وزارة التعليم العالي والبحث العلمي
جامعة وارث الانبياء عليه السلام
كلية الطب

وصف البرنامج الأكاديمي
فرع الكيمياء

2025

جامعه وارث الانبياء – كليه الطب – فرع الكيمياء الحياتيه والطبيه

وزارة التعليم العالي والبحث العلمي

جـــهاز الاشراف والتقــويم العلــمي

دائرة ضمان الجودة والاعتمادية

الاكاديمية

استمارة وصف البرنامج الاكاديمي للكليات والمعاهد

الجامعة وارث الانبياء

الكلية/ المعهد: الطب

القسم العلمي: الكيمياء

الحياتيه والطبيه

تاريخ الانجاز الملف: 20/7/2025

توقيع:

اسم رئيس القسم:

ع.م د رياض عبد الرسول حنيوه

التاريخ :

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اسم المعاون العلمي :

أ.د ليث محمد عباس

التاريخ: ٢٠٢٥/٨/٢٥

دقق الملف من

قبل شعبة ضمان الجودة

والاداء الجامعي

اسم مدير شعبة ضمان الجودة والأداء الجامعي:

التاريخ: ٢٠٢٥/٨/٢٥

التوقيع:

الأستاذ الدكتور
علي عبد سعدون الغزي
عميد كلية الطب

مصادقة السيد العميد

وصف البرنامج الاكاديمي

.1 المؤسسة التعليمية	**كلية الطب / جامعة وارث الأنبياء**
.2 القسم العلمي / المركز	**الكيمياء الحياتيه والطبيه**
.3 اسم البرنامج الاكاديمي	**الكيمياء الحياتيه والطبيه**
.4 اسم الشهادة النهائية	**طب وجراحة عامة**
.5 النظام الدراسي : سنوي /مقررات /أخرى	**سنوي + وحدات**
.6 برنامج الاعتماد المعتمد	**WFME + معايير اعتماد كليات الطب العراقية**
.7 المؤثرات الخارجية الأخرى	**-العتبات المقدسة (المستشفيات التابعه للعتبه الحسينيه المقدسه)** **- دائرة صحة كربلاء**
.8 تاريخ إعداد الوصف	**20/7/2025**

.9 أهداف البرنامج الاكاديمي

تعريف الطالب بدراسة التركيب الكيمياوي لجسم الانسان والتغيرات التي تحدث في هذا التركيب في الحالة الطبيعية والحالات المرضية. اجراء بعض التجارب المختبرية على بعض مركبات الجسم الطبيعية مع إجراء تجارب أخرى بسيطة للكشف عن بعض الحالات المرضية. ربط النتائج المختبرية في مجال الكيمياء الحياتية بتشخيص الأمراض.
وضع أساس علمي بحت على أن مادة الكيمياء هي أساس العلوم وتثقيف الطالب وتعليمه كيفية التعامل مع الادوات والاجهزة المختبرية واطلاعه على مبادئ أساسية لمختبرات تحاليل أخرى وكذلك جعل مادة الكيمياء الحياتية مهمة في دعم الاختصاصات الاخرى ودعم نشاط الطلبة العلمي في مضمار الكيمياء ودفع الاطباء لآكمال دراستهم العليا في هذا المجال.

.10 مخرجات البرنامج المطلوبة وطرائق التعليم والتعلم والتقييم

-1 الأهداف المعرفية

أ-1 الحصول على المعلومات الأساسية لعلم الكيمياء الحياتية
أ-2 توفير قاعدة واسعة من المعرفة والفهم لمختلف أنواع العمليات الأيضية والتغيرات البيوكيميائية
أ-3 تطوير مهارات الحصول على المعلومات
أ-4تشجيع وتدريب الطالب حول كيفية التعامل مع الحقائق العلمية التي تخص هذا المجال
أ-5 تشجيع الطلبة على الاستنتاج وتفسير النتائج وكيفية عرضها ومناقشتها.

ب – الهداف المهاراتية الخاصة بالبرنامج

ب1 – استخدام التطبيقي للمادة العلمية في مجال علم الكيمياء الحياتية
ب 2 – التعرف على مختلف أنواع العمليات الأيضية والتغيرات البيوكيميائية
ب 3 - التعرف على الاستخدام الامثل للتحاليل الكيميائية في تشخيص مختلف الأمراض
ب -4 التعرف على طرق عمل التحاليل الكيميائية
ب-5 التعرف على عمل للتحاليل الكيميائية والتفاعلات بينها.

ج- الاهداف الوجدانية والقيمية:

- 1الحفاظ على سرية المعلومات الشخصية للمريض
- 2الحرص على عمل التحاليل التي يحتاجها المريض
-3 الامانة بالعمل وعدم تجريح الكسب المادي على الجانب الاخلاقي للمهنة

طرائق التعليم والتعلم

1- **المنهج التعليمي والمزيج بين النظري والعملي**
2- **اسلوب المحاضرات والتفاعل داخل القاعه**
3- **النشاط العلمي والبحوث**
4- **الشراكات الاكاديميه والتعليم المؤسسي**

القاء المحاضرات النظرية باستخدام تقنيات العرض المتوفرة (أجهزة العرض و السبورة الذكية)

واستخدام التعليم الإلكتروني في المختبر
-اعطاء تعليمات وتوجيهات تخص سلوكيات واهداف المهنة الطبية -
الاطلاع الميداني على الطرق العملية للتعامل مع المرضى في مواقع العمل -
عرض افلام وفيديوهات تثقيفية تخص الأهداف الوجدانية والقيمية

طرائق التقييم

1. امتحانات نظرية (شهرية +نصف السنة + نهاية السنة)

2. امتحانات قصيرة

3. امتحان العملي : **OSPE** (امتحان شفهي , امتحان المهارة , امتحان للمعلومات العملية)

د -المهارات العامة والتأهيلية المنقولة (المهارات الاخرى المتعلقة بقابلية التوصيف والتطور الشخصي.)

د-1كتابه التحاليل الكيميائيه اعتمادا على التشخيص الصحيح

د-2تعلم كتابة لتحاليل الكيميائيه حسب واختيار التحليل المناسب لكل حالة مرضية

د-3تعلم طرق التعامل مع زملاء العمل والمرضى.

د-4 اكتساب مهارات ادارة المختبر.

