A Guide to Physiology & Bio-Chemistry

Reflex

MCQ & COLOUR ATLAS

Bangladesh is my Pride

14th Edition

Dr. Reza
Dr. Arzu
Dr. Ranzu

Following New Curriculum

14th edition

A Guide to Physiology and Bio-chemistry

Reflex

MCQ & Colour Atlas

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Preface

It is well known that the students of medical scinces are greatly handicapped to the want of a concise and comprehensive text book on the subject as a whole. A beginner has therefore, no other way than to go through a number of voluminous text books on each one of the various branches of medical sciences and in doing so, he/she is very often confused about how much he/she should read and know. This confusion obviously leads to undue wastage of time and energy on the part of the student. Reflex, a promising guide to *Physiology & Bio-Chemistry*, which thought about this problem & was published in May 1989. Since its publication in 1989, Reflex has garnered cosiderable response from medical students & doctors.

In this 14th edition I have tried my best to give the reference of different authorized books e.g '*Text Book of Medical Physiology* 11th edition' by Arthur C. Guyton, M.D & Hall; '*Review of Medical Physiology*- 22th edition by William F. Ganong, MD; MD Samson wright's; MD Harold A. Harper; Davidson's Medicine; Robbins Pathologic Basis of Disease; in addition to some necessary diagrams & sketches with question's answer following the new curriculum so that the student will not have to face any problem in their study, together with their both written examinaion & viva voice.

All the chapters have been revised thoroughly, added some new figure & sketches, some new aspects on the basis of the latest edited "Physiology text books" mentioned above specially- '*Text Book of Medical Physiology- 11th edition*' by Arthur C. Guyton, M.D & Hall, and '*Review of Medical Physiology- 22th edition* by William F. Ganong, MD. All the systems are rearranged.

Multiple choice questions are added with their answers which will aid the students & doctors in particular content.

Color Atlas of physiology is added for medical students who want to master large amounts of information in a limited amount of time and review specific topics quickly & easily.

In this fourteen edition, MCQ portion is shifted from paper I and paper II to the Reflex, and paper I (written-SAQ), paper II (written-SAQ), and viva & practical (SOE, OSPE, & practical) is rearranged into one book named "***Reflex- Written & Viva*** (SAQ, SOE, OSPE & practical).

Efforts will be worthwhile if students find the work helpful in introducing this to the realm of the *vast science of medicine*. Please go through the text books.

With best wishes to all-

Dr. Md. Mustafizur Rahman Ranzu
10 April 2006

Dedicated
To
Our Beloved Parents

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Given under my hand and seal on this 29TH day of JUNE A.D. 2008.

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New curriculum

Notable features of new curriculum

1. M.B.B.S course will be of 05 (Five) years duration plus 01 (one) year Internship training.
2. There will be 3 professional Examinations during the M.B.B.S course :
   - i. At the end of 1 & 1/2 years : 1st professional.
   - ii. At the end of 3 & 1/2 years : 2nd professional.
   - iii. At the end of 5 years : Final professional.
3. There will be 2 (two) professional examination in one year.
   - i. In 1st week of January
   - ii. In 1st week of July

Subjects with marks allocated for different professional examination will be as follows :

i. ***In 1st Professional*** :

1. Anatomy	:	500 Marks
2. Physiology	:	400 Marks
3. Biochemistry	:	400 Marks
Total		*= 1300 Marks*

ii. ***In 2nd professional*** :

1. Pathology (300) + Microbiology (300)	:	600 Marks
2. Community Medicine	:	300 Marks
3. Pharmacology & Therapeutics	:	300 Marks
4. Forensic medicine & toxicology	:	300 Marks
Total		*= 1500 Marks*

iii. ***In Final Professional*** :

1. Medicine	:	500 Marks
2. Surgery	:	500 Marks
3. Obs. & Gynae	:	500 Marks
Total		*= 1500 Marks*

* Pass Mark will be 60% in each written, Oral, & Practical/Clinical Exam, Separately.

* Marks and pattern of questions in written examination in each subject will be as follows -

1. 10% Marks of written examination of each paper of each subject is allocated for formative assessment.
2. 20% Marks are allocated for MCQ for each paper. There will be separate Answer script for MCQ examination. Time allocation is 1 (one) minute for each question consisting of 5 stems (20 questions).
3. 70% Marks are allocated for SAQ (Except in Community medicine) for each paper.

* For oral, clinical & practical the examination system & Marks distribution is shown against each subject (See the Curriculum).

* Oral part of the examination will be structured oral.

* ***In Medicine*** : There will be 2 boards consisting of 4 examiners for oral, clinical & practical examination.

Board - I	:	1 examiner from Internal Medicine
	:	1 examiner from pediatrics
Board - II	:	1 examiner from Internal Medicine
	:	1 examiner from sub specialities (e.g. dermatology/Psychiatry)

There will be No Temp-Chart, slides and specimen in the Practical Examination.

* ***In Surgery*** : Oral, Practical & clinical examination will be held in Two separate days.

One Day	:	General Surgery
Another day	:	Ophthalmology + ENT

Assessment of Physiology

Summative Assessment (First Professional Examination)

Components	*Marks*	*Total Marks*
i. *Formative assessment :*	10+10	20
ii. *Written Examination :*		
Paper -I :		
a. MCQ	20	
b. SAQ	70	
Paper - II :		180
a. MCQ	20	
b. SAQ	70	
iii. *Practical Examination :*		
a. OSPE	40	
b. Traditional practical methods and experiments	50	100
c. Practical Note Book	10	
iv. *Oral Examination (Structured) :*		
a. 2 boards (4 examiners) : I. 2 internals II. 2 externals		100
Grand Total :		***= 400***

Paper I :

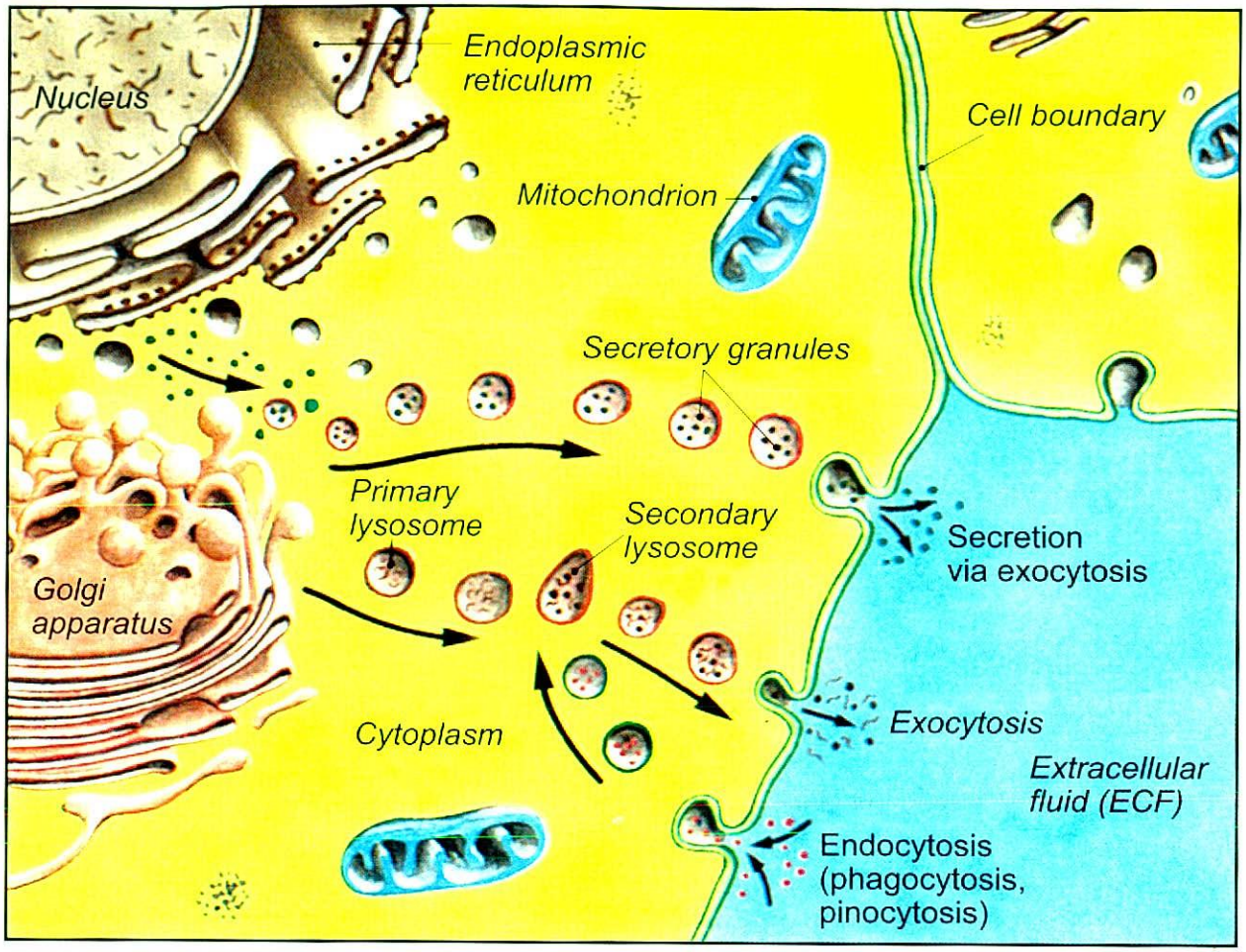
1. General Physiology
2. Blood
3. Cardiovascular
4. Respiratory System
5. Alimentary System.

Paper II :

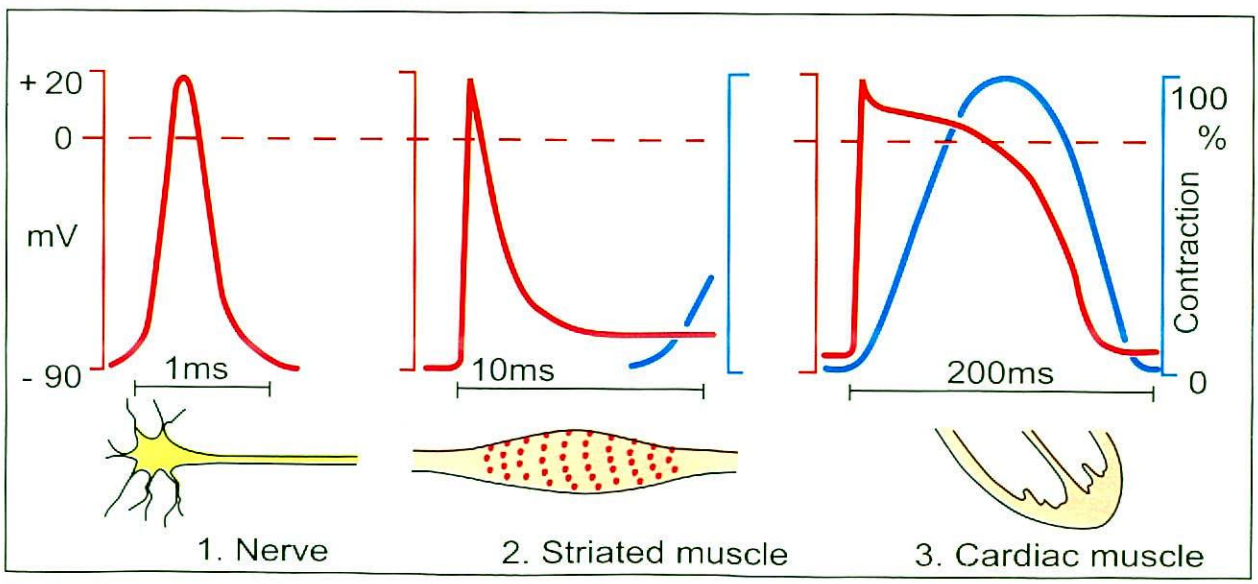
1. Renal Physiology & body fluid
2. Endocrine & reproductive
3. Nervous System & Temp. Regulation
4. Special senses.

There will be separate Answer Script for MCQ & SAQ
Pass marks 60% in each of theoretical oral and practical.

Content in brief

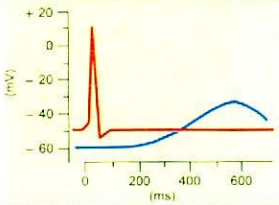
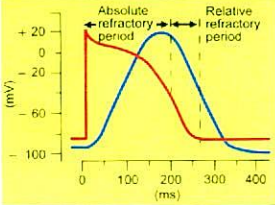
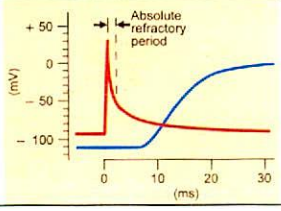


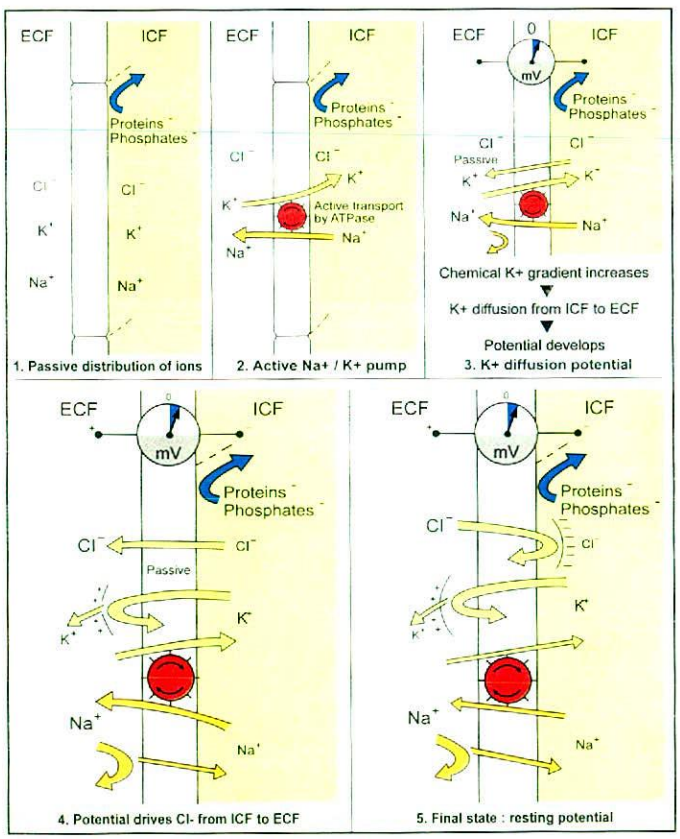
A. The cell. Endocytosis and exocytosis



B. Action potential - nerve and muscle

A. Structure and function of 3 classes of muscle

		Smooth muscle	Cardiac muscle	Skeletal muscle
				
Structure	Motor end-plate	None	None	Yes
	Fiber	Fusiform, short (max 0.4mm)	Branched	Cylindrical, long (max. 15 cm)
	Mitochondria	Few	Many	Few
	Nucleus/fiber	1:1	1:1	Several per fiber
	Sarcomere	None	Yes-max. length 2.6 µm	Yes-max. length 3.65 µm
	Syncytium	Yes (bridges)	Yes (functional)	No
	Sarcoplasmic reticulum	Poorly developed	Well developed	Extensively developed
	ATPase	Little	Average	Much
Function	Pacemaker	Yes (slow)	Yes (fast)	No (requirees neural impulse)
	Response	Graded	All or none	Graded
	Tetanus	Yes	No	Yes
	Operating range	Variabl length-tension curve	On rising portion of length-tension curve	On peak of length-tension curve
Response	Potential —— Mechanical tension ——			

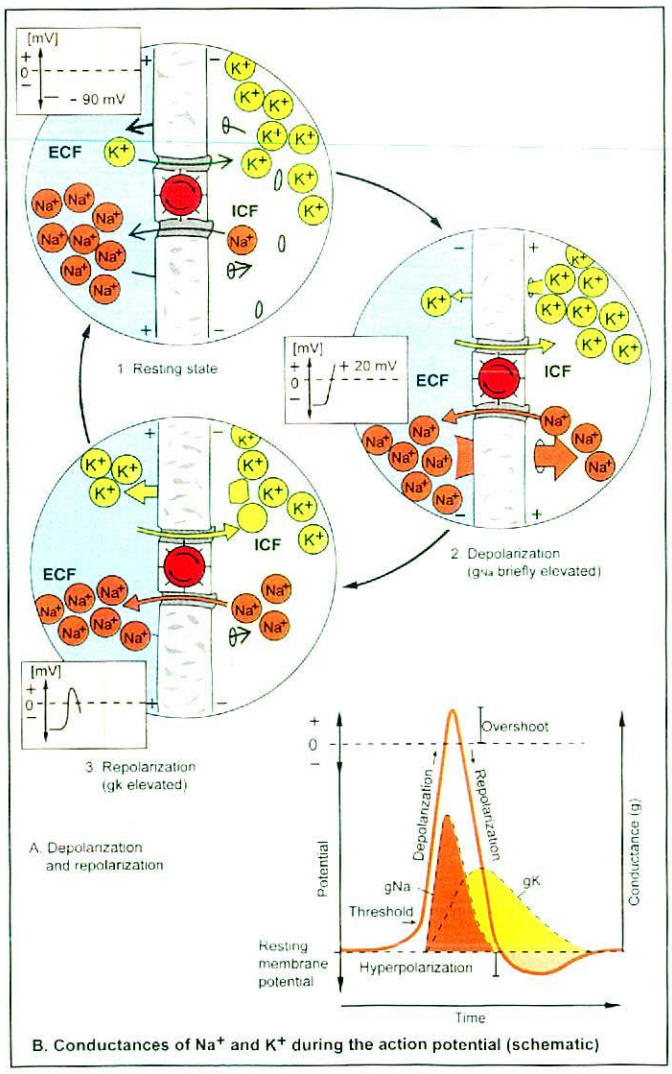


A. Causes and consequences of the resting potential

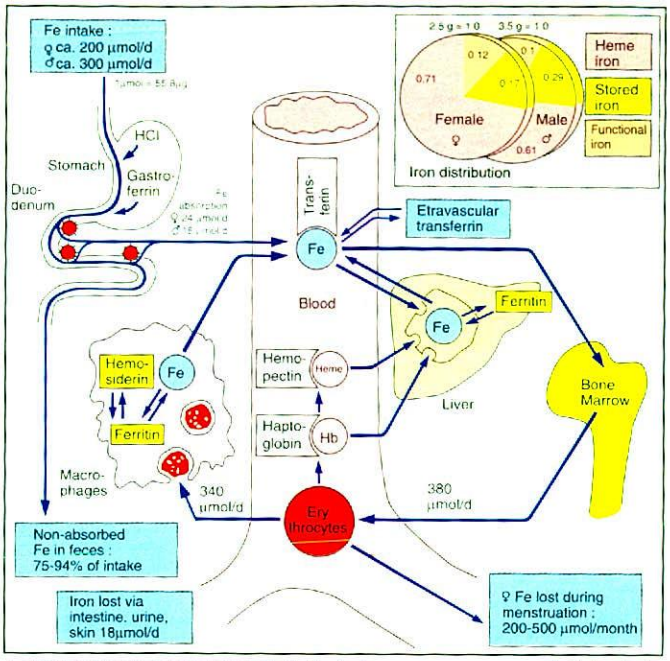
	"Effective" concentration (mmol/kg H_2O)		Equilibrium potential
	Interstitium (ECF)	Cell (ICF)	
K^+	4.5	160	- 95 mV
Na^+	144	7	+ 80 mV
H^+	$4 \cdot 10^{-5}$ (pH 7.4)	10^{-4} (pH 7.0)	- 24 mV
Cl^-	114	7	- 80 mV
HCO_3^-	28	10	- 27 mV

B. Typical "effective" concentrations and equilibrium potentials of important ions in skeletal muscle (37°C)

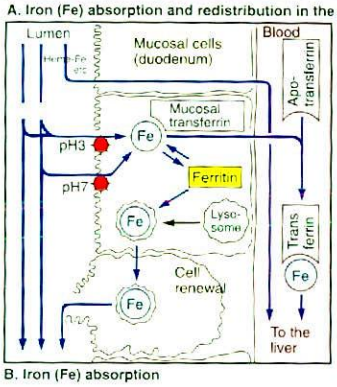
(after Conway)



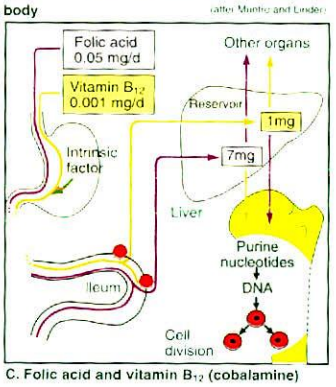
B. Conductances of Na^+ and K^+ during the action potential (schematic)



