification and structure of amino acids (see *Appendix I*)

2. acid-base behavior of amino acids (see *Appendix I*)

3. interactions stabilizing of protein structure. Peptide bond (see *Appendix I*).

4. formation and name of di-,tri- and tetrapeptides (see *Appendix I*).

**Key words**: color reactions for proteins and amino acids, ionization, hydration, solubility of the proteins, precipitation of proteins (reversible and irreversible), salting out of proteins, denaturation, renaturation, separation, purification and quantitation of the proteins.

**Content of lesson:**

1. Written control.

2. Recitation.

3. Practical part:

-color reactions for proteins and amino acids (Biuret reaction, Ninhydrin reaction, Xantoprotein test, Milon’s reaction, Nitriprusside test).

**QUESTIONS FOR PREPARATION FOR LESSON:**

1. Color reactions for proteins and amino acids (Biuret reaction, Ninhydrin reaction, Xantoprotein test, Milon’s reaction, Nitriprusside Test).

2. Physical and chemical properties of proteins: ionization, hydration, solubility. Isoelectric point of protein.

3. Forming the protein’s hydration shell.

4. Precipitation of proteins (reversible and irreversible). Salting out.

5. Denaturation of protein. Factors of denaturation. Properties of denatured protein.

6. Renaturation (reversible denaturation).

\*7. General techniques for separation, purification and quantitation of the proteins.

**QUESTIONS FOR WRITTEN CONTROL:**

1. Draw the ionization scheme of albumin at each pH (pI=5,5):

a) 5,5 b)2 c)7,4

2. Draw the ionization scheme of pepsin at each pH (pI=1,5-2,5):

a) 0,5 b)2 c)7,4

3. Draw the ionization scheme of glutamatdehydrogenase at each pH (pI=7.4):

a) 5,5 b)10 c)7,4

4. Draw and name the tripeptide: Glu, Cys, Gly.

5. Draw and name the tripeptide: Val, Pro, Ala.

6. Draw and name the tripeptide: Asp, Phe, Pro.

7. Draw the formation scheme of hydration shell

8. Draw the protein salting-out scheme.

9. Draw scheme of denaturation by heating.

10. Numerate the properties of denatured protein.

**RECOMMENDED BIBLIOGRAPHY**

**a) Compulsory**:

1. Lectures.

2. DM Vasudevan, Sreekumari S, Kannan Vaidyanathan. (2014) *Textbook of biochemistry for medical students.7*th edn. Jaypee Brothers Medical Publishers (P) Ltd.

**b) Supplementary**:

1. Janice Gorzynski Smith. (2012) *Principles of general, organic, and biological chemistry.* The McGraw-Hill Companies, Inc.

2. Laurence A. Moran, H. Robert Horton, K. Gray Scrimgeour, Marc D. Perry. (2012) *Principles of Biochemistry*. Pearson Education, Inc.

3. Lehninger A., David L. Nelson, Michael M. Cox. (2008) *Lehninger Principles of Biochemistry*. 5th edn. W.H.Freeman and company, New York.

4. Mary K. Campbell, Shawn O. Farrell Biochemistry. (2012) *Biochemistry*. 7th edn. Brooks/Cole, Cengage Learning.

5. Pamela C. Champe, Richard A. Harvey, Denise R. Ferrier. (2004) *Lippincott’s Illustrated Reviews: Biochemistry*. Lippincott Williams & Wilkins

6. Reginald H. Garrett, Charles M. Grisham. (2010) *Biochemistry.* Brooks/Cole, Cengage Learning.

7. Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. (2009) *Harper's Illustrated Biochemistry*. 28th edn. The McGraw-Hill Companies, Inc.