11. بنية البرنامج

المرحلة الدراسية	رمز المقرر أو المساق	اسم المقرر أو المساق	الساعات المعتمدة	
			نظري	عملي
الاولى		الكيمياء الطبيه	60	40
الثانيه		الكيمياء الحياتيه	الدرجه مدمجة ضمن الوحدة (3.4.5.6)	
الثالثه		الكيمياء الحياتيه	الدرجه مدمجة ضمن الوحدة(7.8.9.10)	
الرابعه		الكيمياء الحياتيه	الدرجه مدمجة ضمن الوحدة	

12. التخطيط للتطور الشخصي

- تعزيز مهارات التعلم الذاتي .
-التدريب على التقنيات الإلكترونية للحصول على المعلومات **Technology Internet** .
-تعزيز مهارات التعلم الجماعي .
-تعزيز مهارات القدرة على القيادة وتحفيز الاخرين .

13. معيار القبول (وضع الأنظمة المتعلقة بالالتحاق بالكلية أو المعهد)

القبول مركزي عن طريق خطة سنوية توضع من قبل وزارة التعليم العالي والبحث العلمي وتستحدث سنويا طبقا لنتائج الامتحانات المركزية للدراسة الإعدادية وعادة يكون القبول ضمن المجموعة الطبية للمعدلات العالية (أكثر من % 98 .)
14. أهم مصادر المعلومات عن البرنامج
-الكتاب المنهجي المقرر: 1- Textbook of BIOCHEMISTRY for Medical Students 2- Quick Review of Biochemistry for Undergraduates Questions and Answers 3-CLINICAL BIOCHEMISTRY & METABOLIC MEDICINE

مخطط مهارات المنهج																							
يرجى وضع اشارة في المربعات المقابلة لمخرجات التعلم الفردية من البرنامج الخاضعة للتقييم																							
				مخرجات التعلم المطلوبة من البرنامج																			
السنة/ المستوى	رمز المقرر	اسم المقرر	أساسي أم اختياري	ألهداف المعرفية				ألهداف المهاراتية الخاصة بالبرنامج				ألهداف الوجدانية والقيمية				المهارات العامة والتأهيلية المنقولة (المهارات الاخرى المتعلقة بقابلية التوظيف والتطور الشخصي)							
				أ1	أ2	أ3	أ4	ب 1	ب 2	ب 3	ب 4	ج 1	ج 2	ج 3	ج 4	د 1	د 2	د3	د 4				
		علم الكيمياء الطبيه	اساسي	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√				
		علم الكيمياء الحياتيه	اساسي	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√				

توزيع الدرجات:

1) درجة السعي السنوي = (40% (موزعة بالشكل الاتي: الفصل الاول % 10= نظري 5% + عملي 5%
نصف السنة = 20% نظري 18% + عملي 2%

الفصل الثاني 10% =نظري 5% + عملي 5%

2(درجة االمتحان النهائي = (60%) (نظري % 40 + عملي)20%

3- بالنسبه للوحدات وزن الدرجه يكون ضمن امتحان الوحدة

Curriculum in details

Theory: 60 hours / year

Practical: 60**hours / year**

Credit : 6

Syllabus of 1st year			
Week	**Subject**	**Objective**	
1W	Chemistry& metabolism of CHO	**Carbohydrate Chemistry – Learning Objectives** **Define carbohydrates** and classify them based on: ○ Number of carbon atoms (triose, tetrose, etc.) ○ Functional group (aldose, ketose) ○ Complexity (monosaccharides, disaccharides, oligosaccharides, polysaccharides)	LEC 1 & 2
2W	Chemistry & metabolism of CHO	**Describe the structure and functions** of key monosaccharides (glucose, fructose, galactose). **Explain the concept of isomerism** in carbohydrates: • Structural isomers • Stereoisomers (D- and L-forms) • Epimers and anomers	LEC 3&4
3W	Chemistry & metabolism of CHO	**Discuss the structure and biological importance** of major disaccharides and polysaccharides: ○ Disaccharides: sucrose, lactose, maltose ○ Polysaccharides: starch, glycogen, cellulose **Describe common chemical reactions** of carbohydrates: ○ Oxidation and reduction	LEC 5&6

		○ Glycosidic bond formation ○ Benedict's and Barfoed's tests	
4W	Chemistry & metabolism of CHO	**Carbohydrate Metabolism – Learning Objectives** **Outline the major pathways** of carbohydrate metabolism: ○ Glycolysis ○ Gluconeogenesis ○ Glycogenolysis and Glycogenesis ○ Pentose Phosphate Pathway (PPP) **Describe the steps of glycolysis**, including: ○ Key enzymes ○ Energy yield (ATP and NADH) ○ Regulatory points **Explain the role of the TCA cycle** and its integration with glycolysis.	LEC 7&8
5W	Chemistry & metabolism of CHO	• **Discuss the regulation of blood glucose**: • Hormonal control (insulin and glucagon) • Fed vs. fasting state • **Understand the Cori cycle** and its significance in anaerobic metabolism. • **Describe glycogen metabolism**, including: • Enzymes involved • Regulation by hormones	LEC 9&10
6W	Chemistry & metabolism of CHO		LEC 11&12

		• Fructose intolerance
		
		• **Apply knowledge to clinical conditions**, such as:
		
		  • Diabetes mellitus
		  • Hypoglycemia
		  • Metabolic acidosis	

7W	Chemistry & metabolism of Amino acid	**Amino Acid Chemistry – Learning Objectives**
		Define amino acids and describe their general structure:
		
		  ○ Amino group, carboxyl group, side chain (R group), central carbon
		
		Classify amino acids based on:
		
		  ○ Polarity (non-polar, polar, acidic, basic)
		  ○ Nutritional requirement (essential vs non-essential)
		  ○ Metabolic fate (glucogenic, ketogenic, or both)
		  ○ Optical activity (D- and L- forms)
		
		Understand peptide bond formation:
		
		  ○ Structure of dipeptides and polypeptides
		  ○ Role in protein primary structure
		  ○ Role in protein 2nd structure
		  ○ Role in protein 3rd structure
		  ○ Role in protein 4th structure
			LEC 13&14