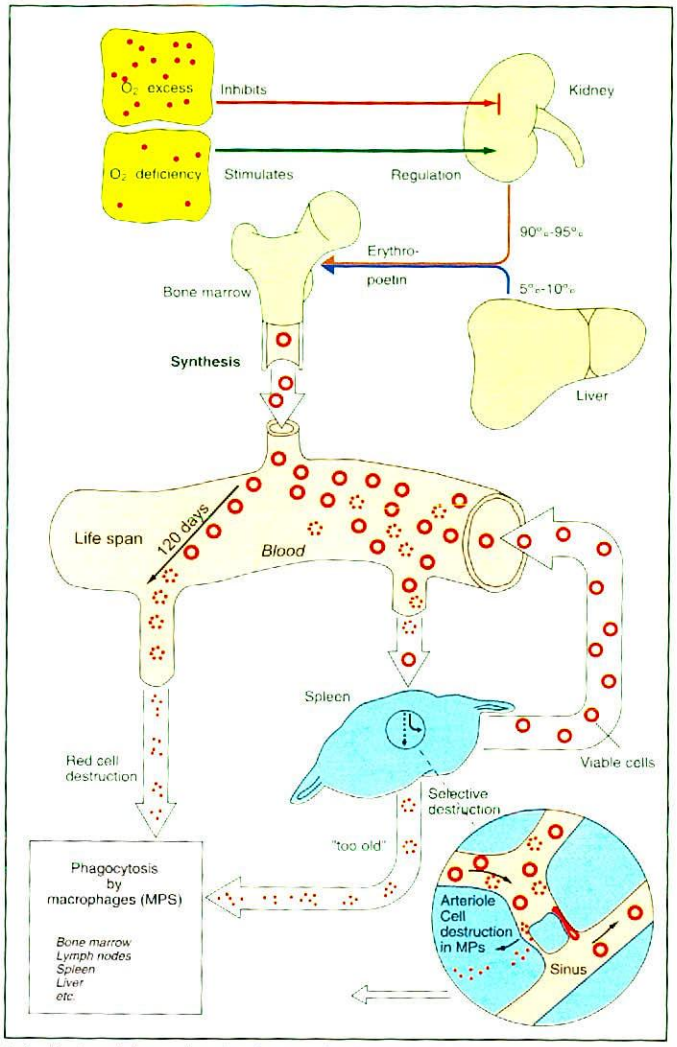
A. Iron (Fe) absorption and redistribution in the body



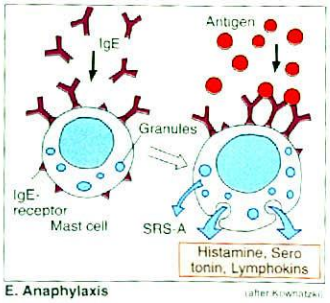
B. Iron (Fe) absorption



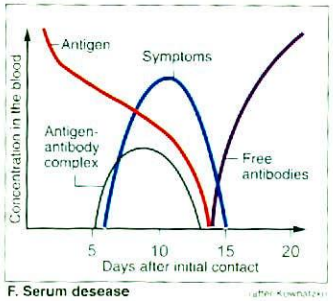
C. Folic acid and vitamin B_{12} (cobalamine)



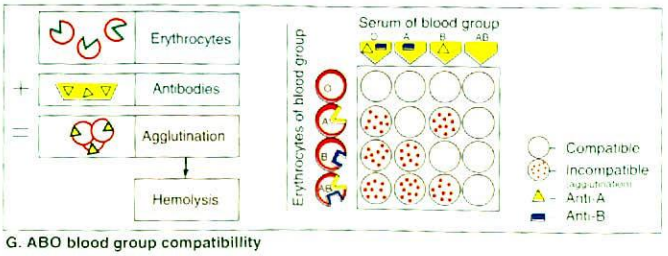
A. Synthesis and destruction of erythrocytes in adults



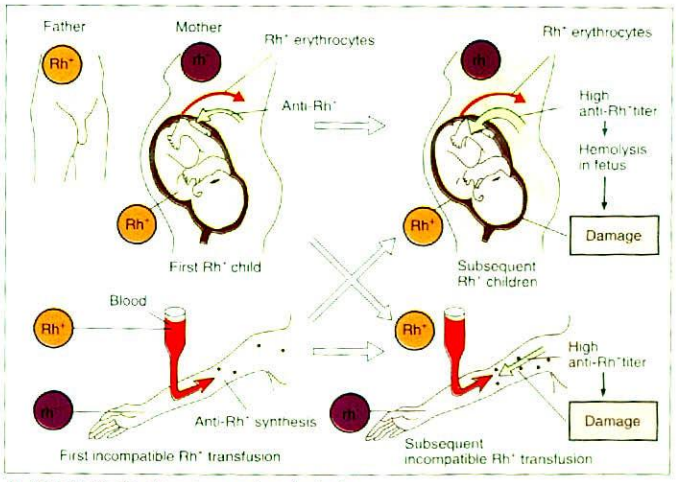
E. Anaphylaxis



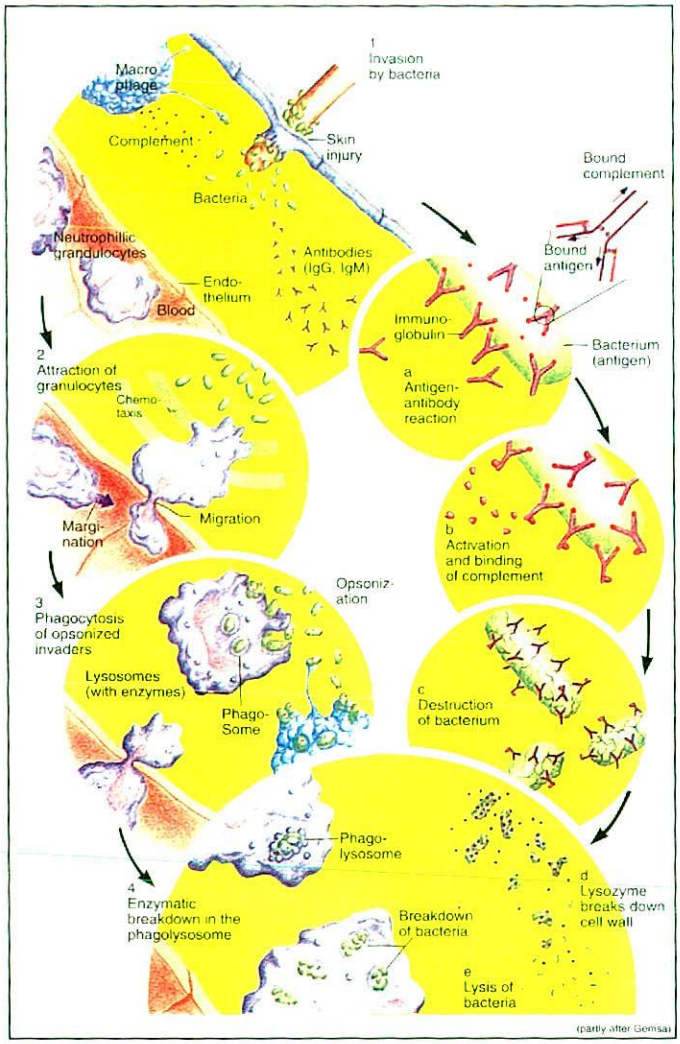
F. Serum desease



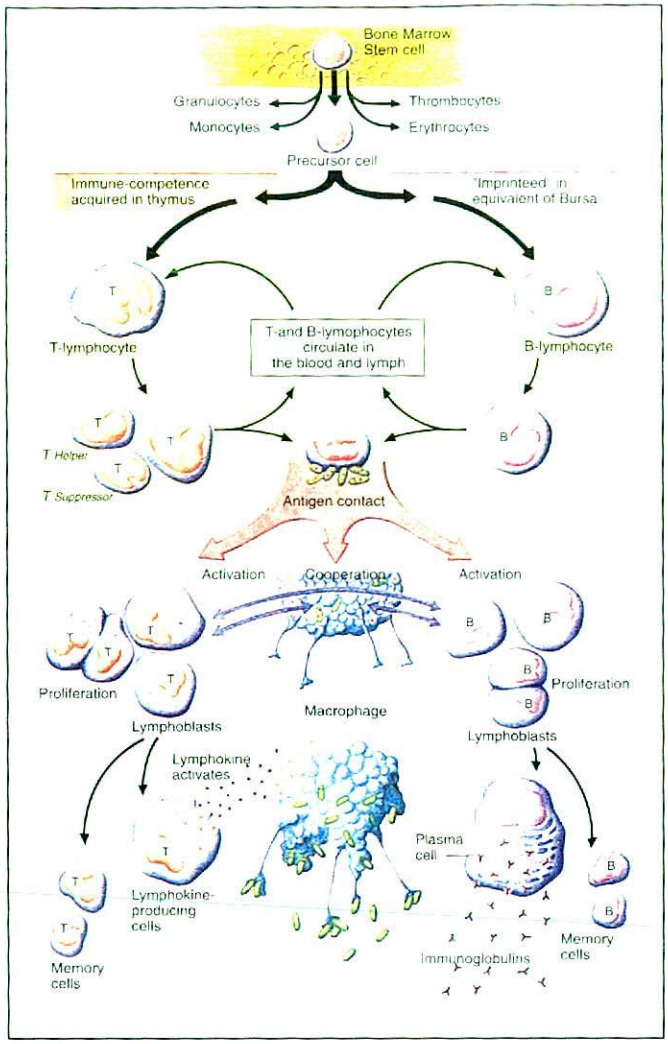
G. ABO blood group compatibillity



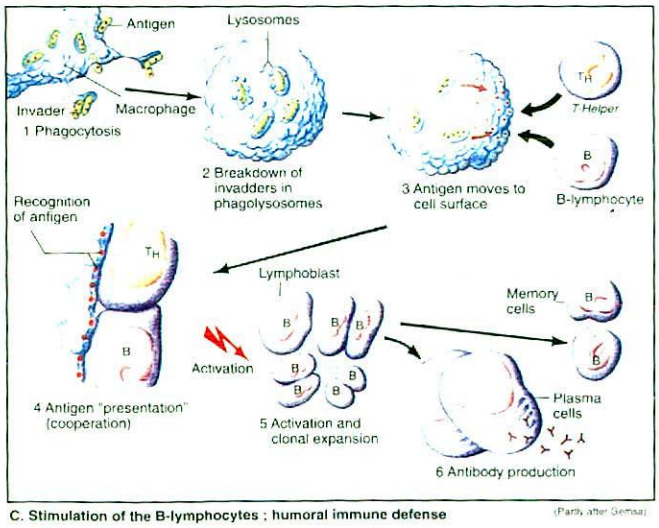
H. Rh sensitization (pregancy or transfusion)



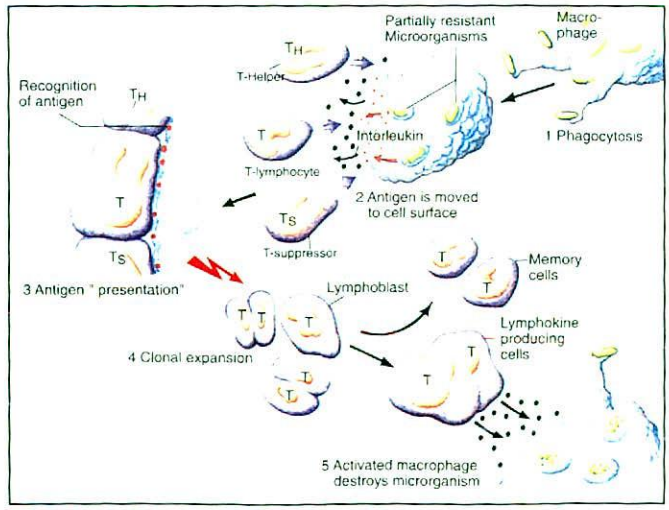
A. Mechanisms involved in defense against bacteria : phagocytosis (1-4) : extracellular lysis (1, a-e)



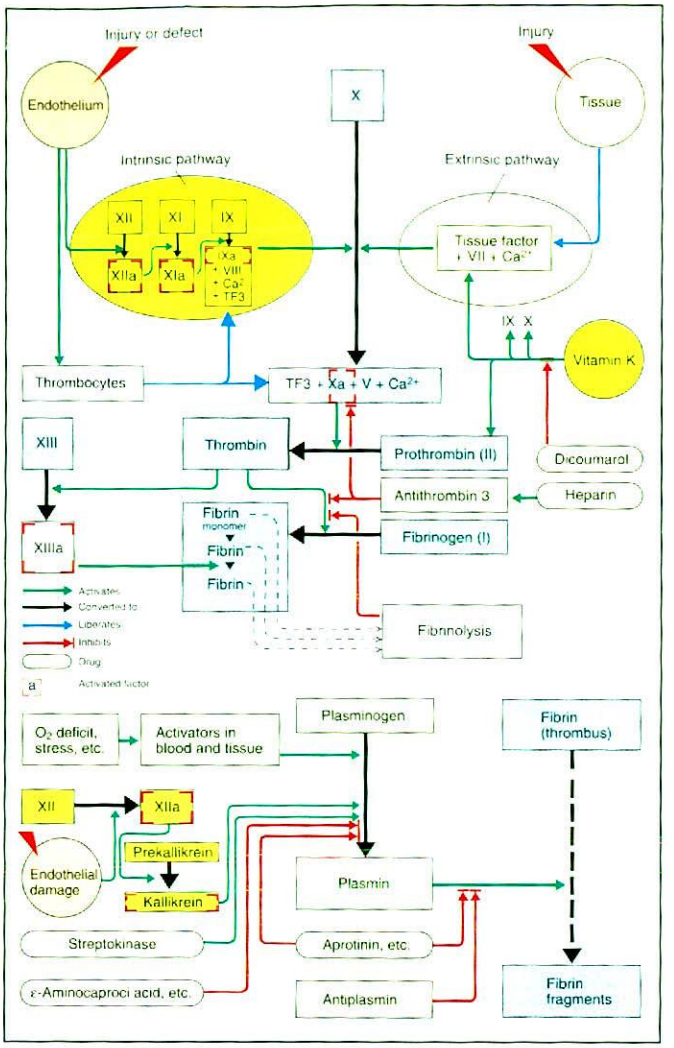
B. Cells involved in Immune system



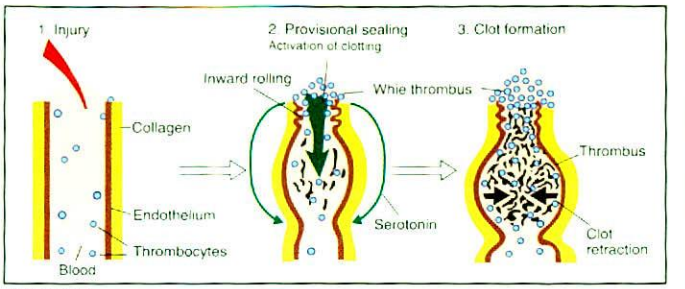
C. Stimulation of the B-lymphocytes ; humoral immune defense



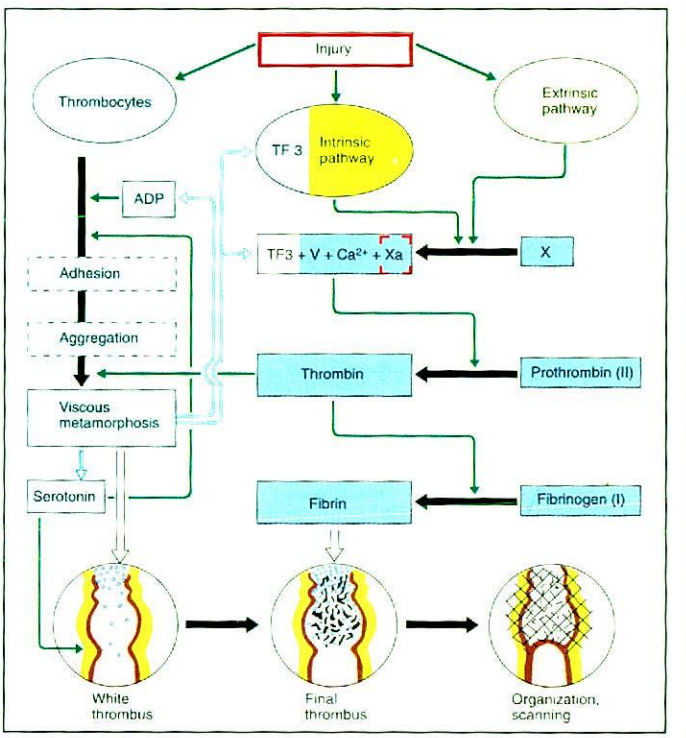
D. Stimulation of the T-lymphocytes and activation of macrophages