8W	Chemistry & metabolism of Proteins	**Amino Acid Metabolism – Learning Objectives** **Explain the digestion and absorption** of dietary proteins: ○ Enzymes involved (pepsin, trypsin, etc.) ○ Amino acid transport systems **Describe amino acid catabolism**, including: ○ Transamination ○ Deamination ○ Ammonia formation and detoxification **Understand the urea cycle**: ○ Key steps and enzymes ○ Role in nitrogen excretion ○ Clinical relevance (e.g. hyperammonemia) **Outline the fate of carbon skeletons** of amino acids: ○ Entry into TCA cycle, gluconeogenesis, or ketogenesis **Describe the biosynthesis** of non-essential amino acids **Identify common inborn errors of amino acid metabolism**: ○ Phenylketonuria (PKU) ○ Alkaptonuria ○ Maple syrup urine disease ○ Homocystinuria	LEC 15&16

		Apply biochemical principles to clinical situations: ○ Malnutrition (Kwashiorkor, Marasmus) ○ Protein-energy deficiency ○ Aminoacidurias	
9W	Chemistry of Enzymes (I)	**Enzyme Chemistry – Learning Objectives** **Define enzymes** and describe their general characteristics: ○ Biological catalysts ○ Specificity and efficiency ○ Reusability **Classify enzymes** based on the type of reactions they catalyze: ○ Oxidoreductases, Transferases, Hydrolases, Lyases, Isomerases, Ligases **Describe enzyme structure and components**: ○ Apoenzyme and cofactor (holoenzyme) ○ Coenzymes and prosthetic groups ○ Active site and substrate binding **Explain enzyme kinetics**: ○ Michaelis-Menten equation ○ Definitions of Km and Vmax ○ Factors affecting enzyme activity: temperature, pH, substrate concentration	LEC 17&18

		Discuss enzyme inhibition: ○ Competitive vs non-competitive inhibition ○ Reversible and irreversible inhibition ○ Clinical relevance (e.g., drug action) **Describe enzyme regulation mechanisms:** ○ Allosteric regulation ○ Feedback inhibition ○ Covalent modification (e.g., phosphorylation) **Understand the concept of Isoenzymes (isozymes):** ○ Clinical significance (e.g., LDH, CK in myocardial infarction)	
10W	Chemistry of Enzymes (II)	**Enzymes in Clinical Diagnosis** **Describe the diagnostic importance of liver enzymes:** ○ **ALT (SGPT), AST (SGOT):** hepatocellular damage ○ **ALP, GGT**: cholestasis, biliary obstruction **Understand the significance of pancreatic enzymes:** ○ **Amylase** and **Lipase** in acute pancreatitis **Describe the cardiac enzymes and biomarkers:** ○ **CK-MB, LDH isoenzymes, Troponins (I, T)** for myocardial infarction	LEC 19&20

		○ Timeline of enzyme release and peak activity post-infarction **Understand the role of enzymes in muscle disorders**: ○ **Creatine kinase (CK/CPK)** in muscular dystrophy, rhabdomyolysis **Interpret renal function-related enzymes** (limited role, e.g., GGT in renal tubular function) --- **Special Enzymes and Conditions** **Describe enzymes used in bone disorders**: ○ **Alkaline phosphatase (ALP)** in Paget's disease, bone metastasis **Recognize enzyme patterns in hemolysis**: • **LDH** and indirect bilirubin rise **Understand enzyme changes in malignancies**: • Tumour markers (e.g., PSA as a serine protease)	
11W	Chemistry of Hormones	a. Definition of Hormones b. Classification of Hormones c. Mechanisms of Action of Hormones and Signalling Molecules d. Second Messengers and G-proteins	LEC 21&22
12W			LEC 23&24

13W	Chemistry & metabolism of Lipids (I)	**Lipid Chemistry – Learning Objectives** **Define lipids** and describe their general characteristics: ○ Hydrophobic or amphipathic molecules ○ Solubility in organic solvents **Classify lipids** into major groups: ○ Simple lipids (e.g., triglycerides) ○ Compound lipids (e.g., phospholipids, glycolipids) ○ Derived lipids (e.g., cholesterol, fatty acids) **Describe the structure and function** of: ○ Fatty acids (saturated vs unsaturated) ○ Triglycerides ○ Phospholipids and glycolipids ○ Cholesterol and its derivatives	LEC 25&26
14W	Chemistry & metabolism of Lipids (II)	• **Understand essential fatty acids**: • Linoleic acid, α-linolenic acid • Their role in membrane structure and eicosanoid synthesis • **Explain the physical and chemical properties** of lipids: • Saponification • Hydrogenation	LEC 27&28

		• Iodine number (unsaturation level) • **Recognize the biological functions of lipids:** • Energy storage • Structural component of membranes • Precursors to hormones and signaling molecules	
15W	Chemistry& metabolism of Lipids (II)	**Lipid Metabolism – Learning Objectives** **Describe digestion and absorption of dietary lipids:** ○ Role of bile salts and pancreatic lipase ○ Formation and transport via chylomicrons **Understand the β-oxidation of fatty acids:** ○ Steps and location (mitochondria) ○ Energy yield ○ Carnitine shuttle system **Explain fatty acid synthesis:** ○ Occurs in the cytosol ○ Key enzyme: fatty acid synthase ○ Role of acetyl-CoA and NADPH **Discuss the metabolism of triglycerides:** ○ Lipolysis and re-esterification	LEC 29&30

		○ Hormonal regulation (insulin, glucagon, epinephrine)	
16W	Chemistry & metabolism of Lipids (II)	• **Understand the biosynthesis and function of ketone bodies**: • Ketogenesis and ketolysis • Conditions where ketones are produced (fasting, diabetes) • **Explain cholesterol metabolism**: • Biosynthesis pathway (HMG-CoA reductase) • Regulation and feedback inhibition • Role in steroid hormone and bile acid synthesis • **Describe the structure and function of lipoproteins**: • Chylomicrons, VLDL, LDL, HDL • Role in lipid transport • Clinical importance of LDL and HDL • **Recognize lipid-related disorders**: • Hyperlipidemia • Atherosclerosis • Fatty liver disease • Inborn errors (e.g., Tay-Sachs, Gaucher's) • **Relate lipid metabolism to clinical conditions**: • Obesity • Diabetes mellitus • Cardiovascular diseases	LEC 31&32

17W	Chemistry of Vitamins and Coenzymes trace elements	**Vitamin Chemistry & Metabolism – Learning Objectives** ◆ **General Concepts** **Define vitamins** and understand their general classification: ○ Fat-soluble (A, D, E, K) ○ Water-soluble (B-complex and C) **Differentiate between fat-soluble and water-soluble vitamins** based on: ○ Absorption and storage ○ Risk of deficiency vs toxicity --- ◆ **Fat-Soluble Vitamins** **Describe the chemistry, sources, functions, metabolism, and deficiency symptoms** of: ○ **Vitamin A** – vision, epithelial health, antioxidant role ○ **Vitamin D** – calcium metabolism, bone health ○ **Vitamin E** – antioxidant, membrane protection ○ **Vitamin K** – role in blood clotting (γ-carboxylation of clotting factors) **Understand the consequences of excess (hypervitaminosis)** of fat-soluble vitamins.	LEC 33&34

18W	Chemistry of Vitamins and Coenzymes trace elements	**Water-Soluble Vitamins** **Describe the chemistry, sources, functions, coenzyme forms, and deficiency states** of: ○ **Vitamin B1 (Thiamine)** – carbohydrate metabolism; deficiency: Beriberi, Wernicke's encephalopathy ○ **Vitamin B2 (Riboflavin)** – FAD/FMN coenzymes ○ **Vitamin B3 (Niacin)** – NAD/NADP coenzymes; deficiency: Pellagra ○ **Vitamin B5 (Pantothenic acid)** – CoA formation ○ **Vitamin B6 (Pyridoxine)** – amino acid metabolism ○ **Vitamin B7 (Biotin)** – carboxylation reactions ○ **Vitamin B9 (Folate)** – DNA synthesis; deficiency: megaloblastic anemia ○ **Vitamin B12 (Cobalamin)** – DNA & nerve function; deficiency: pernicious anemia ○ **Vitamin C (Ascorbic acid)** – collagen synthesis, antioxidant; deficiency: Scurvy **Understand vitamin absorption, transport, and storage** (especially B12 requiring intrinsic factor). **Relate vitamin deficiencies to clinical conditions** and recognize signs for diagnosis. --- ## ⚙ Trace Elements (Micronutrients) – Learning Objectives ### ◆ General Concepts **Define trace elements** and distinguish them from macro minerals.	LEC 35&36

Explain the general roles of trace elements:

- Cofactors for enzymes
- Structural roles
- Antioxidant defence

◆ Specific Trace Elements

Describe the biological roles, sources, daily requirements, metabolism, deficiency, and toxicity of:

- **Iron (Fe)** – haemoglobin synthesis; deficiency: anaemia
- **Zinc (Zn)** – enzyme function, wound healing; deficiency: growth retardation, dermatitis
- **Copper (Cu)** – iron metabolism, enzyme function; disorders: Wilson's, Menkes
- **Iodine (I)** – thyroid hormone synthesis; deficiency: goiter, cretinism
- **Selenium (Se)** – antioxidant defense (glutathione peroxidase); deficiency: cardiomyopathy
- **Manganese (Mn)** – cofactor in metabolism
- **Chromium (Cr)** – insulin function
- **Fluoride (F)** – dental enamel health; excess: fluorosis

Understand iron metabolism and regulation:

- Role of transferrin, ferritin, hepcidin
- Iron absorption and transport

Recognize trace element toxicities and their clinical manifestations.

19W	Chemistry of Nucleotides & metabolism (I)	**Nucleotide Chemistry – Learning Objectives** **Define nucleotides and nucleosides**: ○ Structure and difference between them ○ Components: nitrogenous base, sugar, phosphate **Classify nitrogenous bases**: ○ **Purines**: adenine, guanine ○ **Pyrimidines**: cytosine, thymine, uracil **Describe the structure and functions of nucleotides**: ○ Role in DNA/RNA synthesis ○ Energy carriers (ATP, GTP) ○ Second messengers (cAMP, cGMP) ○ Coenzymes (NAD^+, FAD, CoA) **Understand base pairing and tautomerism** in purines and pyrimidines. **Explain nucleic acid structure** (briefly, as part of context): ○ DNA vs RNA ○ 5' to 3' orientation	LEC 37&38

20W	Chemistry of Nucleotides & metabolism (II)	**Nucleotide Metabolism – Learning Objectives** ◆ **Purine Metabolism** **Outline the de novo synthesis pathway** of purine nucleotides: ○ Starting materials (ribose-5-phosphate, PRPP) ○ Key enzymes and regulatory steps **Describe the salvage pathway of purines**: ○ Role of HGPRT and APRT enzymes ○ Clinical relevance (Lesch-Nyhan syndrome) **Explain purine degradation**: ○ Formation of uric acid ○ Enzyme: xanthine oxidase **Relate purine metabolism to clinical conditions**: ○ Gout (uric acid accumulation) ○ Hyperuricemia ○ Immunodeficiency (e.g. ADA deficiency in SCID)	LEC 39&40

		◆ **Pyrimidine Metabolism** **Describe the de novo synthesis of pyrimidines:** • Role of carbamoyl phosphate synthetase II (CPS II) • Formation of UMP, UTP, CTP **Understand the synthesis of thymidine nucleotides:** • Role of thymidylate synthase • Folate dependence **Describe pyrimidine degradation:** • Simpler than purine degradation • Produces β-alanine, β-aminoisobutyrate **Recognize clinical disorders of pyrimidine metabolism:** • Orotic aciduria (UMP synthase deficiency)	
21W	Molecular biology	**Molecular Biology – Learning Objectives** **DNA Structure and Function** **Describe the structure of DNA:** ○ Double helix, base pairing, antiparallel strands	LEC 41&42

		○ Purines vs pyrimidines ○ Hydrogen bonding and base stacking **Differentiate between DNA and RNA**: ○ Sugar type, nitrogenous bases, structure, and stability **Explain DNA packaging in eukaryotes**: ○ Role of histones and nucleosomes ○ Chromatin structure: euchromatin vs heterochromatin	
22W	Molecular biology	**DNA Replication** **Outline the process of DNA replication**: ○ Semiconservative mechanism ○ Origin of replication, replication fork, leading/lagging strands **Identify key enzymes in replication**: ○ DNA polymerase, helicase, primase, ligase, topoisomerase **Understand the concept of replication fidelity**: ○ Proofreading, mismatch repair	LEC 43&44