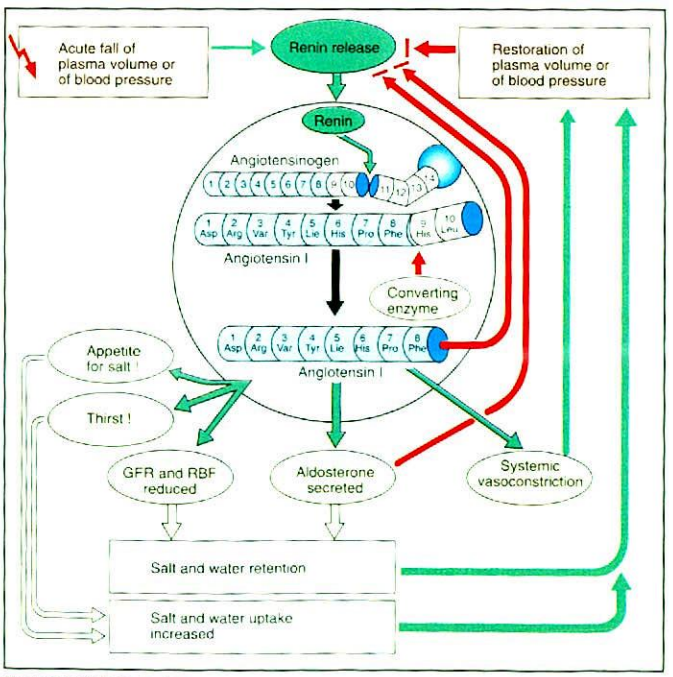
Blood clotting and fibrinolysis



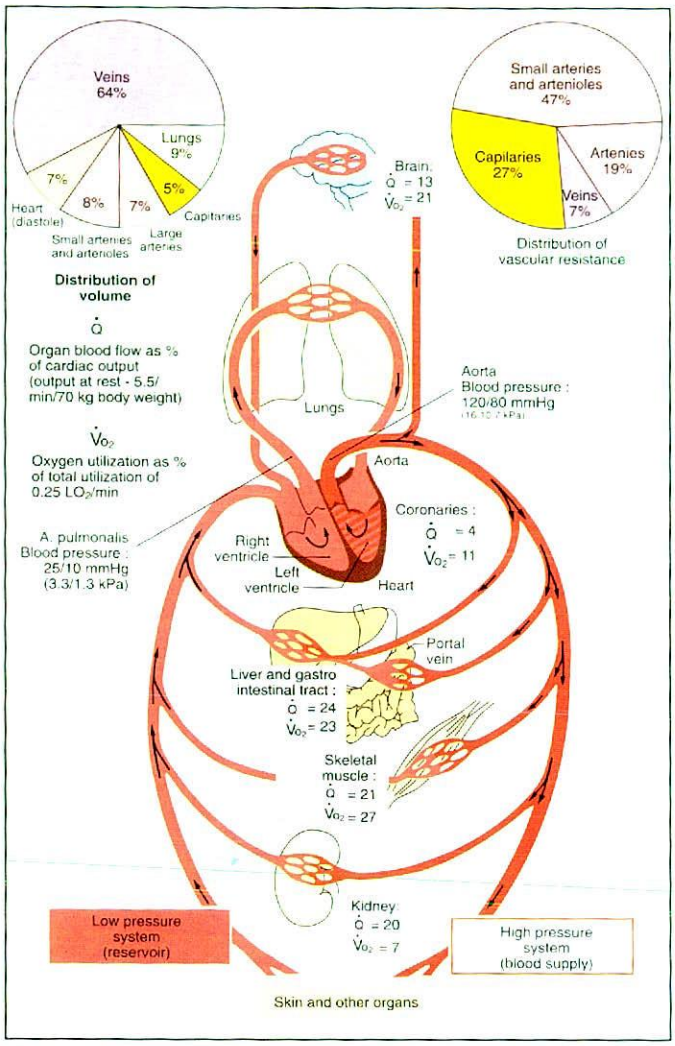
Hemostasis



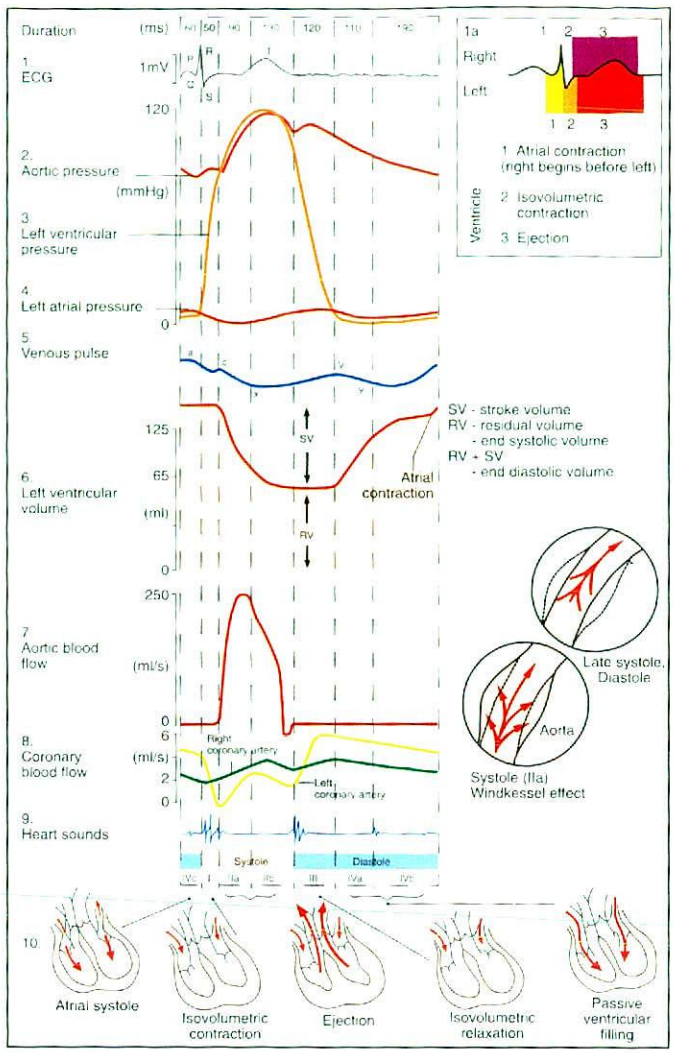
Hemostasis



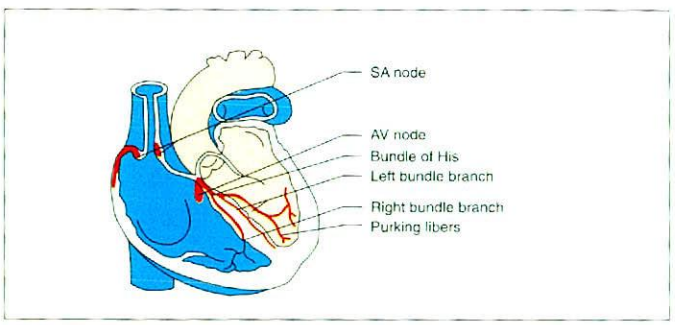
Renin-anglotensin system



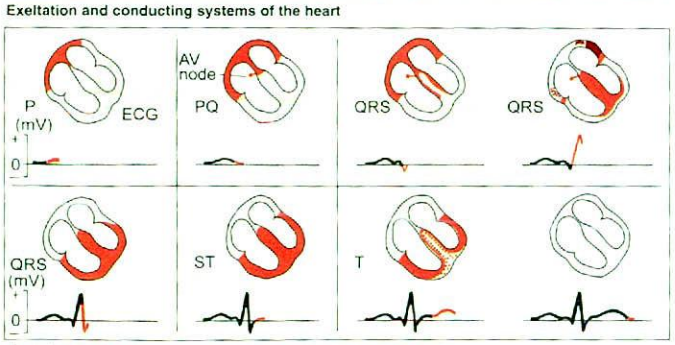
Cardiovascular system



Cardiac cycle



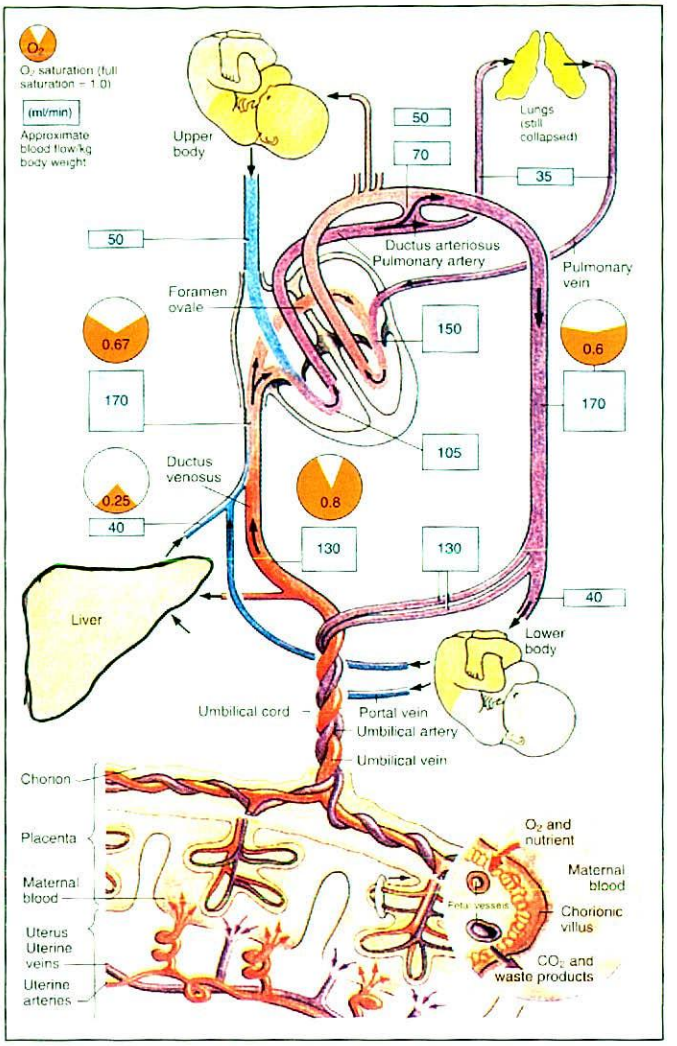
Exeltation and conducting systems of the heart



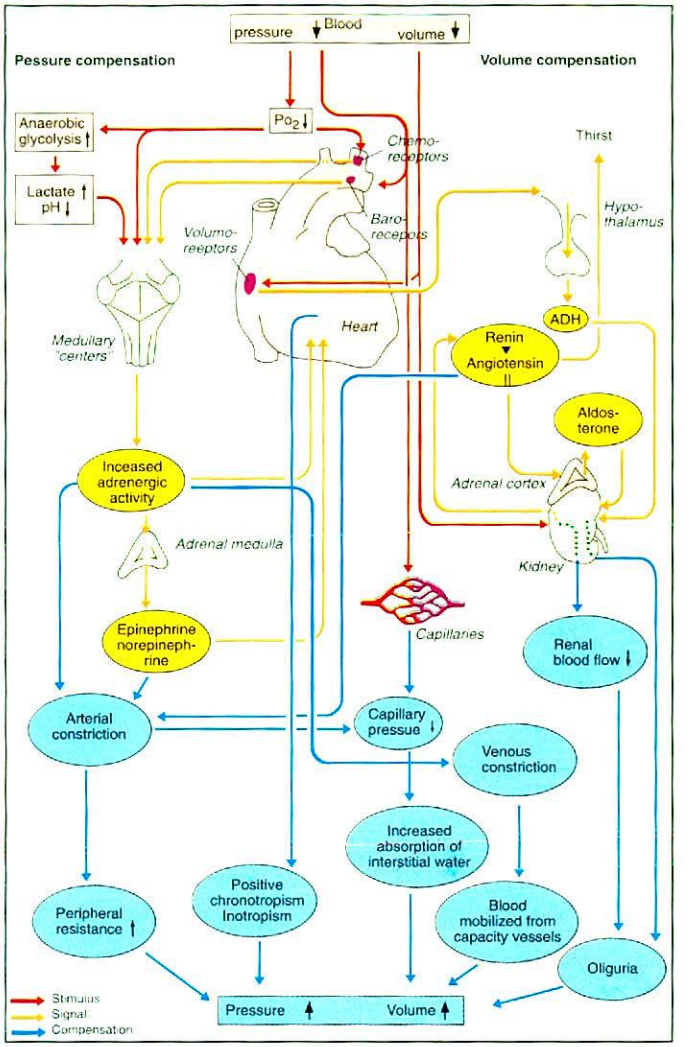
Correlation of ECG with de-and repolarization wave in the heart

Event		Time (ms)	ECG	Conduction velocity (m/s)	Intrinsic automaticity (min⁻¹)
SA node					
Impulse generated		0	Pwave	0.05	70-80
Atrial depolarization	right	50		0.8-1.0	
	left	85			40-60
AV node					
Arrival of Impulse		50	P.Q Interval (delay in excitation)	0.05	
Departure of Impulse		125		1.0-1.5	
Bundle of His activated		130		1.0-1.5	
Bundle branches activated		145		3.0-3.5	
Purkije fibers activated		150			
Endooardium depolarized	right ventriele	175	QRS complex	1.0 in myocardium	20-40
	left ventricle	190			
Myeeardluum depolarized	right ventricle	205			
	left ventricle	225			

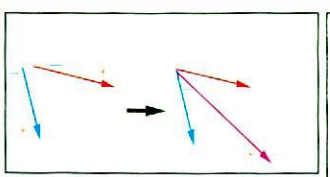
Excitation of the heart : time course, ECG and conduction velocity



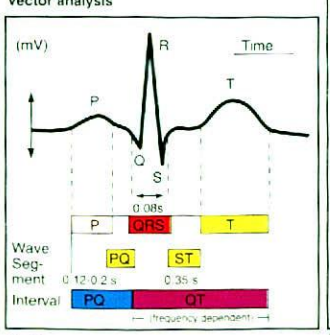
Fetal circulation and placenta



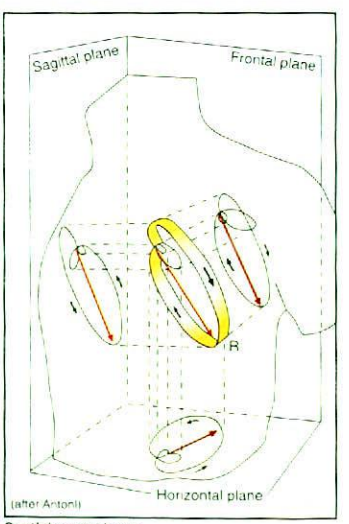
Compensatory responses in reversible hypovolemic shock



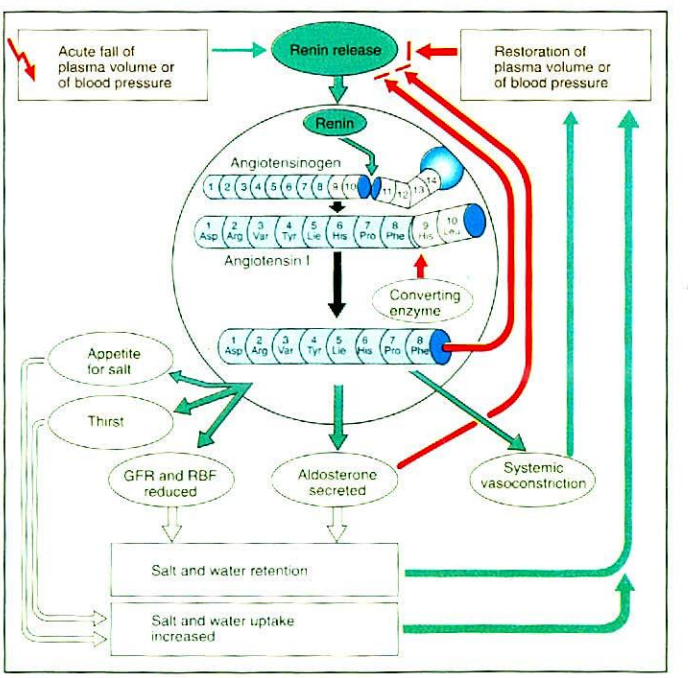
Vector analysis



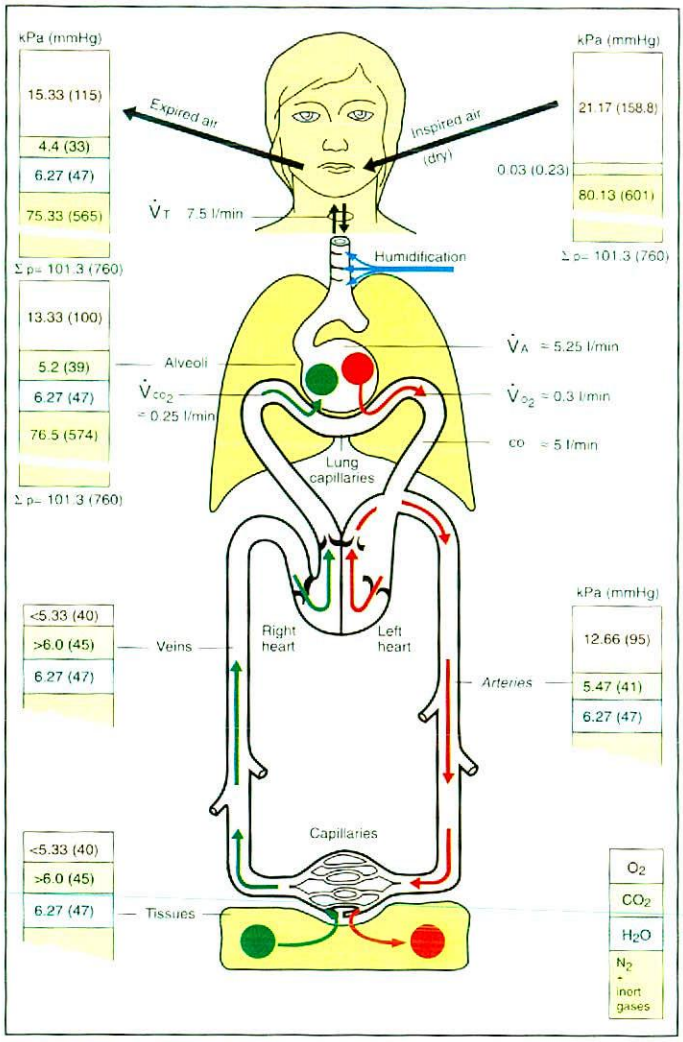
ECG



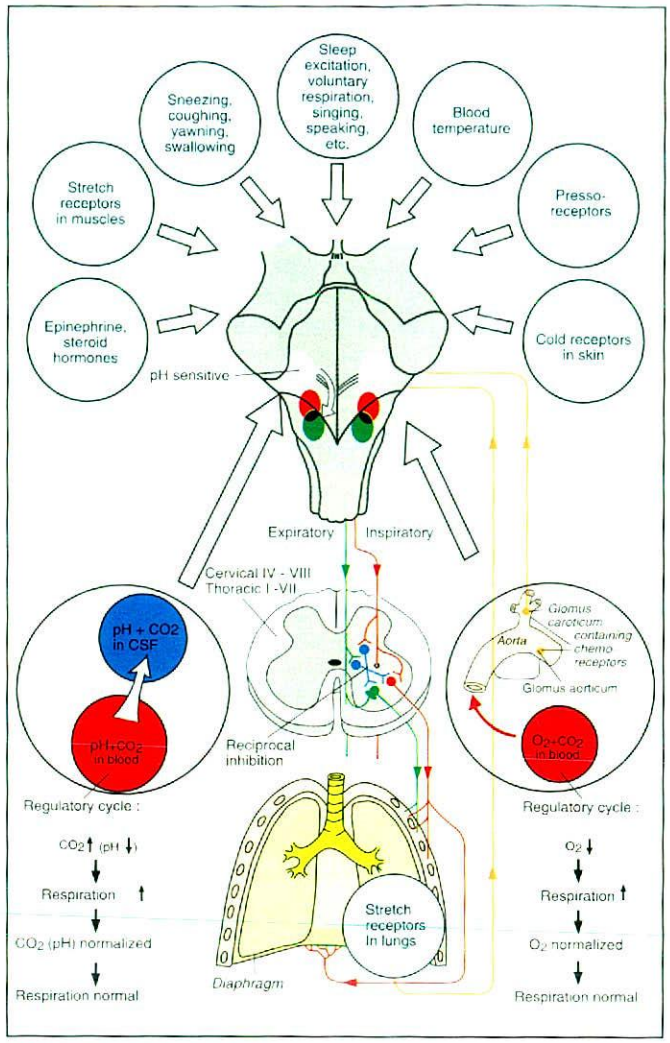
Spatial vector loops



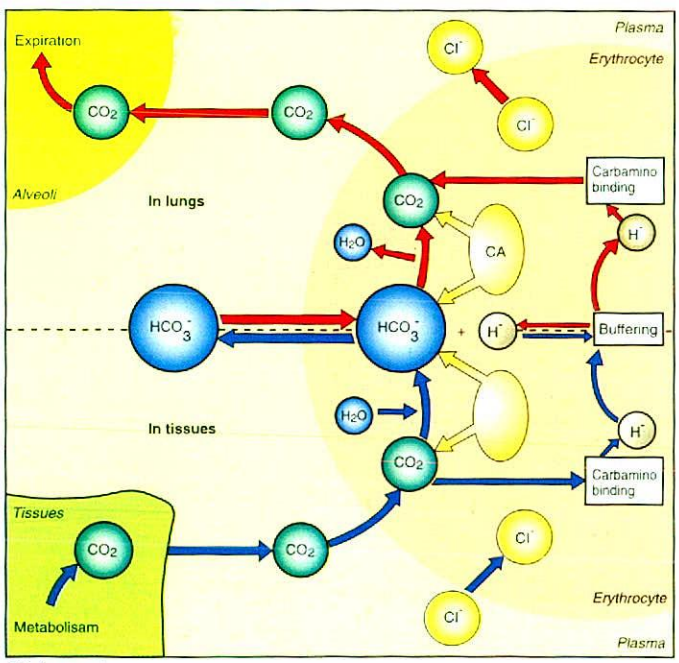
Renin-anglotensin system



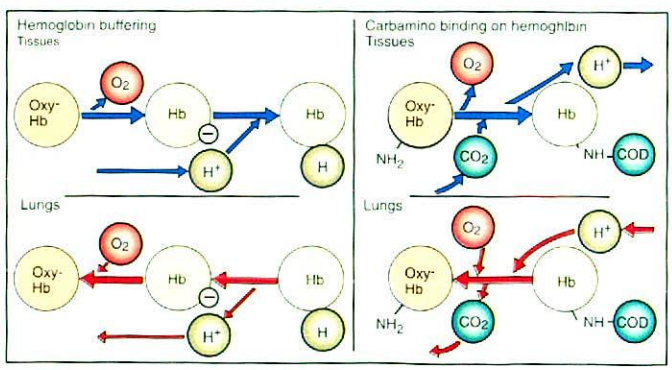
Respiration



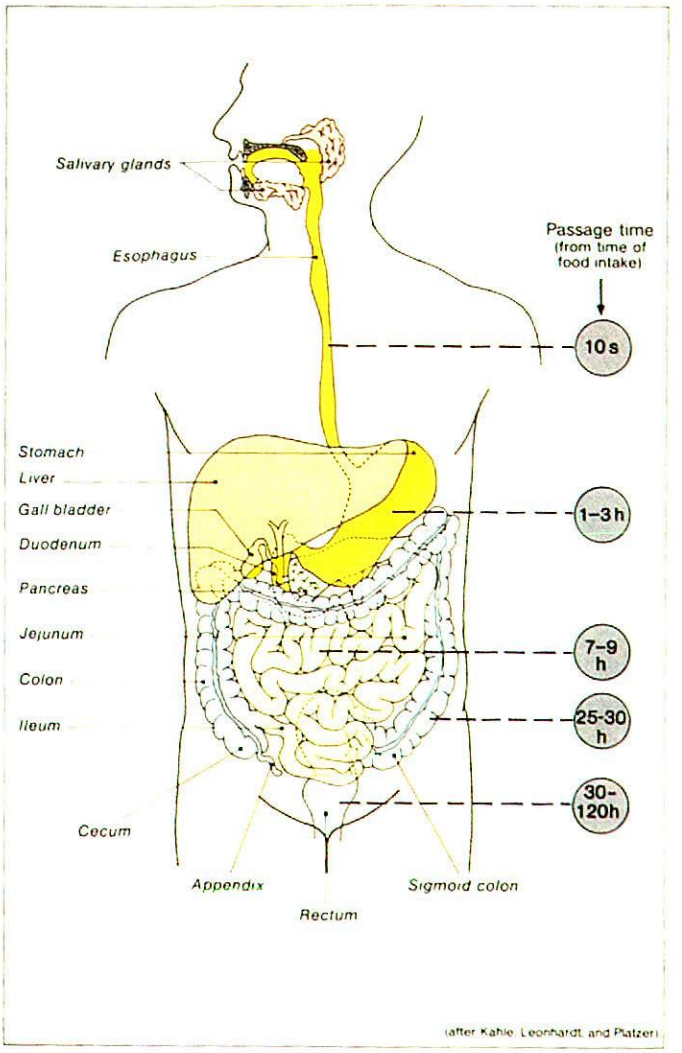
Respiratory " centers" and Influences



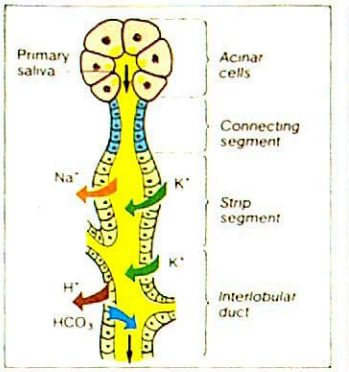
CO_2 transport



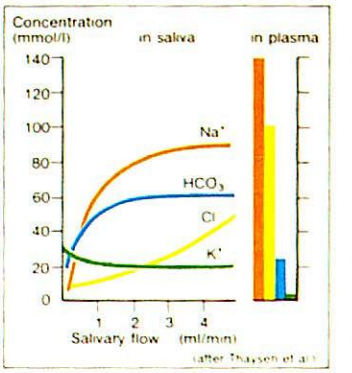
Buffering and carbamino binding in erythrocytes



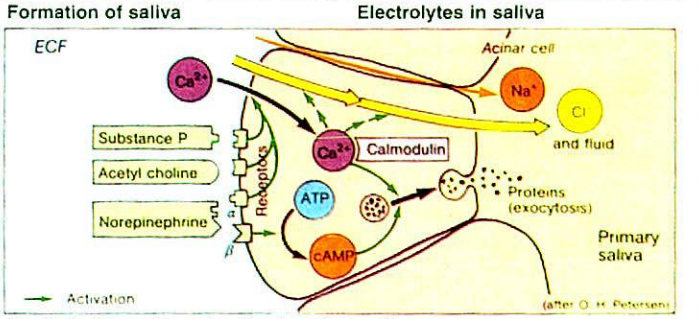
Gastrointestinal tract; organs and passage time