		Transcription (DNA → RNA) **Describe the process of transcription**: ○ RNA polymerase, promoter regions, transcription factors **Differentiate between prokaryotic and eukaryotic transcription** **Explain RNA processing in eukaryotes**: ○ Capping, polyadenylation, splicing (removal of introns)	
23W	Molecular biology	**Translation (RNA → Protein)** **Explain the genetic code**: • Codons, start and stop codons, redundancy **Describe the process of translation**: • Initiation, elongation, termination • Role of ribosomes, tRNA, and aminoacyl-tRNA synthetase **Understand post-translational modifications**: • Phosphorylation, glycosylation, cleavage, etc.	LEC 45&46
24W			LEC 47&48

Practical Biochemistry for 1st year			
1st semester			
1	Biochemical Lab. Safety	1 & 2 w	
2	Biomedical Instruments and Techniques	3 & 4w	
3	Solutions	5 w	
4	Sample type	6 w	
5	Sample Collection and Separation	7 w	
6	Sample Collection and Separation	8 w	
7	Sample Collection and Separation	9 w	
8	Sample Collection and Separation	10w	
9	Carbohydrates	11w	
	Carbohydrates	12w	
2nd semester			
10	Lipids	13w	
11	Lipids	14 w	
12	Body fluid	15 – 24 w	

Second Stage

Unite 3 Musculoskeletal unit (7 hours)

1- Calcium homeostasis 2h

OUTCOME:

Knowing how to investigate abnormal serum calcium homeostasis: what are the actions of calcium and which factors that regulate serum calcium

- Calcium balance: explain calcium balance
- Biological function of calcium: actions of calcium in different tissues
- Control of calcium metabolism: explain calcium levels regulators
- The components of calcium in plasma: explain the free and bound calcium
- Calcium homeostasis: the main hormonal responses to a fall in plasma Ca2+, and the places where the negative feedback mechanism operates if plasma Ca2+ becomes high. The effect of PTH on the renal tubules
- Parathyroid hormone (PTH) (action and diagnostic importance)
- 1,25-Dihydroxycholecalciferol (action and diagnostic importance)
- Calcitonin (action and diagnostic importance) Investigation of abnormal calcium metabolism: how to use the following tests to assess the calcium status
- Serum calcium
- Effects of serum albumin
- Effects of plasma H+
- Serum phosphate
- Alkaline phosphatase (ALP)

2- Hypercalcemia 1h

OUTCOME: knowing the main causes of hypercalcemia
- Biochemical definition of hypercalcemia
- Clinical consequences of high Ca2+ 12 - The causes of hypercalcemia
- Primary hyperparathyroidism effects on calcium metabolism
- 'First-line' biochemical tests for investigating suspected hyperparathyroidism
- Hypercalcemia of malignancy (what are the mechanisms)
- Tertiary hyperparathyroidism (what is the mechanism and to diagnose)
- Familial benign hypocalciuric hypercalcemia (FBHH) (what is its importance, how to differentiate it from other causes of hypercalcemia, how to diagnose)

3- Hypocalcaemia 1h

OUTCOME: knowing the main causes of hypocalcaemia
- Biochemical definition of hypocalcaemia
- The causes of hypocalcaemia
- Vitamin D deficiency: explain how vitamin D deficiency results in hypocalcaemia, what are the causes of vitamin D deficiency, what is its effect on calcium associated tests, and how to diagnose vitamin D deficiency
- Clinical consequences of hypocalcaemia
- Hypoparathyroidism: what are the causes and how to be diagnosed

4- Galactosemia and phenylketonuria, glycogen storage disease and muscle dystrophy 1h

- Discuss the underlying concept of inborn errors of metabolism (galactosemia and phenylketonuria as examples).
- Discuss the relation between metabolic enzymes deficient in glycogen storage disease and muscle dystrophy

5- Uric acid, gout and purine metabolism 2h

OUTCOME: knowing how uric acid is produced and excreted
- The origin and excretion of uric acid - The distinction between primary and secondary gout
- Purine metabolism and uric acid: explain the routes to the formation of uric acid
- Serum urate: explain the factors that influence urate levels

- Hyperuricaemia: explain the effects of the following factors on urate levels
- Dietary factors
- Endogenous overproduction of urate
- Defective elimination of urate
- Gout: • Characteristics of gout attacks
- Features of primary gout
- Primary gout (explain how to Diagnose and its pathogenesis)
- Secondary of hyperuricaemia and gout (explain the causes and their mechanisms to cause hyperuricaemia)

Unite 4 Hematology Unit (5 hours)

1- Metabolic pathways of RBC 1h

- Metabolism: glycolytic pathway, Hexose monophosphate (pentose phosphate) pathway,
- The impact of G6PD enzyme in protecting the RBC from oxidative damage.

2- Inflammation 2h

OUTCOME: Knowing the changes in serum proteins in response to diseases

- Explain the plasma proteins commonly measured for the diagnosis and monitoring of specific diseases
- The acute-phase response: what are changes that characterize the body response to infection, inflammation, or trauma - Plasma proteins that change during the acute-phase response: explain their importance and changes that are occurring in following proteins during diseases

- C-reactive protein + ESR
- α1-Antitrypsin + Clinical consequences of the genetic polymorphism of AAT
- Caeruloplasmin
- α1-Acid glycoprotein
- Fibrinogen
- Ferritin

- Haptoglobin
- Albumin + Hypoalbuminaemia and its causes
- Transferrin
- Pre-albumin

3- Disorders of iron metabolism 2h

OUTCOME: knowing how to use different laboratory tests to assess body iron 15 status

- Essential iron compounds (explain haem and iron storage proteins)
- Iron metabolism: explain the following steps of iron metabolism and their effects on iron status • Dietary iron and iron absorption
- Iron transport, storage and utilization
- Iron excretion and sources of loss
- Laboratory assessment of iron status: what are the necessary tests in the investigation of iron deficiency states and iron overload?
- Serum iron: causes of variation and importance of measurements
- Serum ferritin: what are the causes of changes in serum ferritin and what is the importance of this test
- Serum transferrin, total iron-binding capacity and iron saturation: what are their importance and the causes of changes in their levels?
- Serum transferrin receptor role in assessing iron status
- Iron deficiency: explain the main causes and laboratory changes in iron status - Iron overload: explain the causes and diagnostic tests
- Hereditary haemochromatosis: brief explanation of its pathogenesis
- Iron poisoning: explain its effect on life and indication of intervention

Unite 5 Cardiovascular System Unit (7 hours)