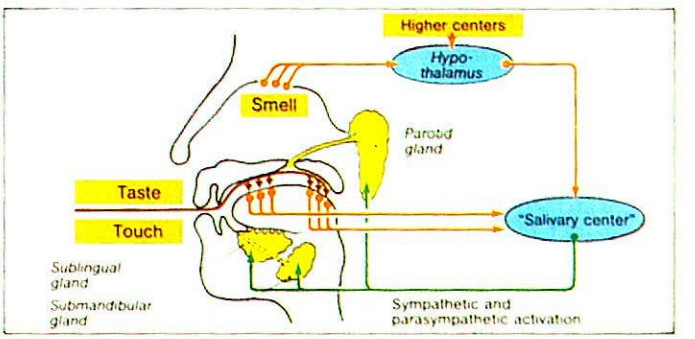
Formation of saliva



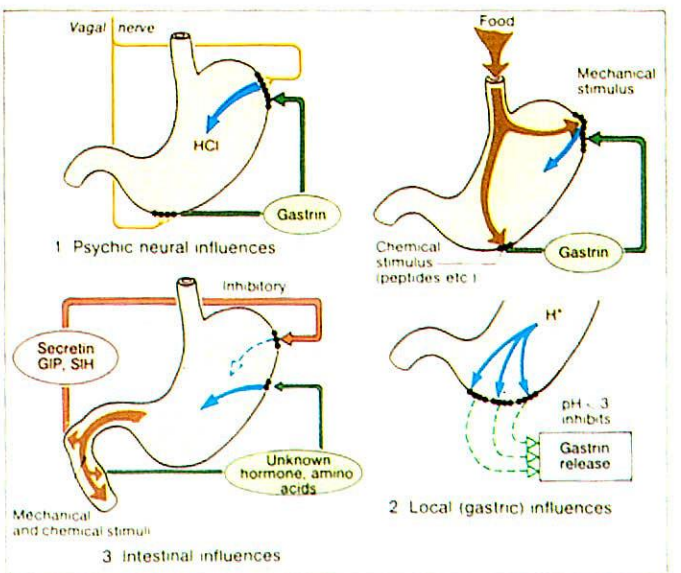
Electrolytes in saliva



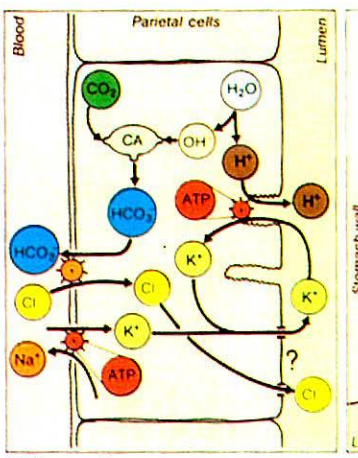
Control of formation of saliva in acinar cells



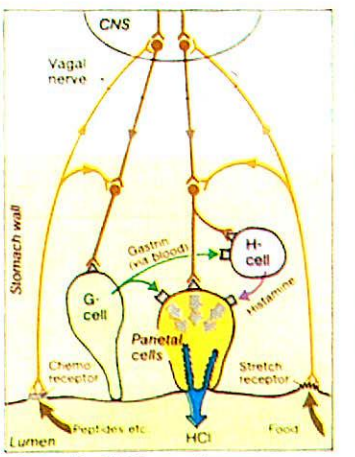
Reflex pathways in salivary secretion



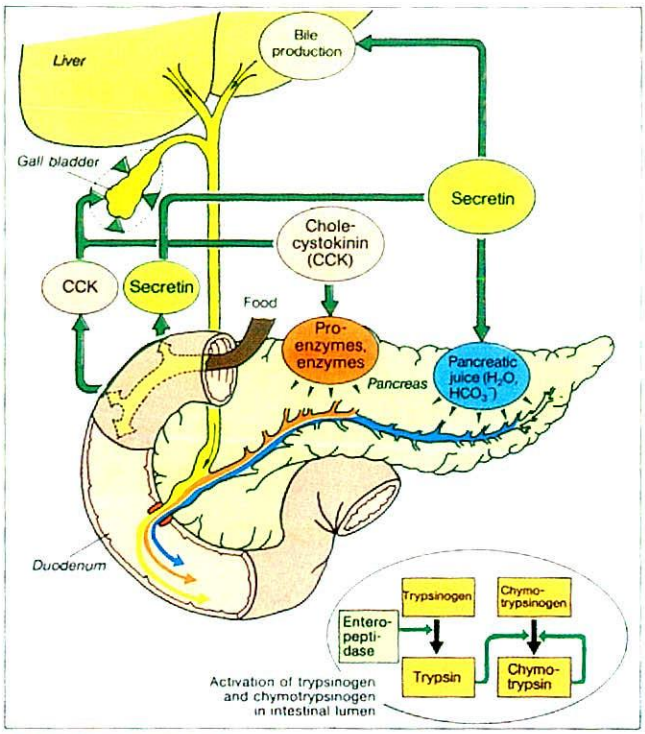
Secretion of gastric juice



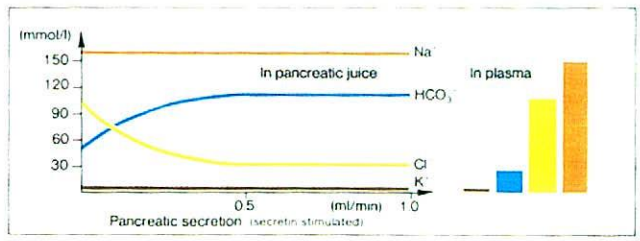
HCl secretion



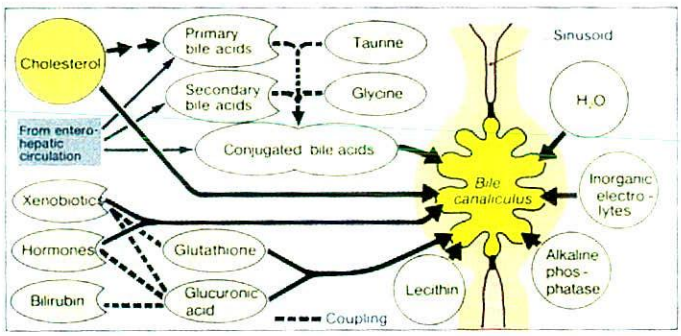
Control of HCl secretion



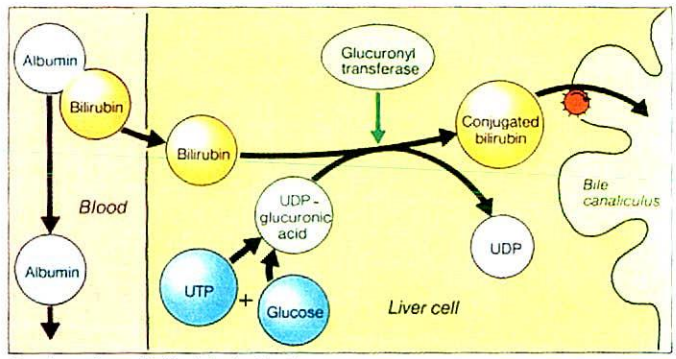
Bile and pancreatic juice



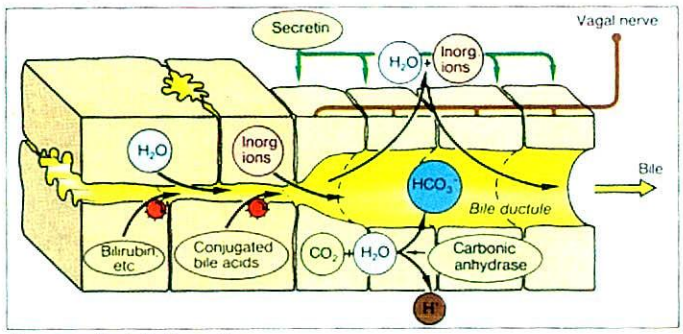
Electrolyte concentrations in pancreatic juice



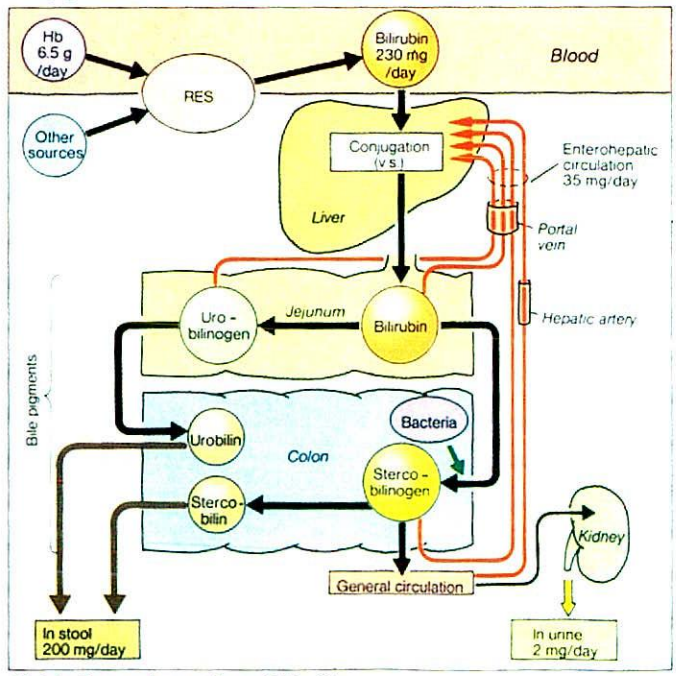
Excretory functions of liver



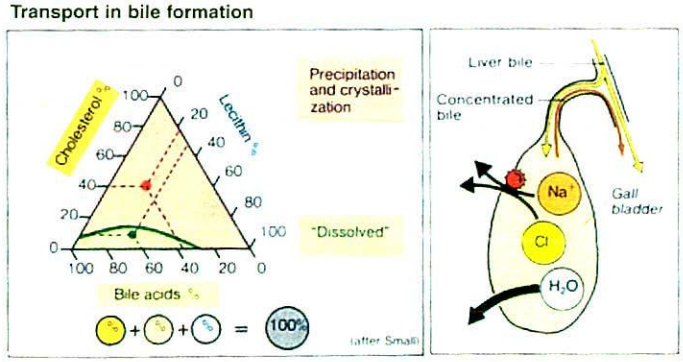
Conjugation of bilirubin in the liver



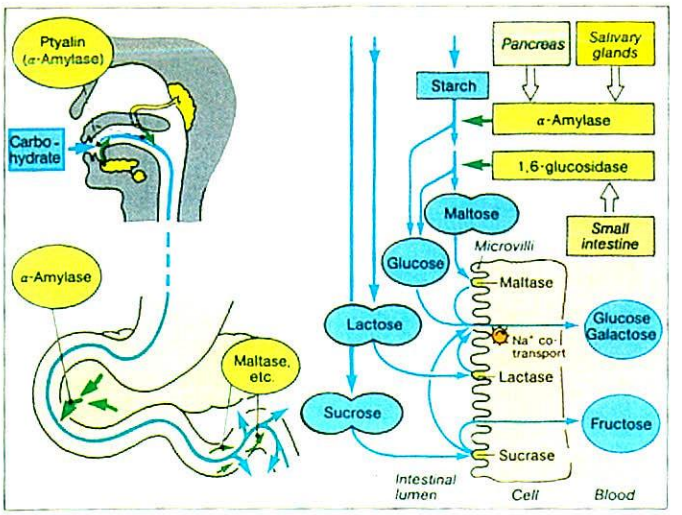
Transport in bile formation



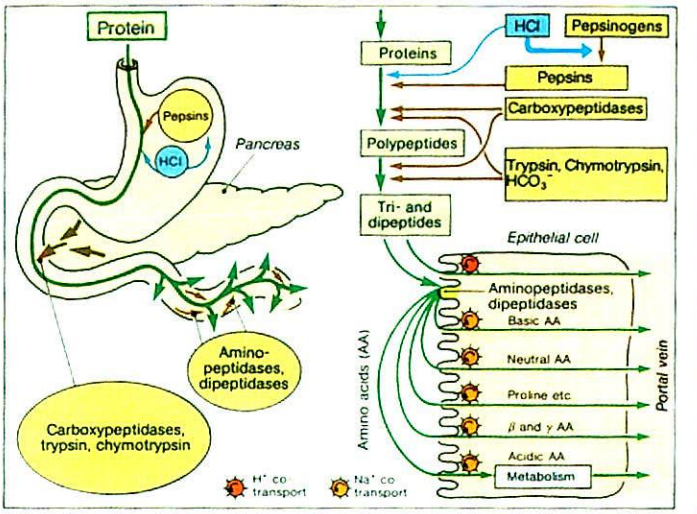
Metabolism and excretion of bilirubin



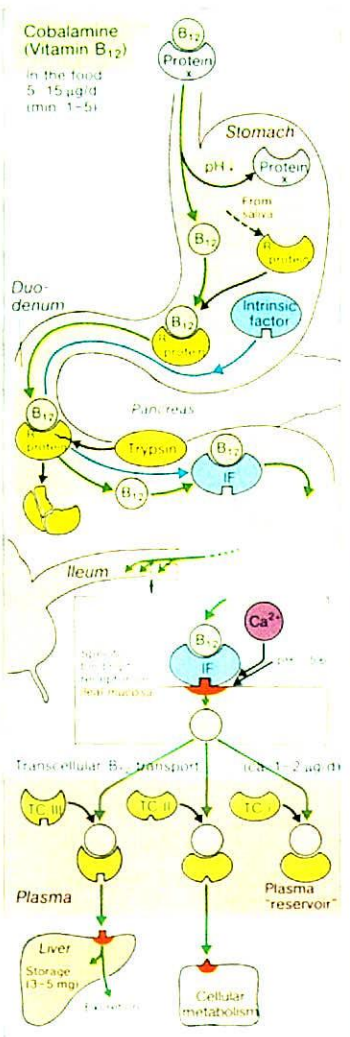
Micellar solution of cholesterol in bile



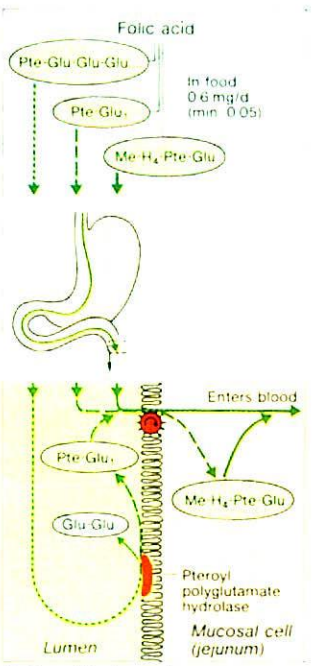
Digestion of carbohydrates and absorption of monosaccharides



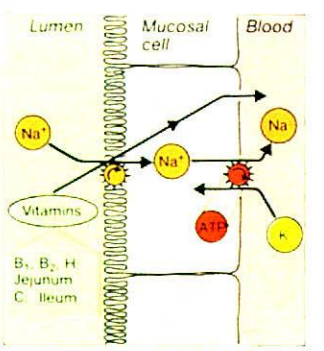
Digestion of proteins and absorption of amino acids and oligopeptides



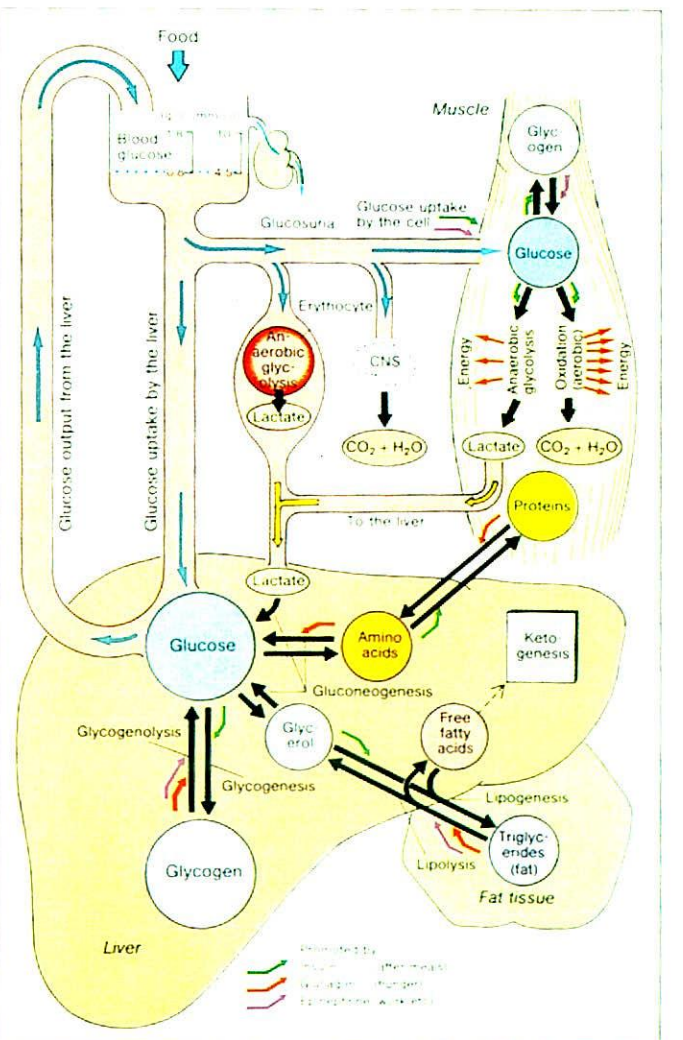
Cobalamine (B_{12}) transport



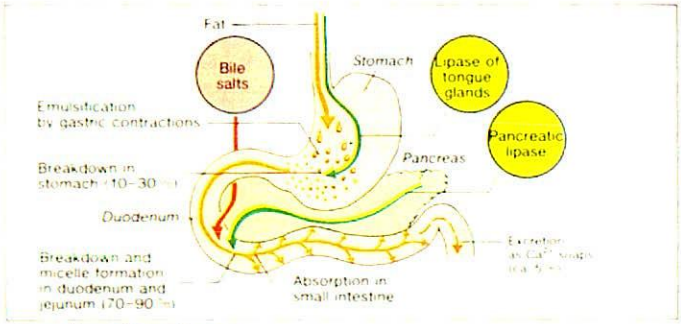
Folic acid absorption



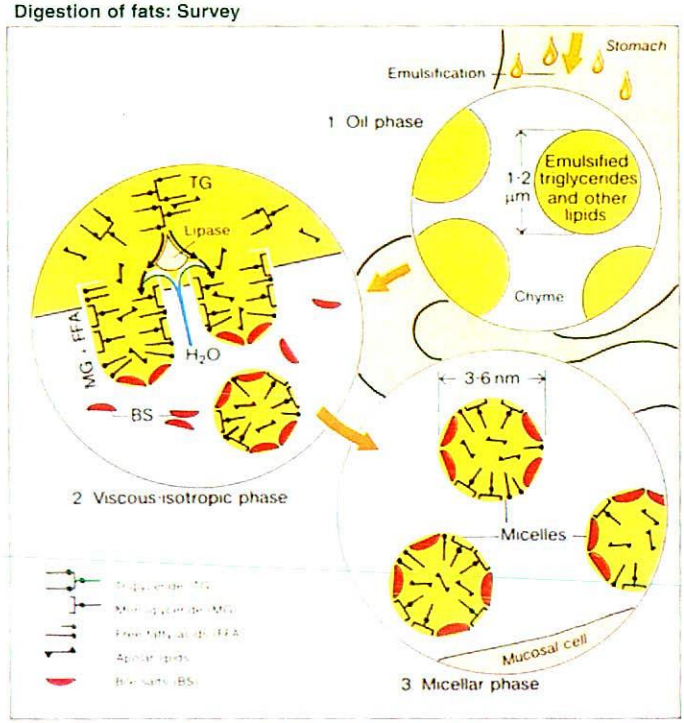
Secondary active vitamin absorption



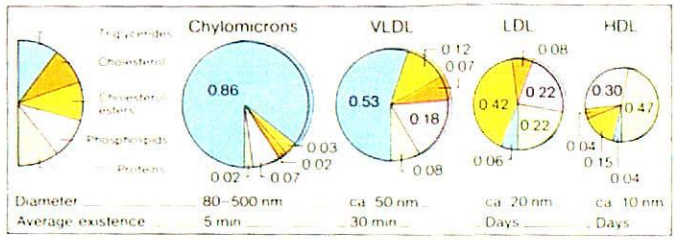
Glucose metabolism (simplified)



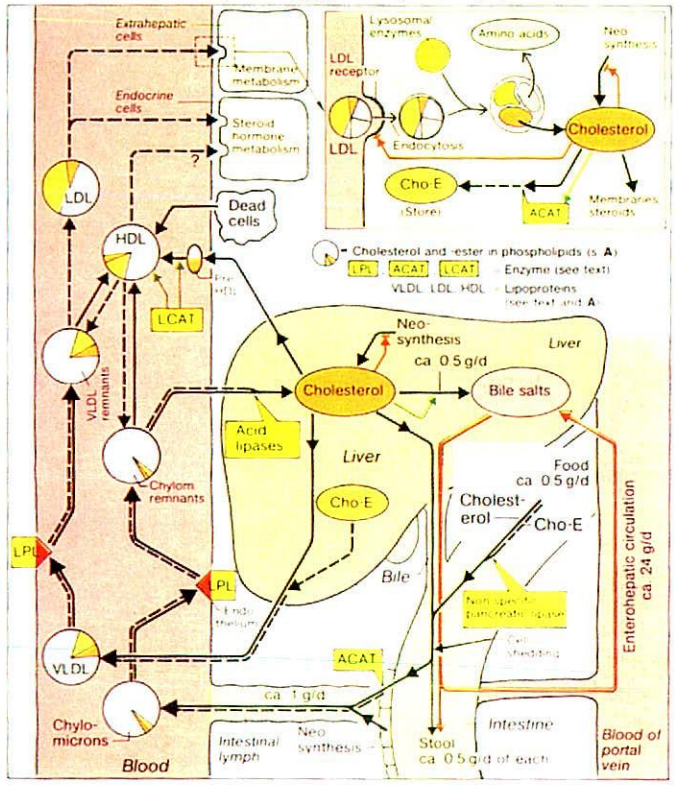
Digestion of fats: Survey



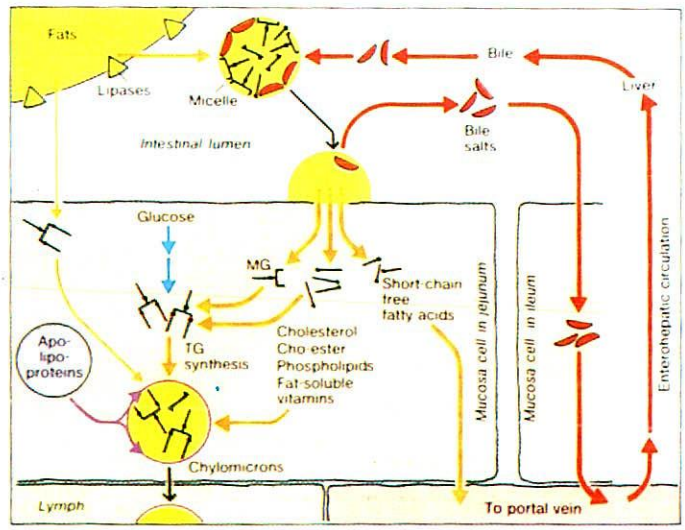
Digestion of fats: Breakdown and micelle formation (after Patton)



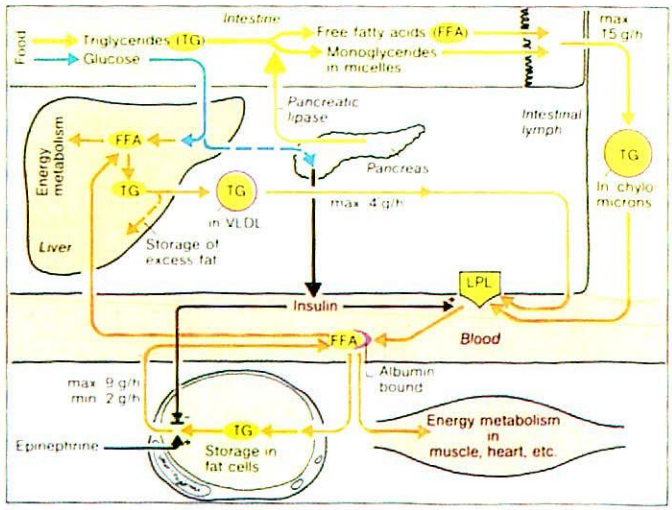
Proportion of lipid and protein (g/g) in the plasma lipoproteins



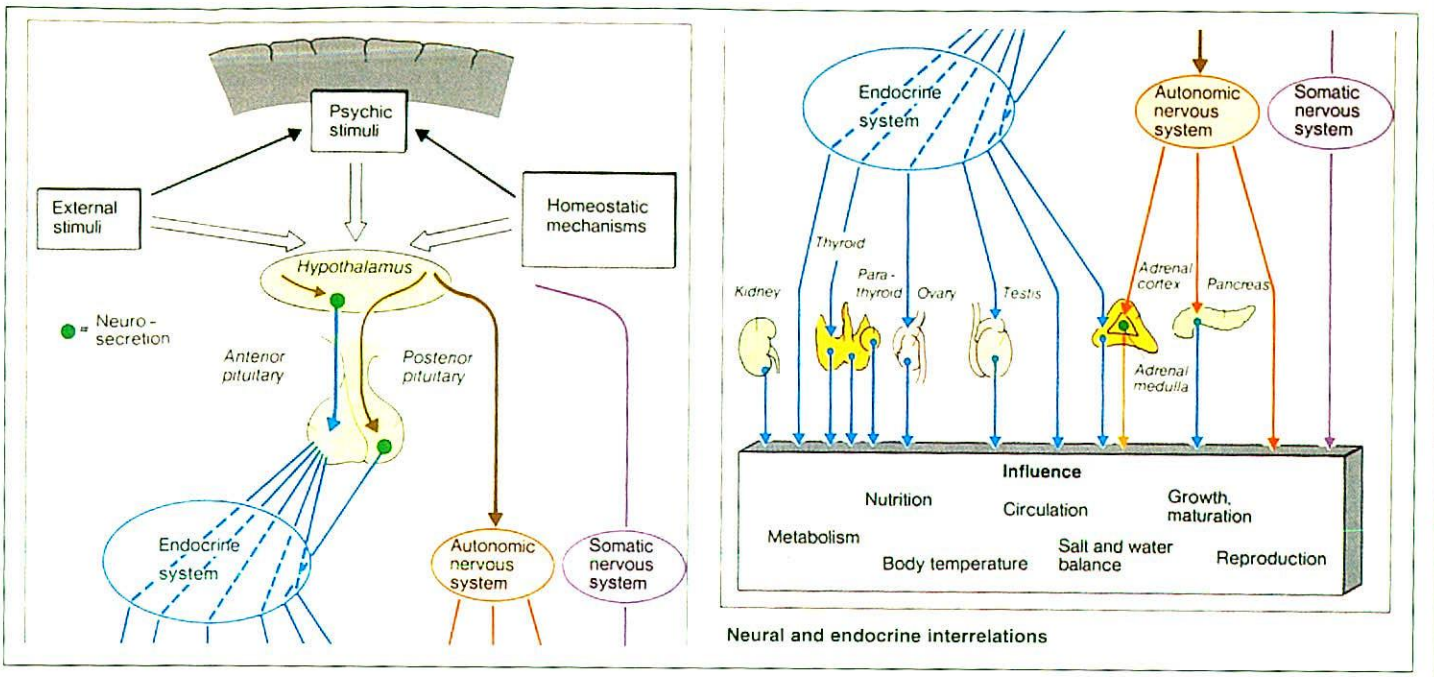
Sources and fate of cholesterol



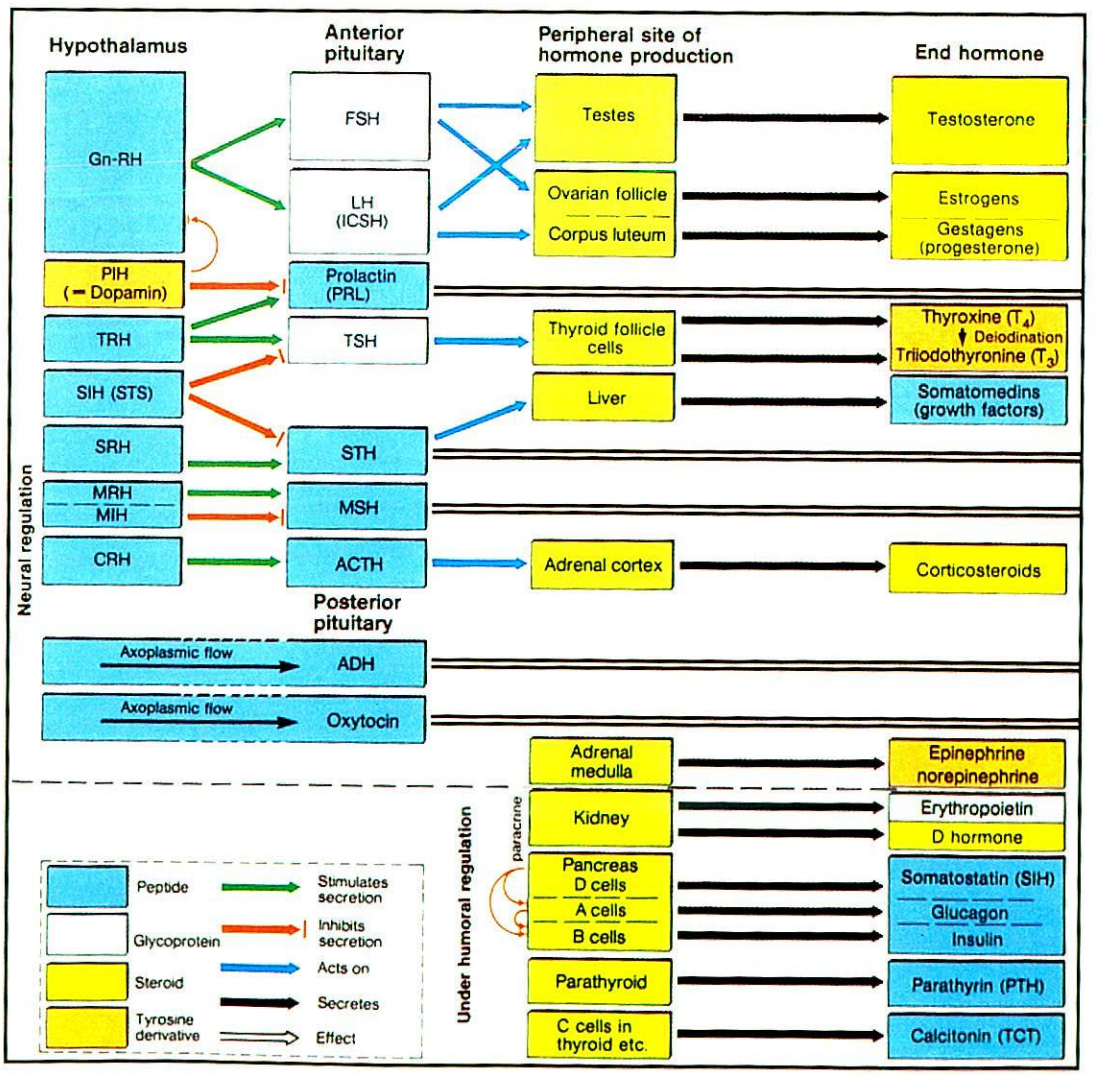
Absorption of fats



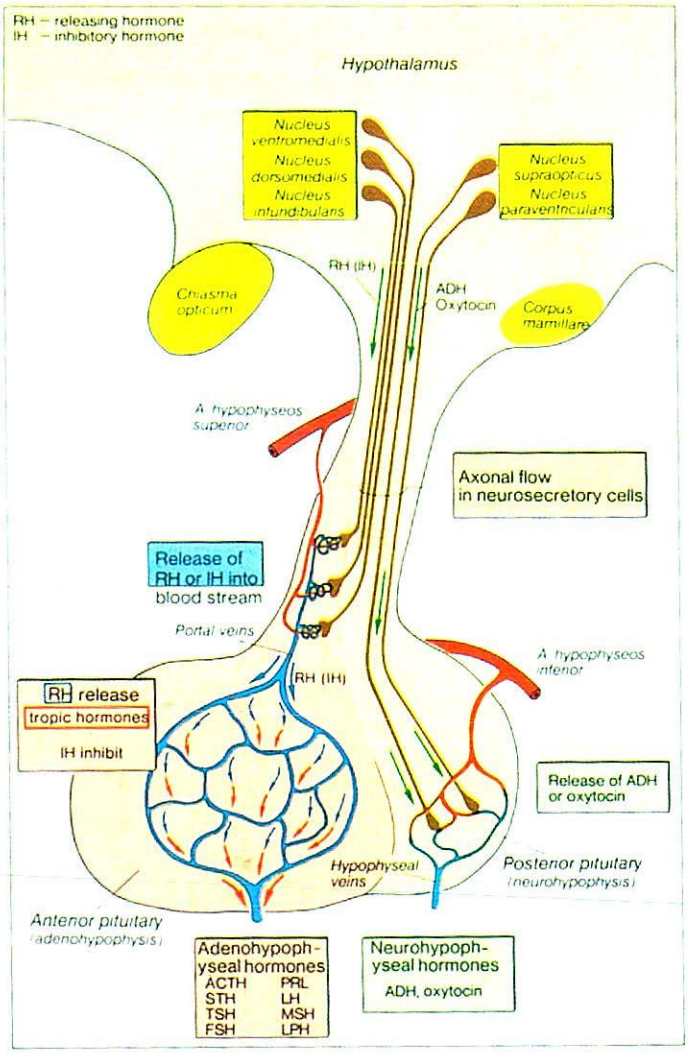
Sources and fate of triglycerides and free fatty acids



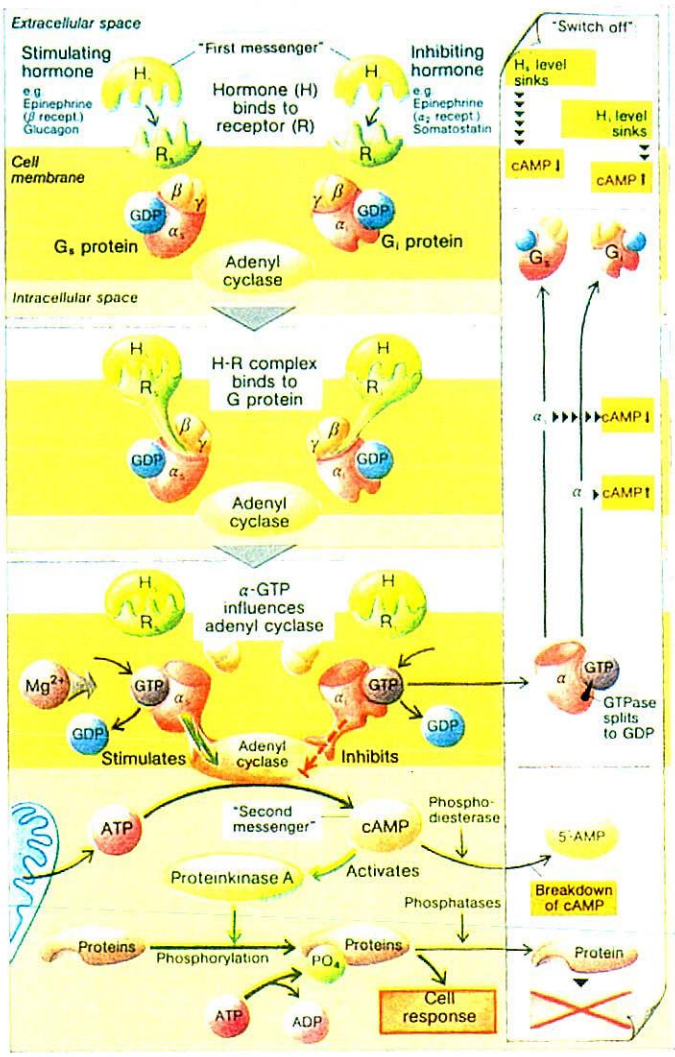
Neural and endocrine interrelations



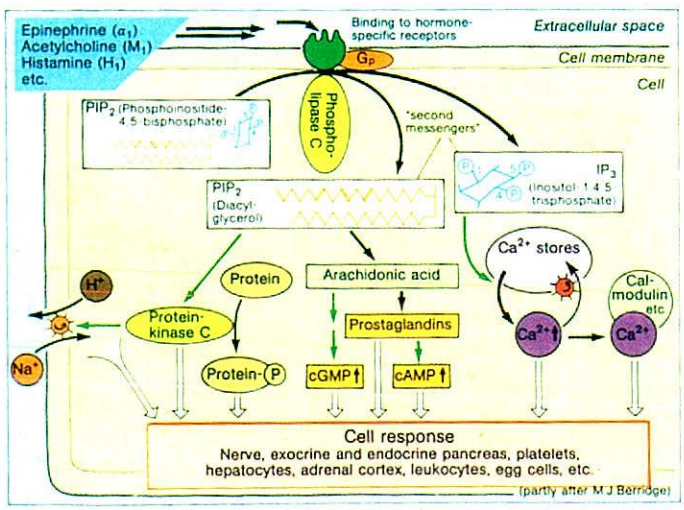
Hormones (excluding tissue hormones)



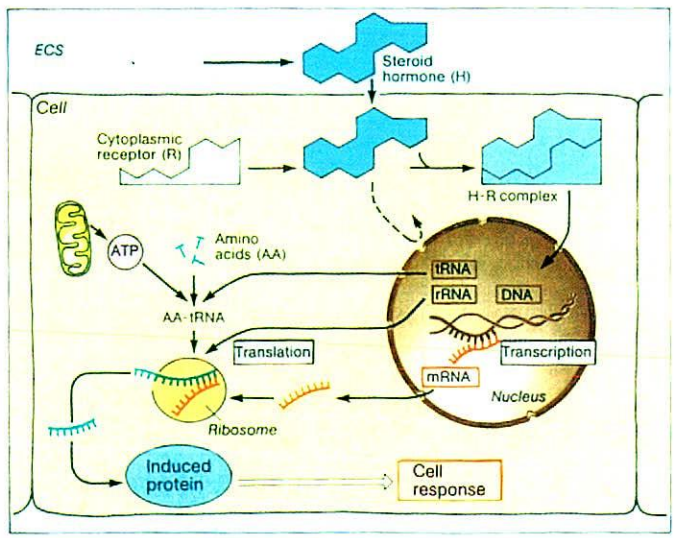
Hypothalamic and pituitary hormones



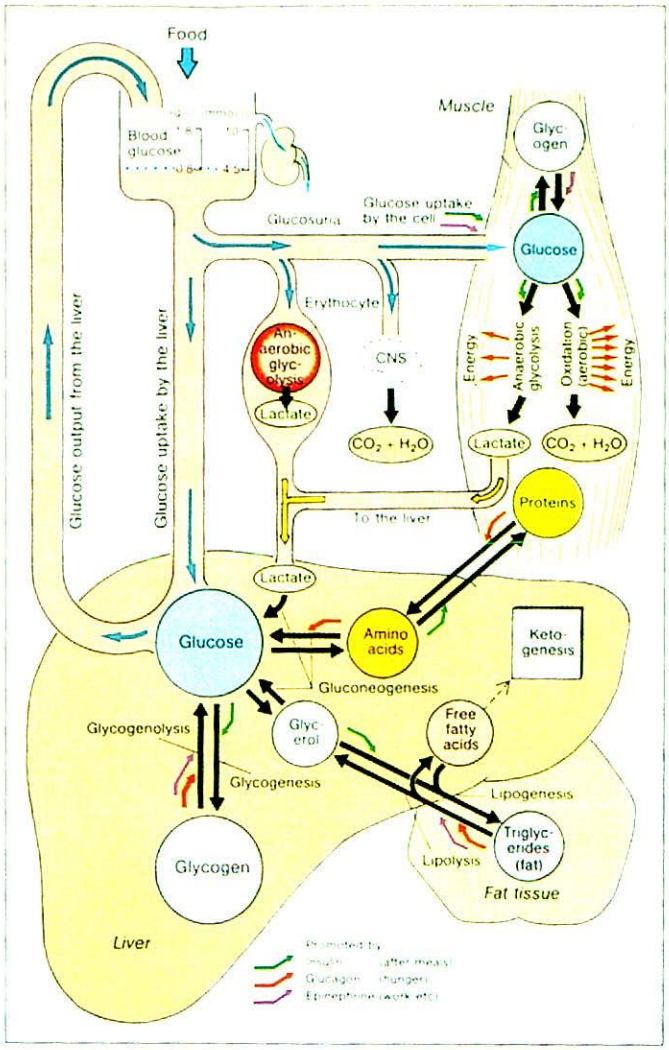
cAMP as "second messenger"



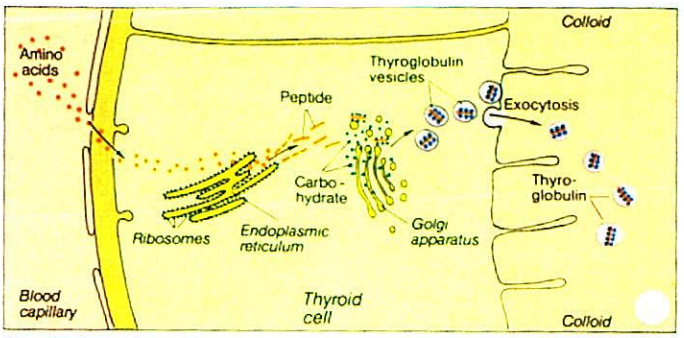
Diacylglycerol and inositol-1,4,5-trisphosphate as "second messengers"