1-The diagnosis of myocardial infarction 2h

OUTCOME: knowing the role of cardiac markers in diagnosis of MI

- WHO criteria + Universal Definition of Myocardial Infarction

- Biochemical tests in myocardial infarction and ischemia: explain which tests could be measured
• Time-course of changes: explain the changes in the levels of cardiac markers according to the duration of MI
• Optimal times for blood sampling: explain the appropriate times to take blood samples for cardiac markers measurement
• Troponin I and troponin T role in diagnosis of MI
• enzymes, such as creatine kinase (CK), CK-MB, aspartate aminotransferase (AST) and lactate dehydrogenase (LDH) role in diagnosis of MI
• myoglobin role in diagnosis of MI
• Elevations of cardiac troponin due to myocardial injury but not due to MI

2-The diagnosis of heart failure and thromboembolic disease 1h

OUTCOME: knowing which test could be useful in diagnosis of HF and TED
- B-type natriuretic peptide (BNP) (importance and clinical use)
- D-dimers (importance and clinical use)

3- Investigation of plasma lipid abnormalities 3h

- Plasma total cholesterol: explain the effecting factors and its importance
- Plasma triglycerides: explain the causes of variation
- Plasma LDL: explain its clinical importance
- Plasma non-HDL cholesterol meaning and importance
- Specimen collection: what are the requirements for good sampling for lipid profile?
- Routine investigations: what are the tests that should be requested in patients suspected to be at increased risk of ischaemic heart disease or of a lipid disorder?
- The primary hyperlipoproteinaemias: explain the causes of this disorder, the changes in lipids concentrations in plasma in each one, and Lipoproteins mainly affected:
• Familial hypercholesterolaemia
• Familial hypertriglyceridaemia
• Familial combined hyperlipidaemia
• Remnant hyperlipoproteinaemia
• Lipoprotein lipase deficiency (or apoC-II deficiency)

- Secondary hyperlipidaemia: explain the patterns of abnormality in each class of secondary hyperlipidaemia

4-Investigation of hypertension 1h:

OUTCOME: knowing which the importance of test in assessing hypertension complications and detecting the cause of secondary hypertension

- Aims of investigations in primary and secondary hypertension - Causes of secondary hypertension (explain renal or adrenal causes of hypertension)
- Laboratory tests and the investigation of hypertension:
• All patients: how to assess end-organ damage and cardiovascular risk
• Patients with suspected secondary hypertension: which test are required
• Biochemical investigations in suspected adrenal hypertension: explain the tests are required to detect different adrenal causes
- Primary hyperaldosteronism: what are the causes and how to establish the differential diagnosis?
- Investigation of suspected primary hyperaldosteronism:
• Screening (explain plasma aldosterone: renin ratio test)
• Confirmation testing (what are the confirmatory protocols)
• Subtype classification (distinguish idiopathic hyperplasia from Conn's adenoma)
- Secondary hyperaldosteronism (explain the mechanism and diagnosis)

Practical curriculum of the second stage

1 Musculoskeletal Unit Investigation of (Para-thyroid hormone, Vit. D3, ALP, Ca, P, Albumin, H+)
2 Cardiac Enzymes (S. troponin, CK, LDH) Cardiovascular system
3 Biochemical Tests BNP, and D-dimer Cardiovascular system
4 Serum iron, S. ferritin, transferrin, TIBC Hematology

Third Stage

Unite 7 Gastrointestinal tract disease (8 hours)

1-Stomach 1h

OUTCOME:

Knowing which laboratory tests are useful to diagnose and monitor PU and ZE syndrome Peptic ulcer

- Causes of Peptic ulcer
- Tests for H. pylori infection:
- Urea breath test (method and interpretation)
- Serological tests (uses and indications)
- Faecal antigen testing (importance)
- Gastrin (causes of abnormal results and indication of use) Zollinger–Ellison syndrome
- Definition
- Laboratory diagnosis (use of serum gastrin and provocative test)

2-Acute pancreatitis 1h

OUTCOME:

Knowing which laboratory tests are useful to diagnose acute pancreatitis and pancreatic insufficiency - Serum amylase activities (variation in different clinical conditions)

- Macro-amylasaemia
- Definition and Cause
- Laboratory diagnosis (how can be differentiated from increased serum amylase) Chronic pancreatitis
- Presentation
- Diagnosis of pancreatic insufficiency by Faecal elastase

3-Small intestine and colon (Tests of absorptive function) 1h

OUTCOME:

Knowing which laboratory tests are useful to diagnose coeliac disease and IBD Coeliac disease

- Serological tests for coeliac disease (the use of Anti-tTG and anti-endomysium IgA)

- IgA deficiency effect on the diagnosis Calprotectin
- Definition
- Uses in GIT diseases and to differentiate between IBD and IBS)

4-The investigation of malabsorption and diarrhea 1h

OUTVOME:

Knowing how to differentiate between pancreas, hepatobiliary system and small intestine causes

Clinical diagnosis: know the workup of diagnosis

- Differential diagnoses (pancreas, hepatobiliary system and small intestine causes)
- Initial investigations (to exclude an infectious cause of a GI disorder)
- Supportive investigations (which test are used to detect common intestinal and pancreatic causes)
- Biochemical abnormalities that are caused by malabsorption and which tests are required to asses them

5-Liver function tests 2h

OUTCOME:

Knowing how use the LFTs to detect different mechanisms of hepatobiliary disorders

- Routine liver function tests (what are they)
- Uses of LFTs - Bilirubin production and metabolism
  - Production
  - Transport in plasma and hepatic uptake
  - Conjugation of bilirubin and secretion into bile
  - Metabolism of bilirubin in the gut
  - Measurements of serum bilirubin (total, direct and indirect bilirubin tests)
- Hepatocellular damage:
  - Aminotransferase measurements roles to detect hepatocellular damage
- Cholestasis:
  - Alkaline phosphatase role to detect hepatobiliary damage

• γ-glutamyltransferase role to detect hepatobiliary damage
- Hepatic protein synthesis: The measurement of plasma proteins as an index of the liver's ability to synthesize protein
• Albumin
• Coagulation factors
• Immunoglobulins
- Overview of the Serological tests (general indications)
- Overview of the Markers of fibrosis
- Disordered metabolism in the liver diseases (changes in RFTs, glucose and lipids)

6- Jaundiced 1h

OUTCOME:
Knowing how to differentiate between different types of jaundice
- Definition of jaundice
- Types and causes of hyperbilirubinaemia
- Bilirubin and urobilinogen measurements (examples of results in various conditions)
- The investigation of jaundice (to differentiate between different causes of increase serum bilirubin)

Causes of Pre-hepatic hyperbilirubinaemia
Causes of Hepatocellular hyperbilirubinaemia
Causes of Cholestatic hyperbilirubinaemia
The congenital hyperbilirubinaemias
- Biochemical base of Gilbert's syndrome
- Biochemical base of Crigler–Najjar syndrome
- Biochemical base of Dubin–Johnson syndrome and Rotor syndrome

7- Laboratory investigations of abdominal pain 1h

OUTCOME:
knowing which laboratory tests are needed in patients presented with acute abdomen
- What biochemical disorders can be presented as acute abdomen and which tests should be ordered?