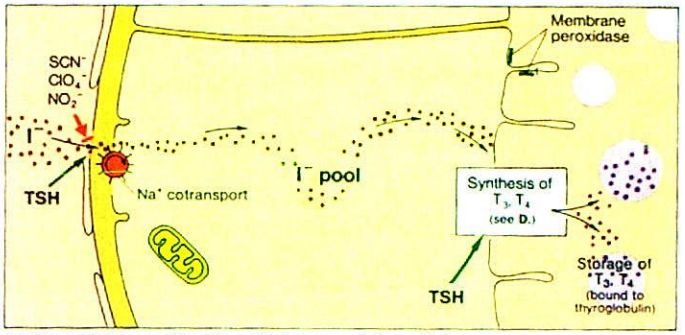
Mechanism of action of steroid hormones



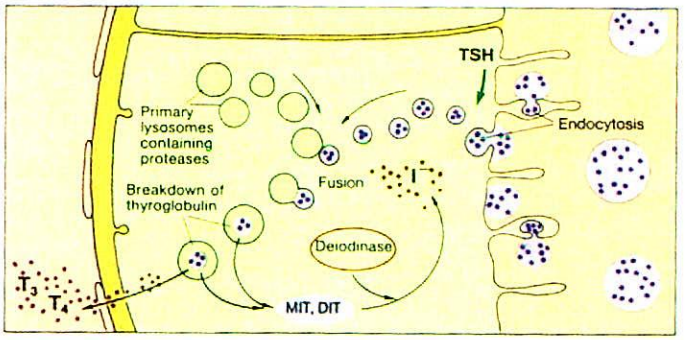
Glucose metabolism (simplified)



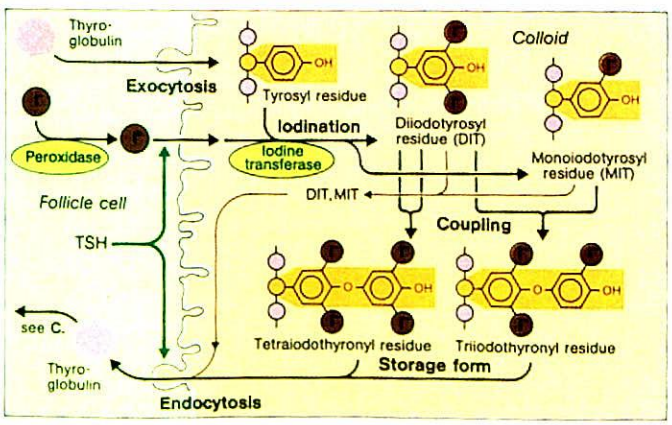
Synthesis of thyroglobulin



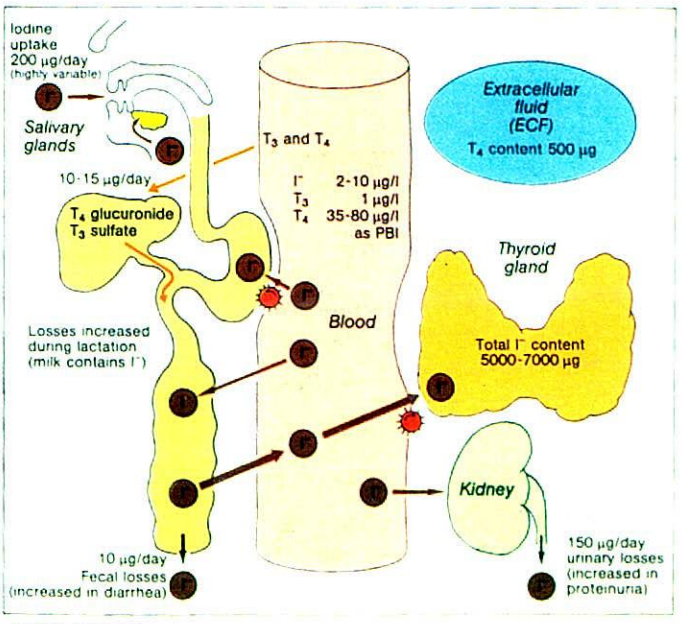
Iodine uptake, synthesis and storage of thyroid hormones



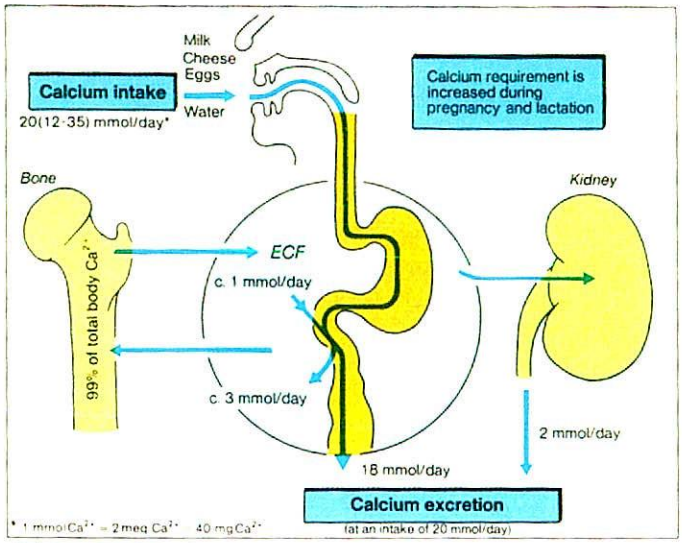
Secretion of thyroid hormones



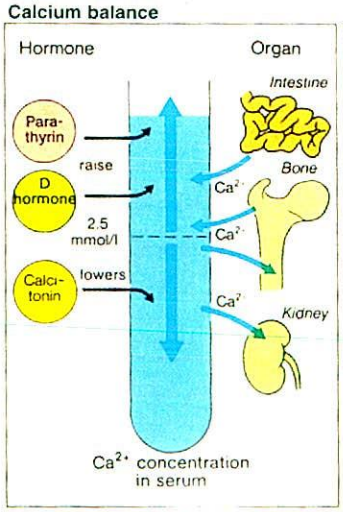
Synthesis, storage and mobilization of the thyroid hormones



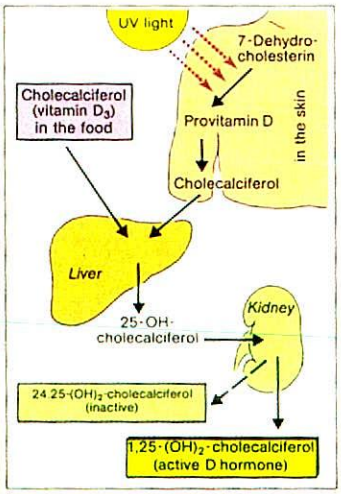
Iodine balance



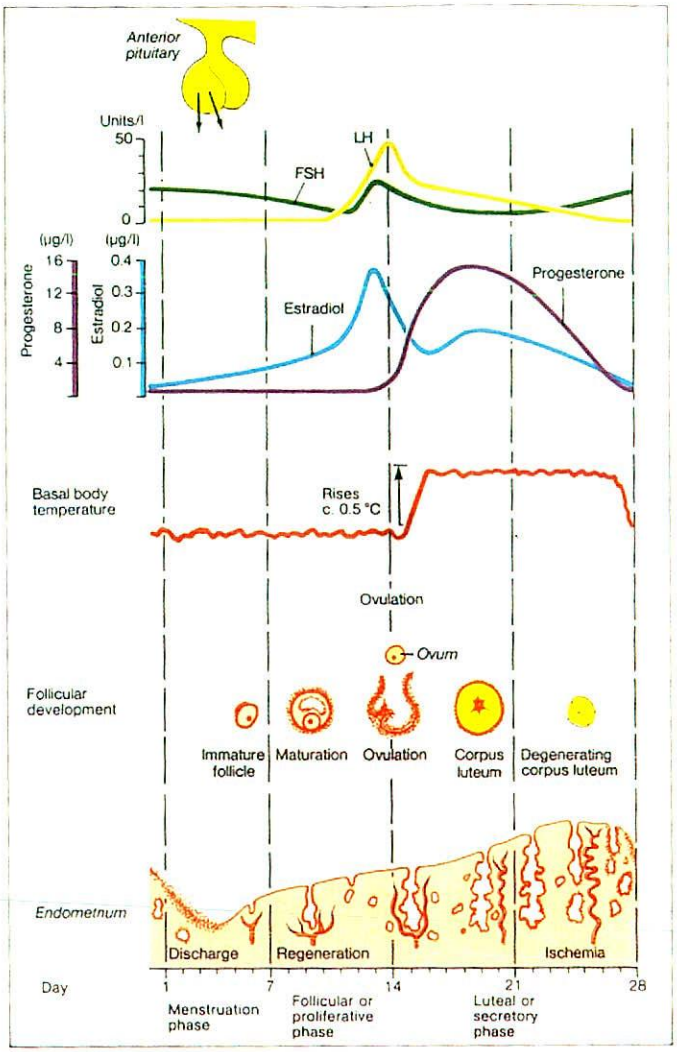
Calcium balance



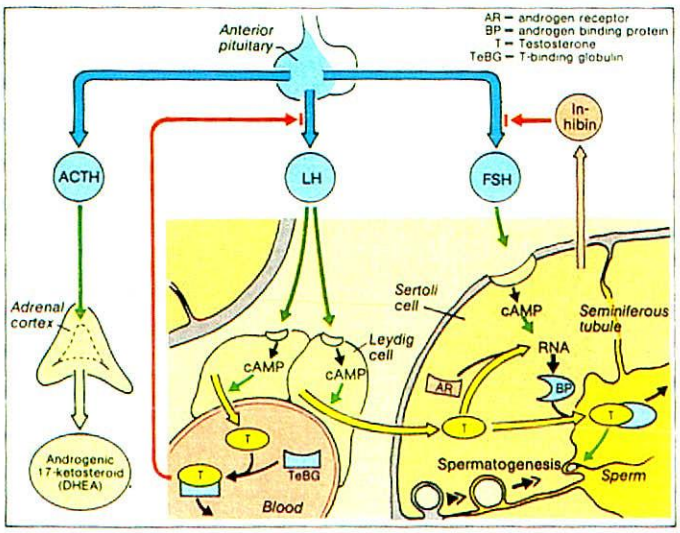
Influences on Ca^{2+} serum levels



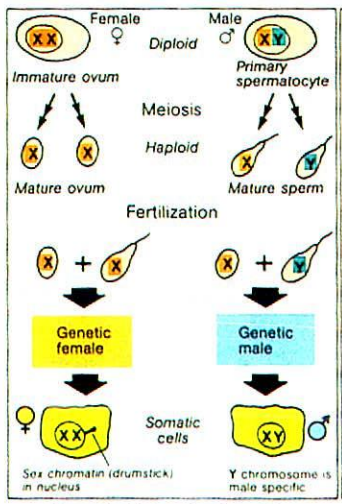
Formation of the D hormone



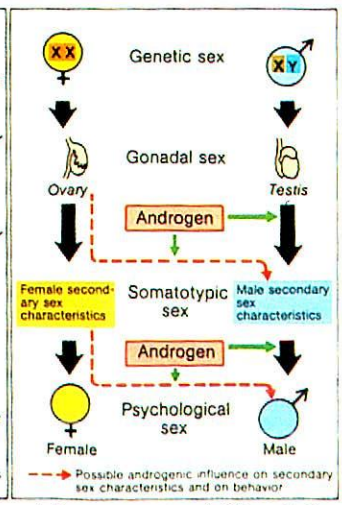
Human menstrual cycle



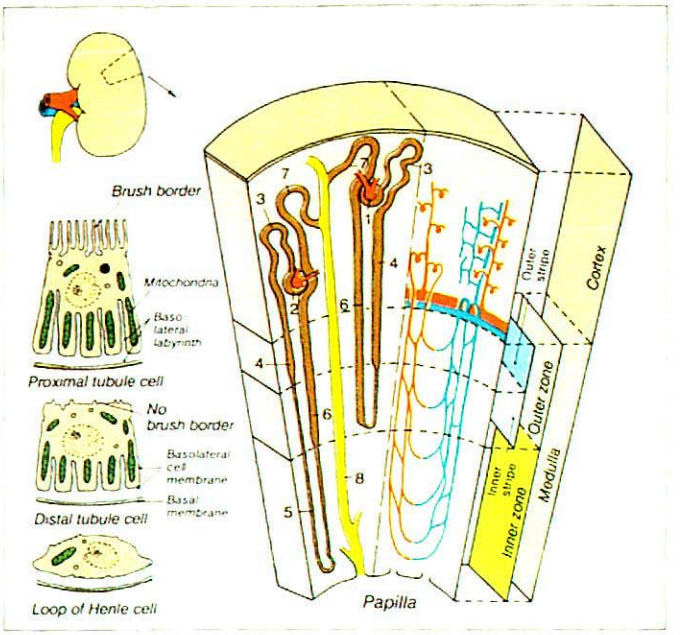
Control and transport of androgenic hormones. Effects of testosterone.



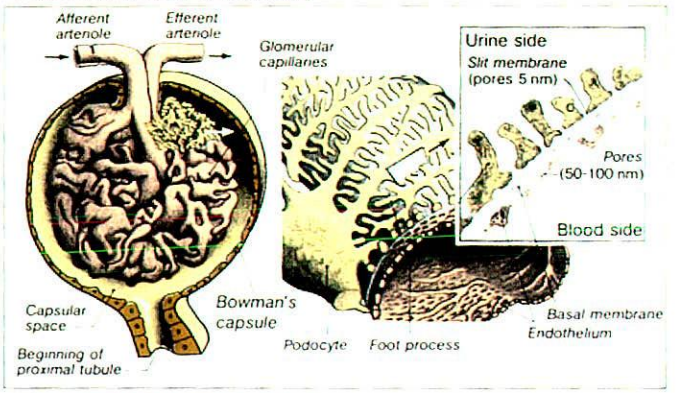
Genetic determination of sex



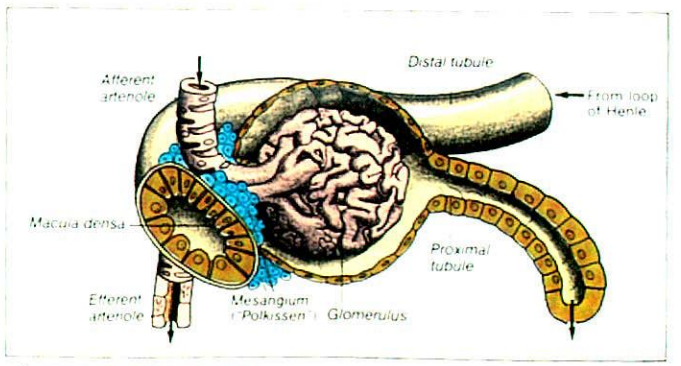
Influences on sexual differentiation



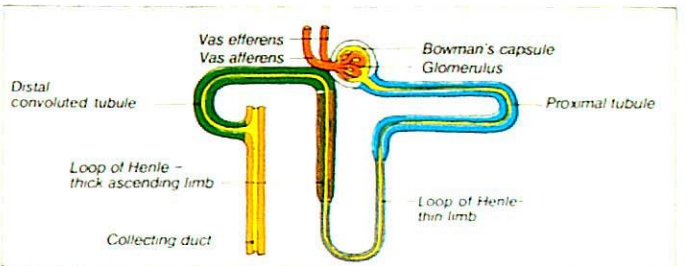
Functional anatomy of the kidney



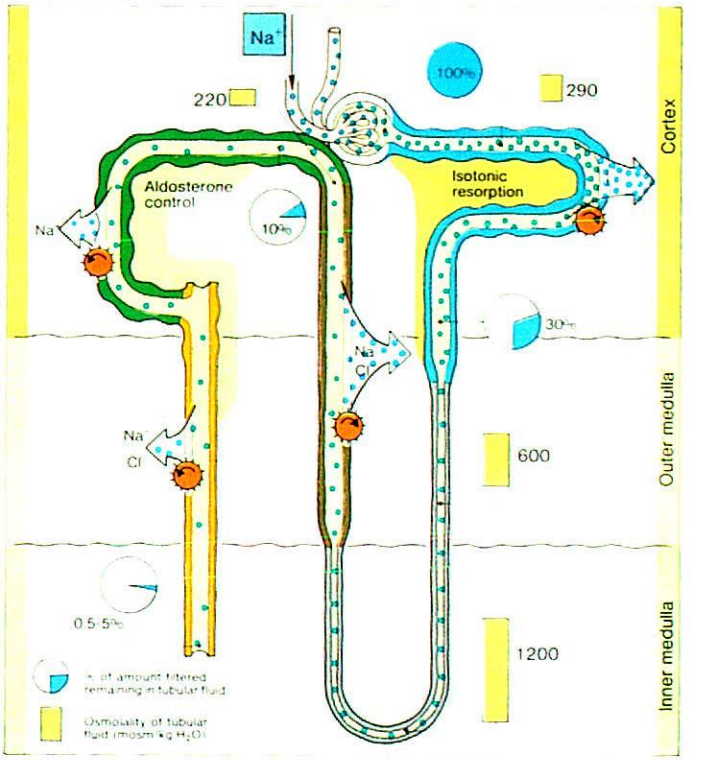
Glomerulus and Bowman's capsule



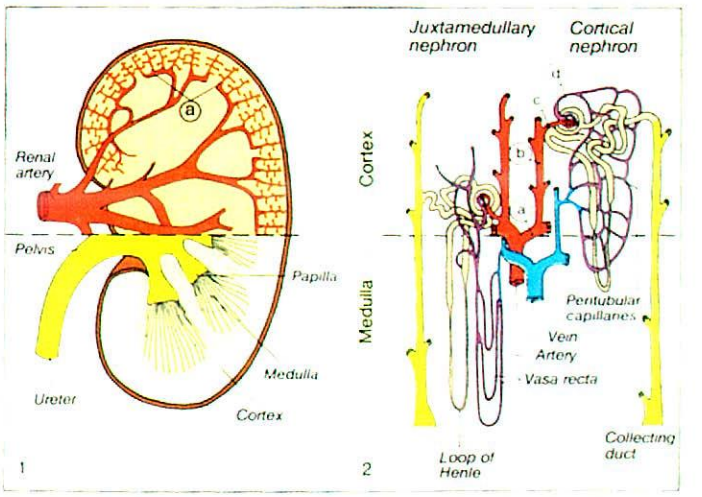
Juxtaglomerular apparatus



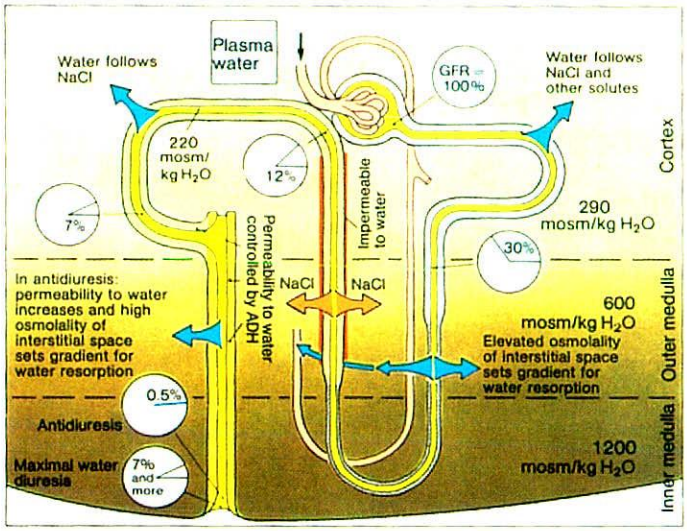
Nephron segments



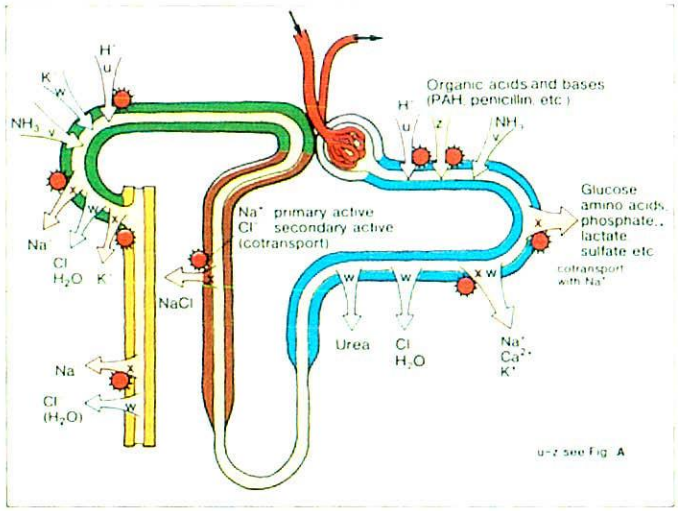
Na+ resorption in the nephron



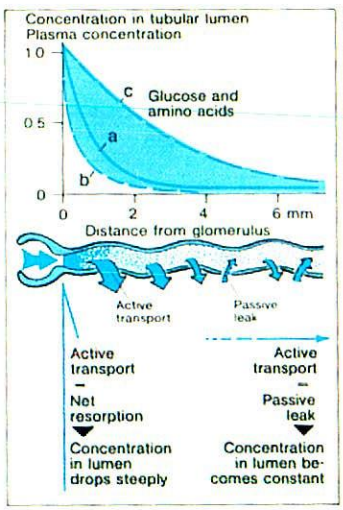
Vascular arrangement in kidney



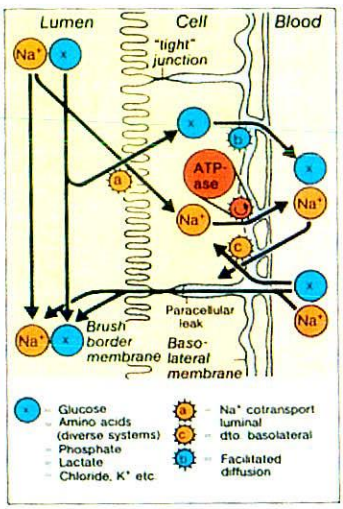
Fluxes of water in the nephron



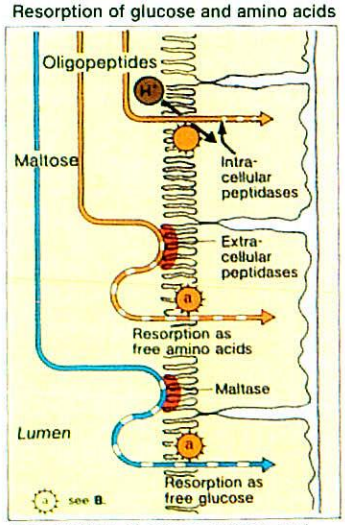
Locus of transport processes in the nephron (simplified)



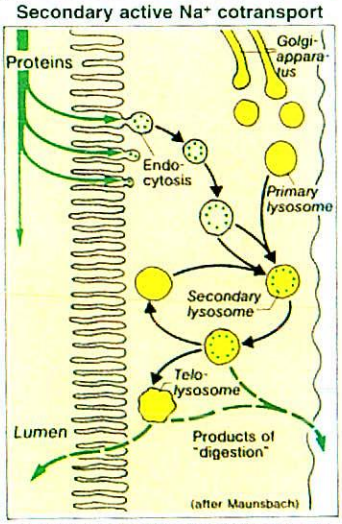
Resorption of glucose and amino acids



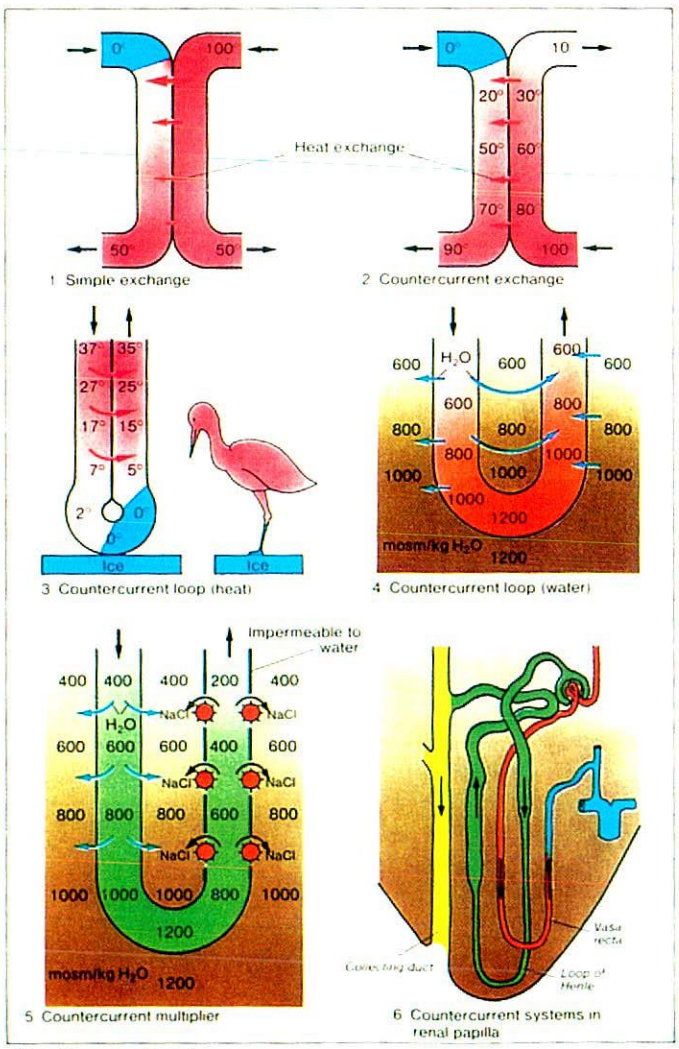
Secondary active Na^+ cotransport



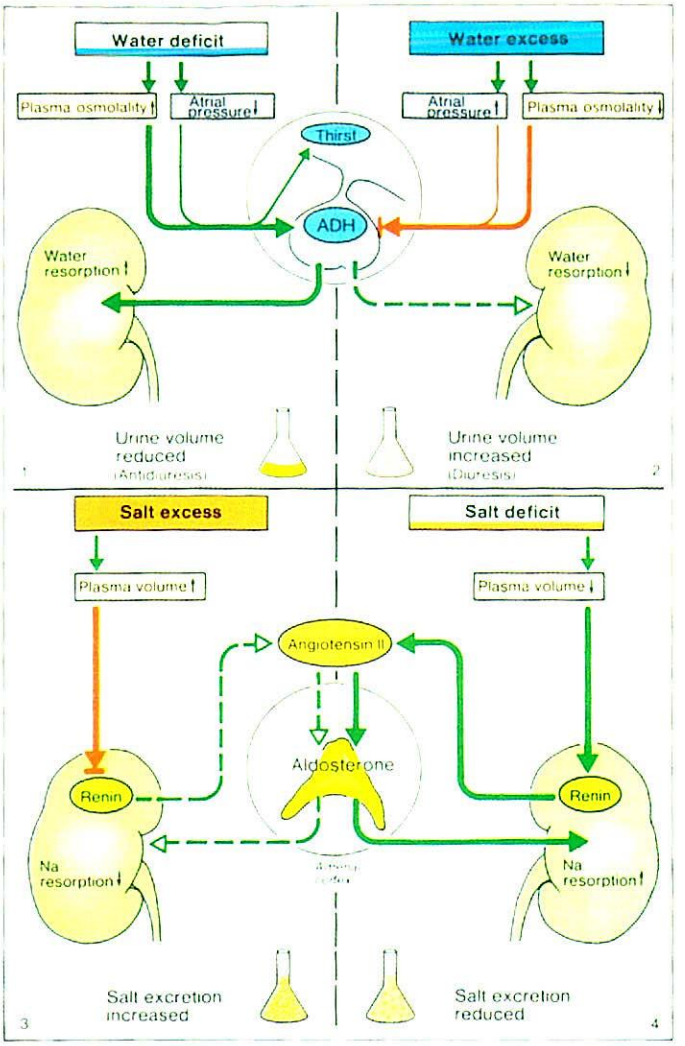
Resorption of oligopeptides and maltose



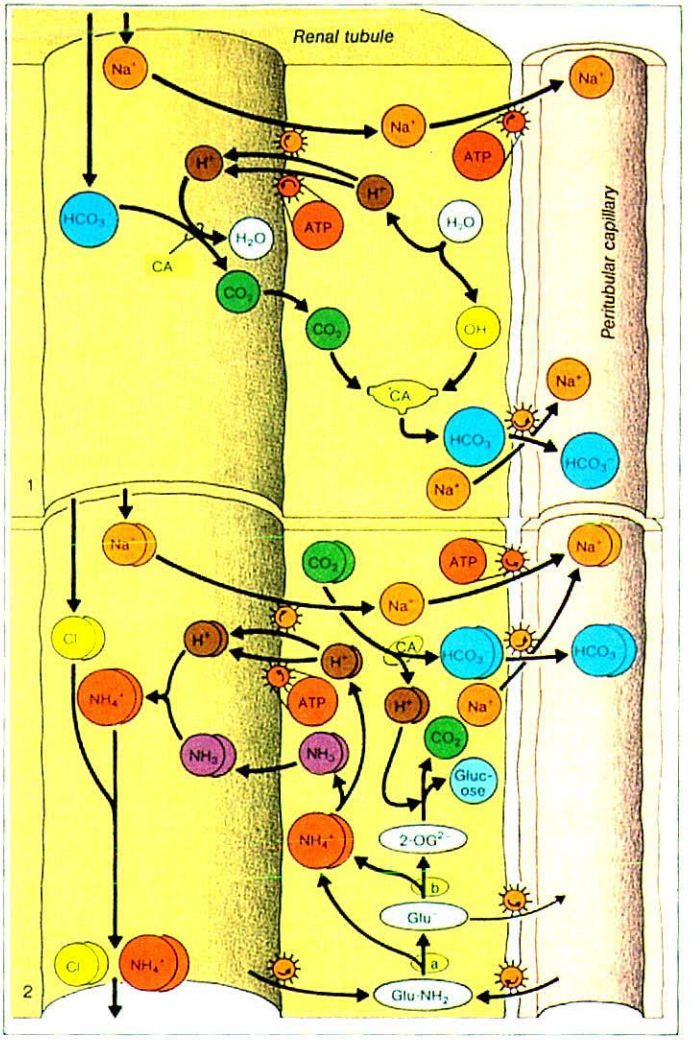
Protein resorption by endocytosis



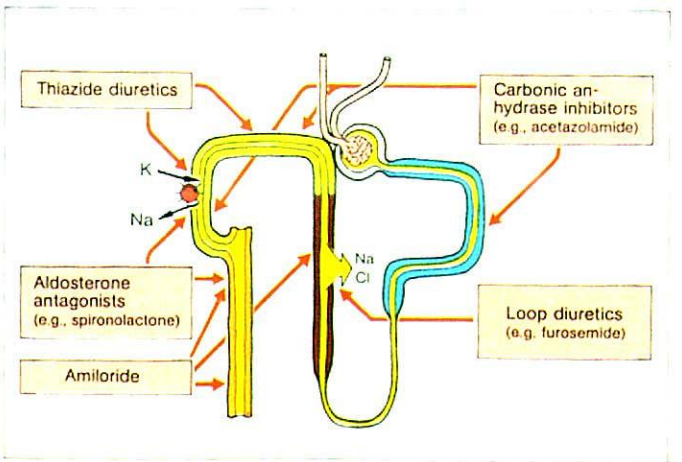
Countercurrent systems



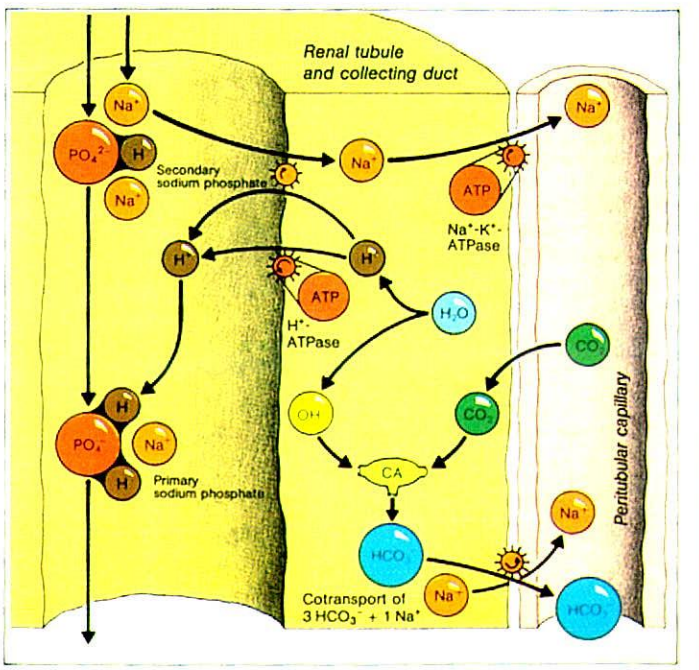
Hormonal control of salt and water balance



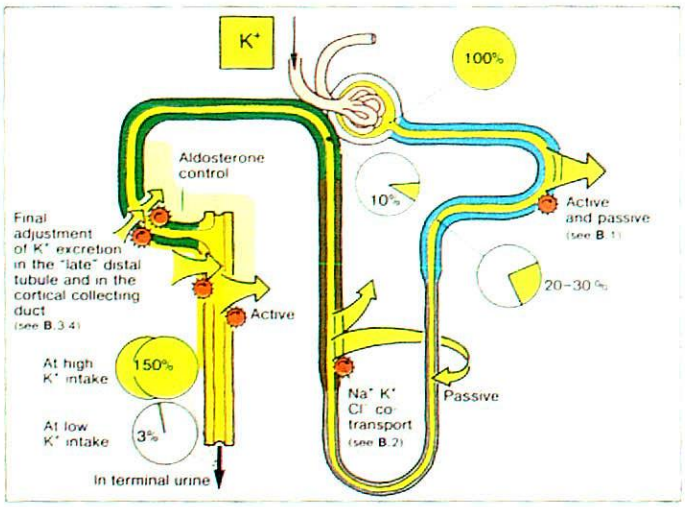
Bicarbonate resorption (1) and NH_4^+ excretion (2)



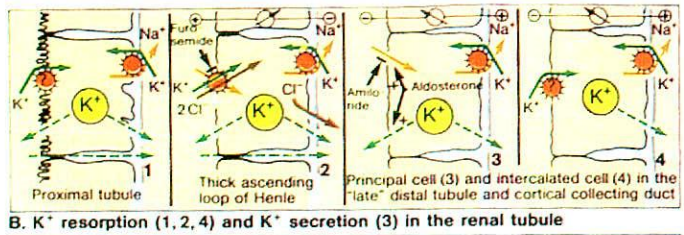
Locus of action of diuretics (simplified)



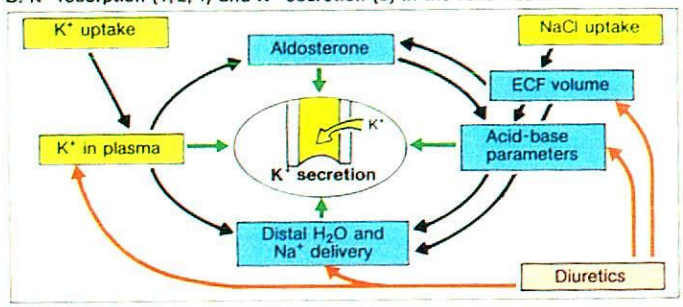
H^+ excretion as $H_2PO_4^-$ (titratable acid)



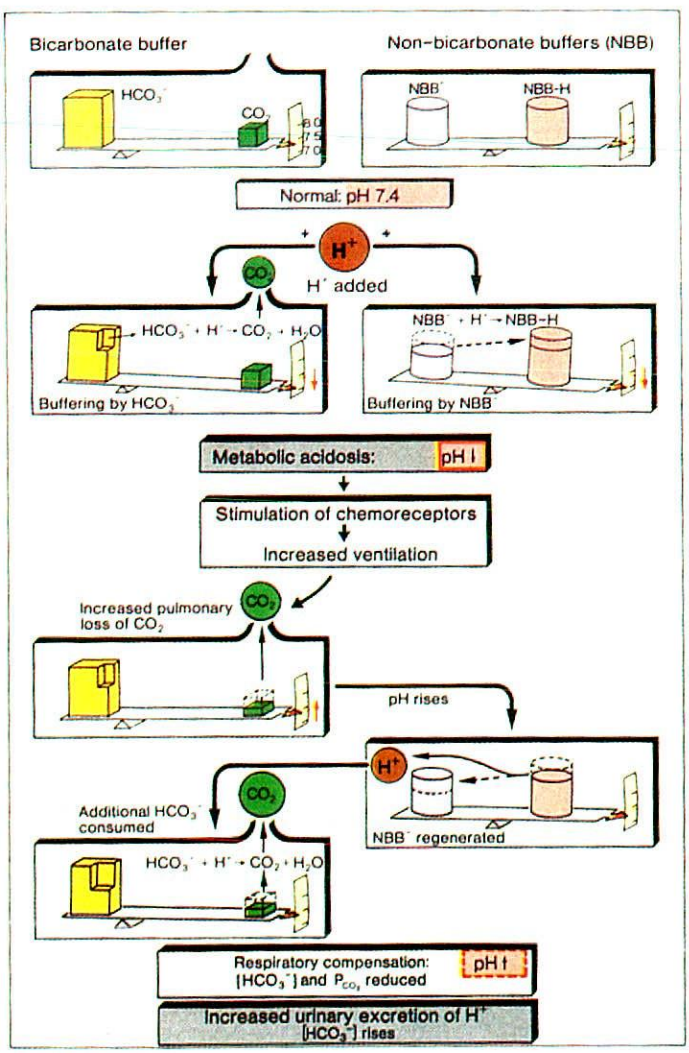
Resorption, secretion and excretion of K+



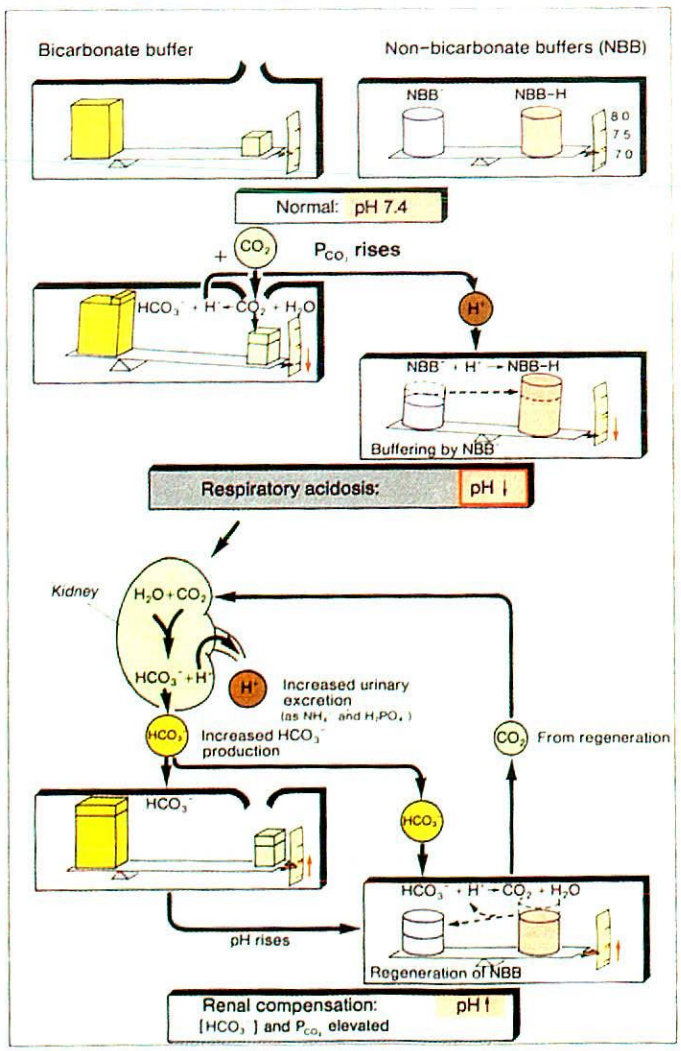
B. K+ resorption (1, 2, 4) and K+ secretion (3) in the renal tubule



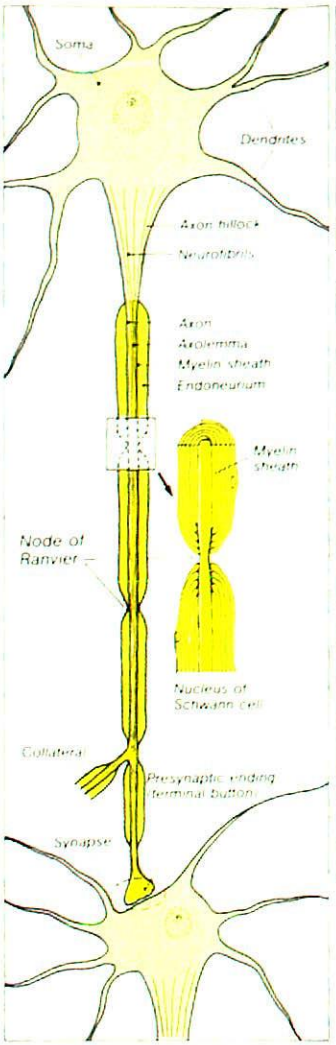
Influences on K+ secretion and excretion



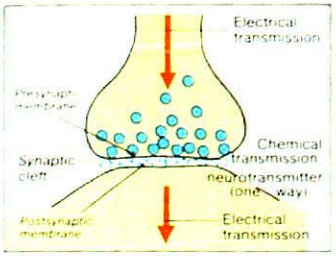
Metabolic acidosis



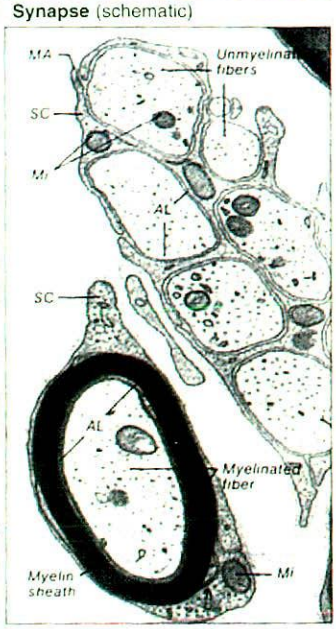
Respiratory



Neuron and synapse (schematic)

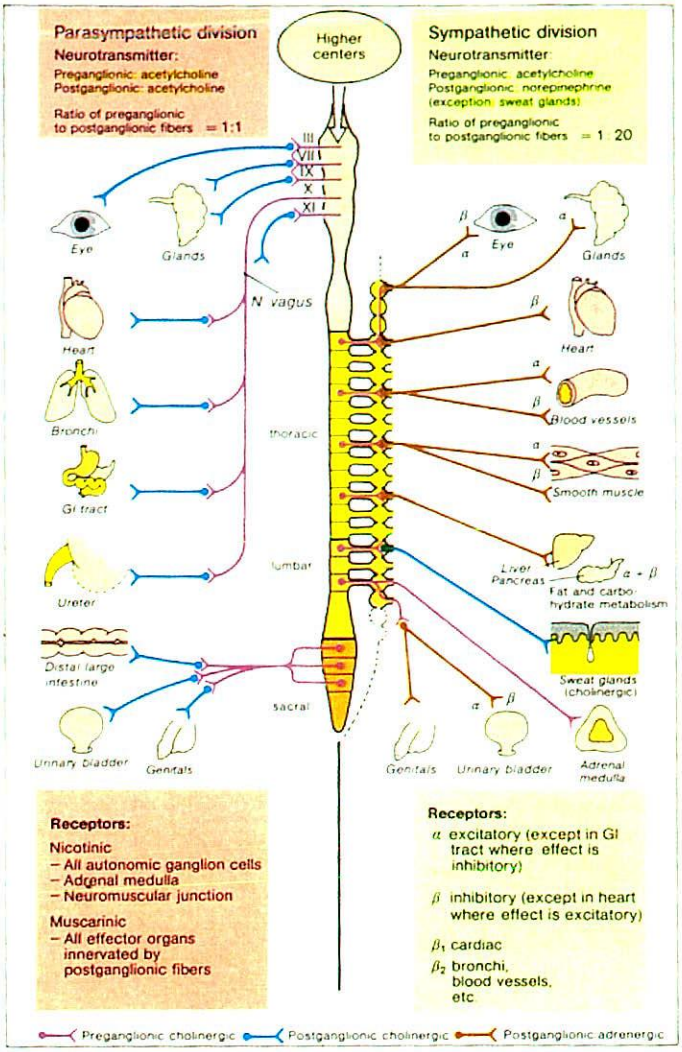


Synapse (schematic)

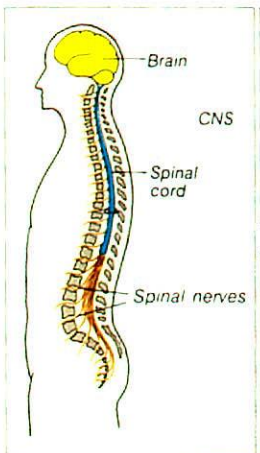


Myelinated and unmyelinated nerve fibers

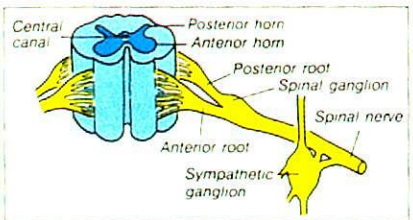
Electron microscopic section (Enlargement 1:22,000). SC-Schwann cell, AL - Axolemma, Mi-Mitochondria, MA-Mesaxon (-connection with extracellular space). The photograph was kindly placed at our disposal by Dr. Lauren A. Langford.