Unite 8 Renal and reproductive unit (10 hours)

1-Tests of glomerular function 2h:

OUTCOME:

knowing how to assess renal glomerular function

- Causes of impaired renal function
- Tests of glomerular function
- Conditions of accurate measurement of the GFR by clearance tests
- Measurement of creatinine clearance
- Estimation of creatinine clearance
- Plasma creatinine (causes of low and high plasma creatinine)
- Plasma urea (causes of low and high plasma urea)
- Cystatin C (advantage and disadvantage)
- Estimation of glomerular filtration rate (contents and uses)

2-Tests of tubular function 1h

OUTCOME:

knowing how to assess renal tubular function

- Classification of renal tubular disorders
- Urine osmolality and renal concentration tests (normal vs abnormal and clinical use of the test)
- Causes of failure to concentrate urine
- Fluid deprivation test
- Mechanism and conditions
- DDAVP test (indication and method)
- Interpretation of tests of renal concentrating ability
- Overview of Urinary acidification tests (methods of test)
- Types of Renal tubular acidosis
- **Overview** of Glycosuria, aminoaciduria's, and Fanconi syndrome

3- Acute kidney injury 1h:

OUTCOME:

knowing how to diagnose AKI

- Criteria of AkI diagnosis - Phases of AKI (biochemical changes and urine output changes)
- Investigation of low urinary output (differentiation between simple hypovolemia and AKI)

4- Chronic kidney disease 1h

OUTCOME: knowing how to diagnose CKD and its metabolic complications

- Definition
- Classification of CKD according to eGFR
- Disturbances of: in patients with CKD what kinds of changes affecting:

• Sodium, potassium and water
• Acid–base disturbances
• Calcium and phosphate
• Mg, Glucose, and erythropoietin

4- Proteinuria 1h

OUTCOME: knowing how to screen, diagnose, and follow up proteinuria

- Normal protein excretion in urine
- Definition of pathological proteinuria
- Laboratory tests of proteinuria (Knowing the screening and definitive tests)
- Types, causes, and differentiation of proteinuria:

• Overflow proteinuria
• Glomerular proteinuria, Nephrotic syndrome, and Glomerulonephritis
• Orthostatic proteinuria
• Tubular proteinuria

5- Renal stones and PSA 1h

OUTCOME: 1- knowing how to use chemical tests to detect the type of renal stones2- how PSA levels can differentiate between prostatic diseases renal stones

- Mechanism of renal stone formation

- Types and causes of renal stones:
• Hypercalciuria
• Oxalate, cystine and xanthine
- Chemical investigations on patients with renal stones to detect the cause and type of renal stone Prostatic specific antigen
- Uses of PSA - Types of PSA tests (ordinary vs high sensitivity test)
- Interpretation of PSA levels to detect the type of prostatic disorders

7- Acid-base balance 3h

OUTCOME:

1- knowing how to diagnose and classify acid base disorders
2- Which tests are required to accurately estimate arterial O2 content
- Maintenance of hydrogen ion concentration of ECF
- Transport of carbon dioxide
- Renal mechanisms for HCO3 reabsorption and H+ excretion
- Buffering of hydrogen ions - Investigating acid–base balance:
• Collection and transport of specimens
- Disturbances of acid–base status: causes and ABG analysis findings of:
• Respiratory acidosis
• Respiratory alkalosis
• Metabolic acidosis
• Metabolic alkalosis
- Interpretation of results of acid–base assessment:
• Plasma H+ is increased
• Plasma H+ is decreased
• Plasma H+ is normal
• Mixed acid–base disturbances
- Other investigations in acid–base assessment:
• Total CO2
• Anion gap

• Plasma chloride
- Oxygen transport:
• The full characterization of the oxygen composition of a blood sample measurements
• Indications for full blood acid–base and oxygen measurements
• Types of Respiratory insufficiency

Unite 9 Endocrine unit (10 hours)

1-Diabetes mellitus and hypoglycemia 2h

OUTCOME:
Knowing how to diagnose, monitor, and detect the metabolic complications of DM
- Classification of DM (primary vs secondary)
- Types (T1DM, T2DM) - Diagnosis: how to use the following test to reach diagnosis
• FBS and RBS
• HbA1c
• OGTT
- Impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) concepts
- Monitoring the treatment of diabetic patients: types and importance of monitoring strategies
• Home blood glucose monitoring
• Glycated hemoglobin
• Glycated plasma proteins
• Microalbumin - Metabolic complications of diabetes mellitus
- Diabetic ketoacidosis (DKA):
• Metabolic and clinical abnormalities in DKA
• Investigations and monitoring
- Hyperosmolar hyperglycemic state (HHS)
• Metabolic and clinical abnormalities in HHS
• Investigations
- Hypoglycemia:

- Diagnostic criteria
- Types and causes
- Investigations

2-Disorders of the hypothalamus and pituitary gland 1h

OUTCOME:

Knowing how to detect hyperprolactinemia

- Factors that regulate the release of anterior pituitary hormones
- Prolactin:
- Secretion and function
- Macroprolactin concept
- Hyperprolactinemia
- Causes of hyperprolactinemia
- Diagnosis (which causes should be excluded first and how detect persistent elevation of prolactin)
- Degrees of hyperprolactinemia in various clinical scenarios

3-Thyroid gland 3h

OUTCOME:

Knowing how to use TFTs to detect different types of thyroid disorders

- Thyroid hormone
- Synthesis and metabolism
- Plasma transport and cellular action
- Regulation of thyroid function - Investigations to determine thyroid status: what are the changes in the following tests in different types of thyroid disorders?
- Thyrotrophin (causes of high and low)
- Free T4 and free T3
- Total T4 and total T3
- Interpretation of thyroid function tests in patients being investigated for 30 suspected thyroid disease
- Categories of patients who should have thyroid function tests performed
- Hyperthyroidism

• Concepts of (Overt primary, Subclinical, and Secondary hyperthyroidism)
• Interpretation of thyroid function tests in suspected hyperthyroidism
- Hypothyroidism • Concepts of (Overt primary, Subclinical primary, secondary (central) hypothyroidism
• Monitoring of HRT with TFTs
• Interpretation of thyroid function tests in suspected hypothyroidism
- Thyroid function testing in patients with non-thyroidal illness (NTI)
- Thyroid hormone resistance (THR):
• Types (generalized, pituitary, and peripheral)
• Diagnosis (the importance to differentiate between TSHoma and THR, and which tests are required)
- Causes of abnormal results for thyroid hormone measurements in euthyroid subjects
- Miscellaneous tests and thyroid disease: the role of the following test to detect the type of thyroid disorders:
• TRH test
• Anti-thyroid peroxidase antibodies (TPOAbs)
• Thyrotrophin receptor antibodies (TRAbs)
• Tests affected by changes in thyroid status

4-Regulation of adrenal steroid hormone synthesis and secretion 1h

OUTCOME: knowing the metabolic effect of the adrenal cortex hormones
- Synthesis and secretion of adrenal hormones
- Glucocorticoid secretion: effects and transport of glucocorticoids
- Factors regulate ACTH secretion
- The hypothalamic
–anterior pituitary
–adrenal axis (overview)
- Aldosterone secretion: the effects and control of aldosterone secretion
- The renin–angiotensin system (overview)
- Androgen secretion: types and importance of adrenal androgens
- Steroid biosynthetic pathways in the adrenal cortex (overview)

5- Investigation of suspected adrenocortical hyper function 2h

OUTCOME:
knowing how to use the laboratory tests to diagnose adrenocortical hyperfunction
- Hyperfunction of the adrenal cortex concept
- Cushing's syndrome definition
- Causes of glucocorticoid excess (ACTH dependent vs ACTH independent)
- Tests used to establish if a clinical diagnosis of Cushing's syndrome is likely: how to do and interpret the following laboratory tests a- Initial screening tests:
• Low-dose dexamethasone suppression test
• Urinary free cortisol (UFC)
• Late night salivary cortisol
• Interpretation of screening tests
b- Confirmatory tests:
• Loss of diurnal rhythm
c- Determining the cause of Cushing's syndrome:
• Plasma ACTH
• High-dose dexamethasone suppression test
• CRH stimulation test
d- Other biochemical tests (k+, GTT): how the adrenocortical hyperfunction could affect the different metabolites

6- Investigation of suspected adrenocortical insufficiency 1h

OUTCOME: knowing how to use the laboratory tests to diagnose adrenocortical insufficiency
- Classification, causes, and presentation patterns (primary vs secondary causes)
- Diagnosis of primary adrenal insufficiency (Addison's disease): how to use the following tests to diagnose adrenocortical insufficiency:
• Cortisol and ACTH measurements
• Short tetracosactrin (Synacthen) test
• Further testing in confirmed adrenocortical insufficiency

Unite 10 Neurosciences unit (2 hours)

CSF examination 2h

OUTCOME:

How to assess the physical and biochemical features of CSF to diagnose some of neurological diseases

- Examination of the cerebrospinal fluid: how the physical and biochemical features of CSF can be interpreted to reach diagnosis:

- Types of CSF examination
- Sample collection (requirements of collection)
- Appearance (normal and abnormal)
- Causes of clotted CSF
- Color (causes of red and yellow color)
- Turbidity (causes)
- Biochemical estimations:

a- Glucose (causes of abnormal CSF glucose)

b- Protein (causes of abnormal total, individual, and CSF protein synthesis)

Practical curriculum of the third stage

1 Pancreatic Function test GIT Unit
2 Fecal occult blood test GIT Unit
3 Liver Function Tests GIT Unit
4 RFTs + GFR Renal and Reproductive
5 Urine analysis Renal and Reproductive
6 Blood gas analysis Renal and Reproductive
7 TFT (TSH,T4,T3) Endocrine
8 DM Endocrine

Fourth stage

Unite 11 Biochemical changes of the pregnancy1 hour

OUTCOME:

Understand how different biochemical parameters are affected by pregnancy

- Explain the concept of foetoplacental unit
- Review the use of HCG in detecting pregnancy
- Explain the changes in the steroids hormones
- Explain the Effect of pregnancy on following biochemical tests:

• Reproductive hormones
• Cortisol
• Thyroid function tests
• Plasma volume and renal function
• Serum lipids and proteins
• Liver function tests
• Iron and ferritin

Unite 12 Metabolic complications in pregnancy 2 hours

OUTCOME:

Knowing how different metabolic complication of the pregnancy can be diagnosed

- How to monitor DM during pregnancy
- How to diagnose, monitor, and follow up GDM
- Thyroid disorders:

- What are the categories of patient should have TSH and FT4 measured
- Explain the risk of hypothyroidism during pregnancy
- What is the ideal monitoring regimen for pregnant women with established hypothyroidism?
- How to diagnose, monitor and follow up hyperthyroid during pregnancy
- Explain the concept of Hyperemesis gravidarum
- How to diagnose Post-partum thyroiditis and what it is its differential diagnosis

- What are the diagnostic test of Obstetric cholestasis

Pre-natal diagnosis of foetal abnormalities 1 hour

OUTCOME: knowing how fetal abnormalities being early detected can

- What are the trisomies that should be screened, and which tests that should be used
- Which tests should be used for first trimester screening?
- Which tests should be used for second trimester screening?
- Explain the concept of Noninvasive prenatal testing (NIPT)

1-Clinical biochemistry in paediatrics Paediatrics 2 hr.

- Specimen collection from neonates and children
- Causes and diagnosis of biochemical disturbances in the neonate and early childhood:

A- Glucose:

- what is the cut off value for diagnosis of hypoglycemia in the neonate
- Infants at risk of developing hypoglycemia
- Explain the Transient and persistent hypoglycemia
- What are the investigations in the hypoglycemic child

b- Calcium and magnesium:

2-Explain the early and late neonatal hypocalcaemia Inherited metabolic disorders. 2

hr.

3- Miscellaneous childhood disorders2 hr.