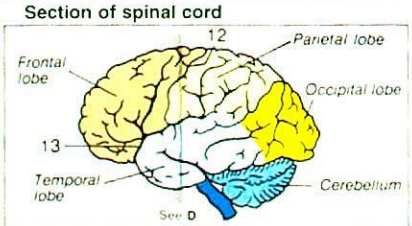
Survey of autonomic nervous system



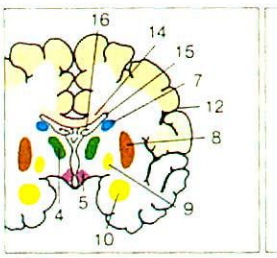
Central nervous system



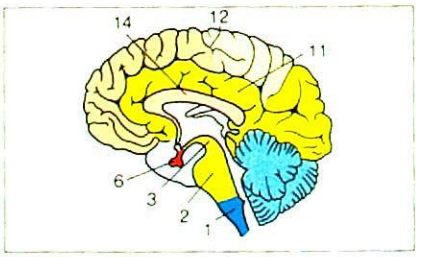
Section of spinal cord



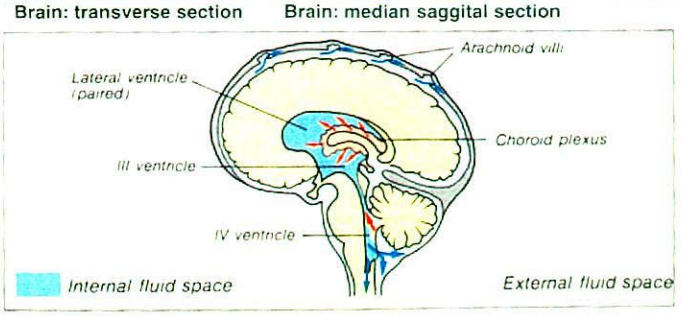
Brain: lateral surface



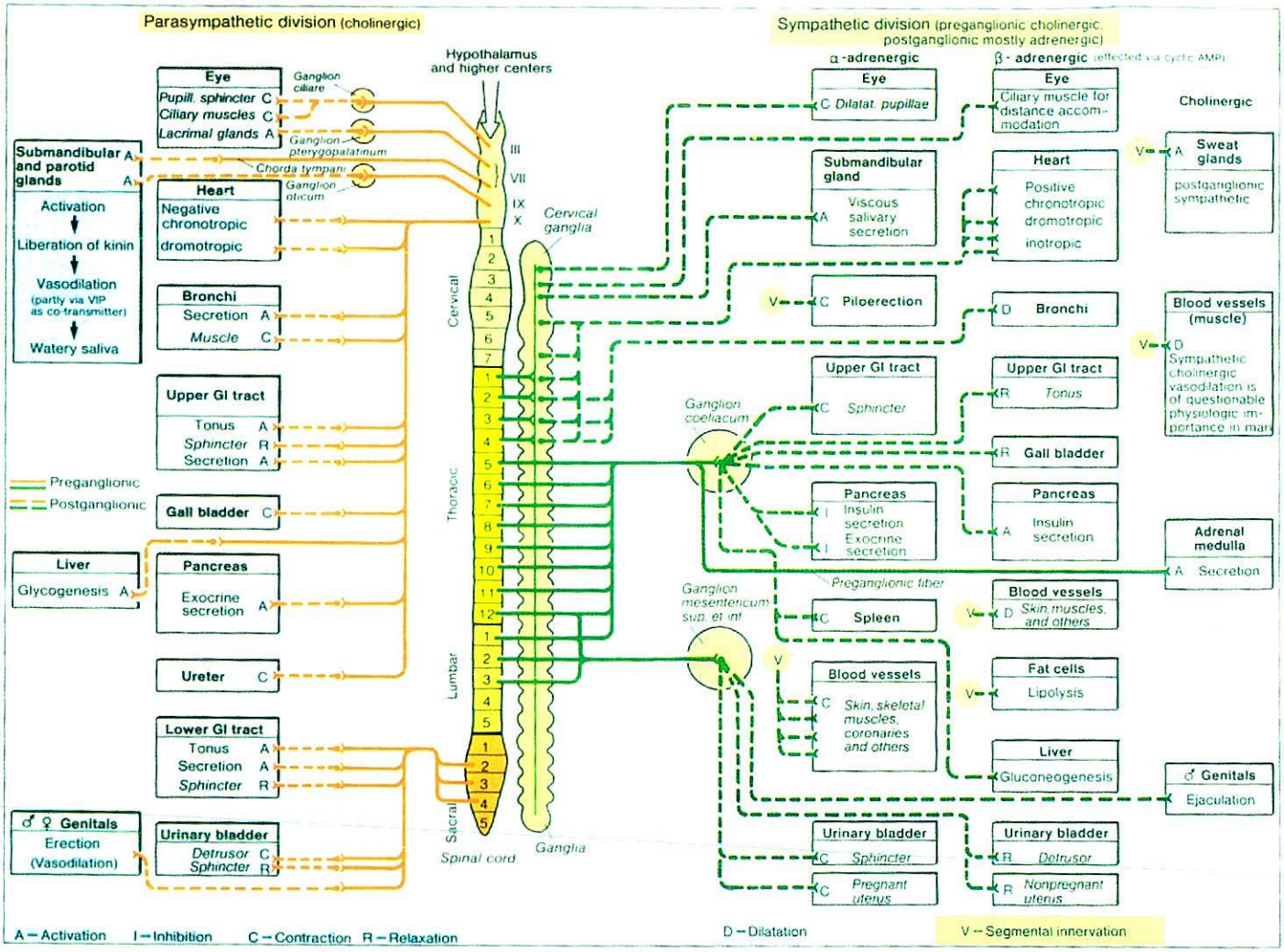
Brain: transverse section



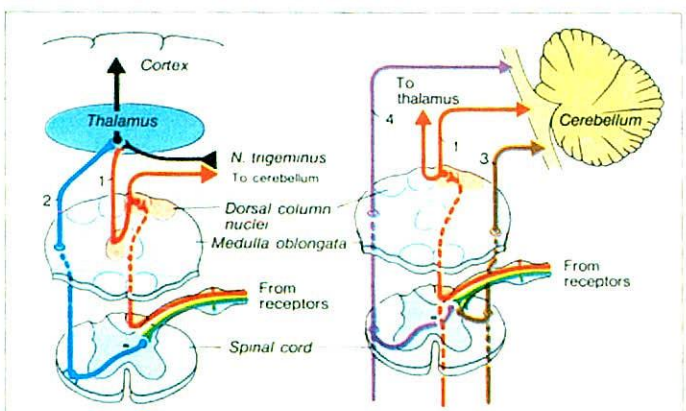
Brain: median saggital section



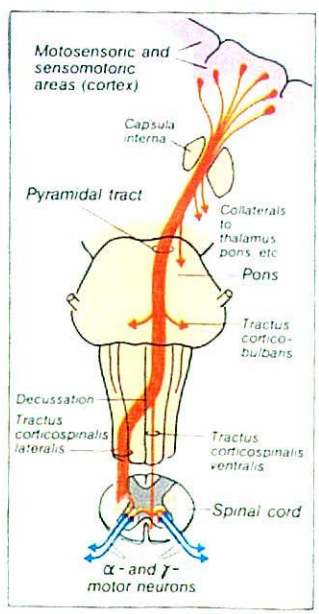
Brain: fluid spaces



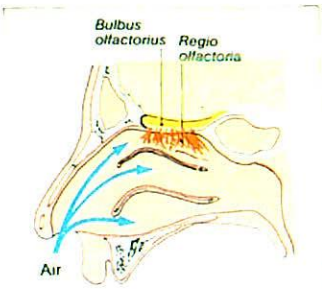
Functional organization of the autonomic nervous system



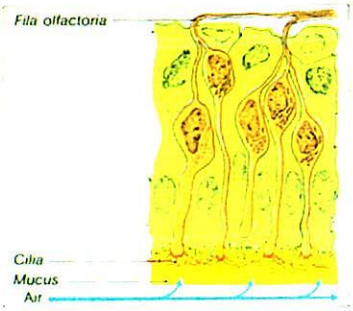
Spinal afferent pathways



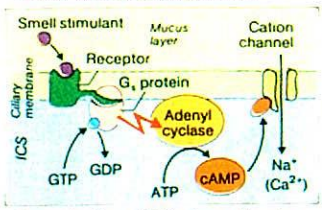
Pyramidal tract



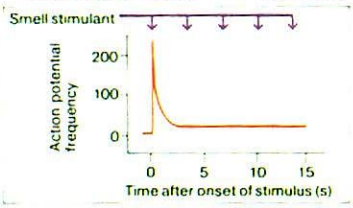
Nasal cavity: orgn of smell



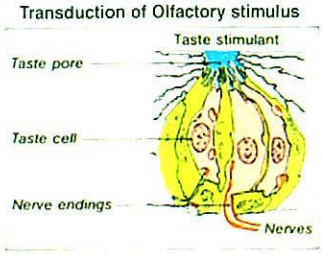
Olfactory epithelium (after Andres)



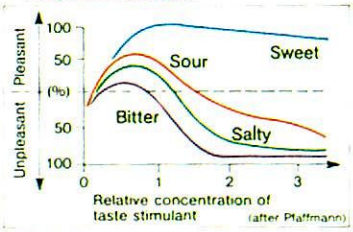
Transduction of Olfactory stimulus



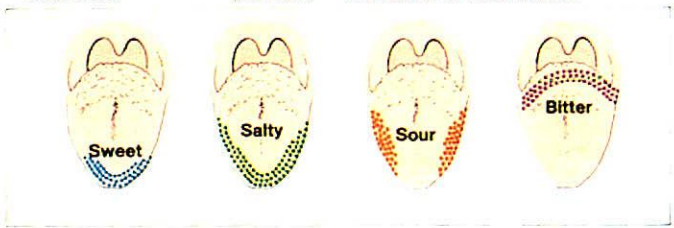
Adaptation to smell



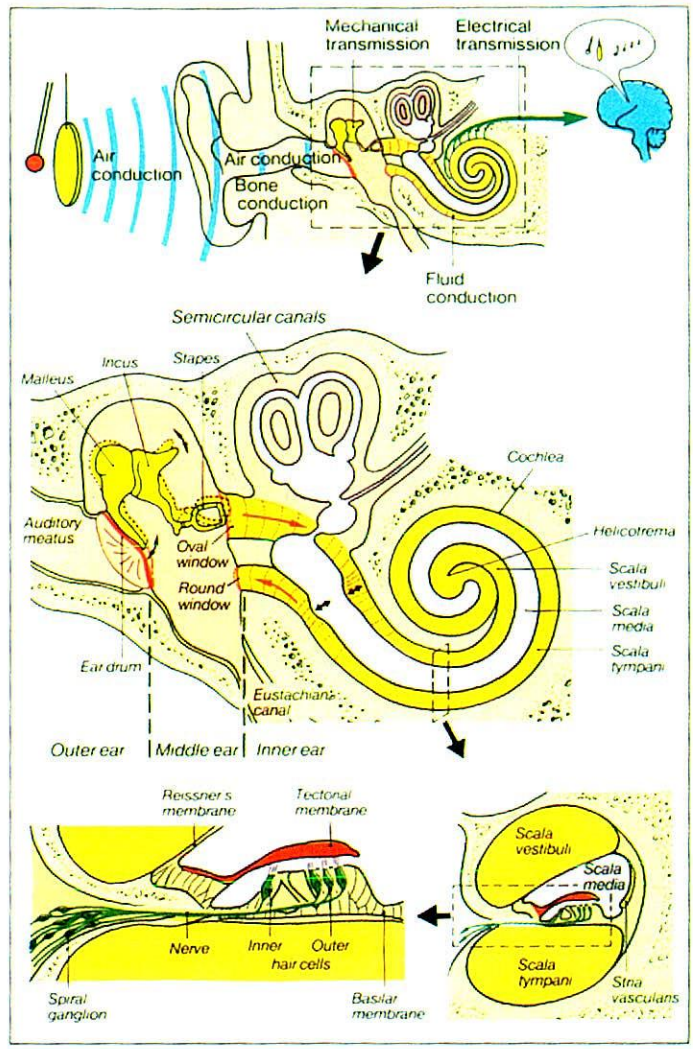
Taste buds (after Andres)



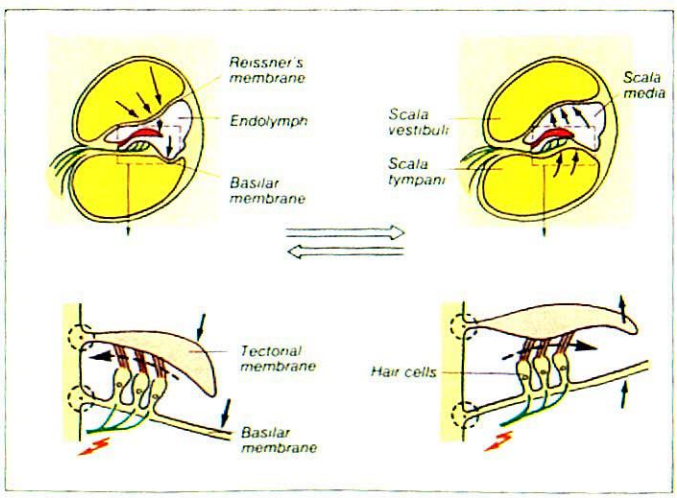
Evaluation of taste stimuli



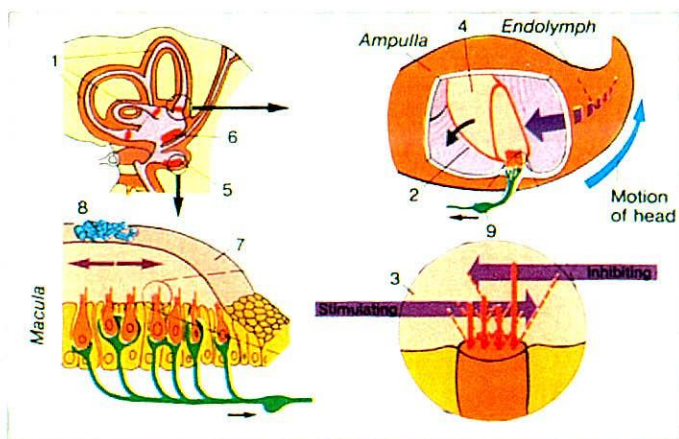
Localization of taste qualities on the tongue



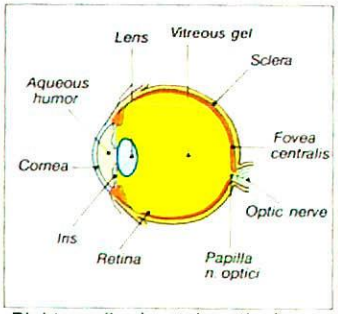
Sound transmission



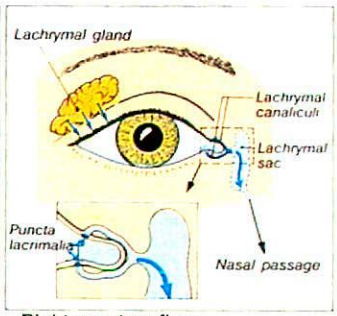
Excitation of hair cells by a shearing action on their hairs



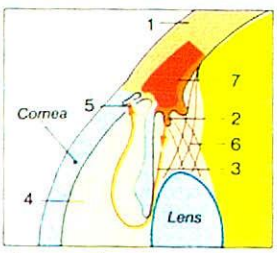
Vestibular organ



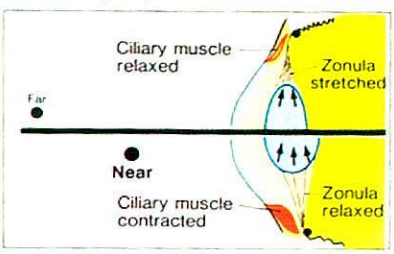
Right eye (horizontal section)



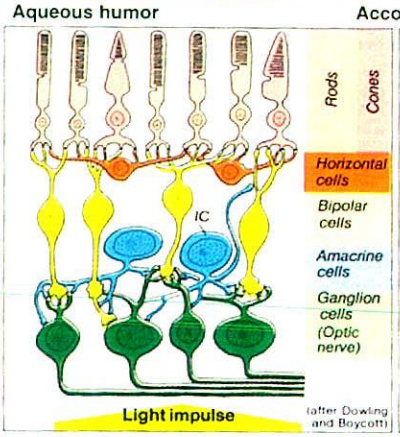
Right eye: tear flow



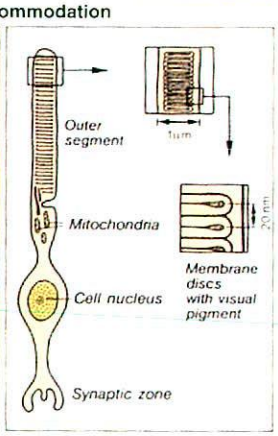
Aqueous humor



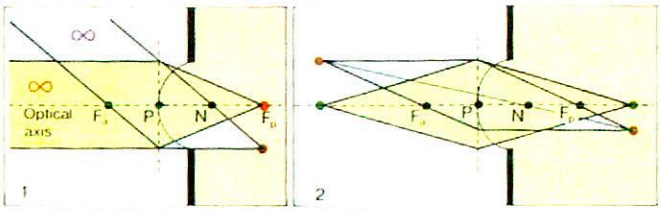
Accommodation



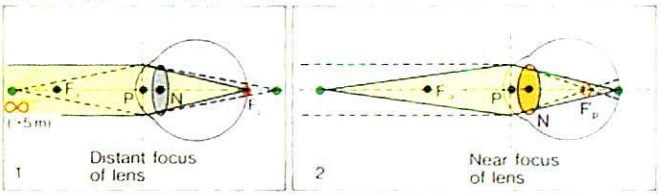
Retina (schematic)



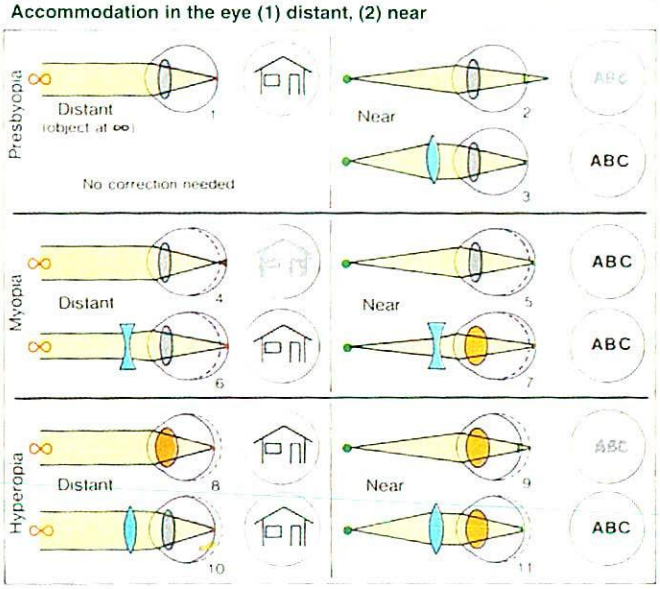
Rods



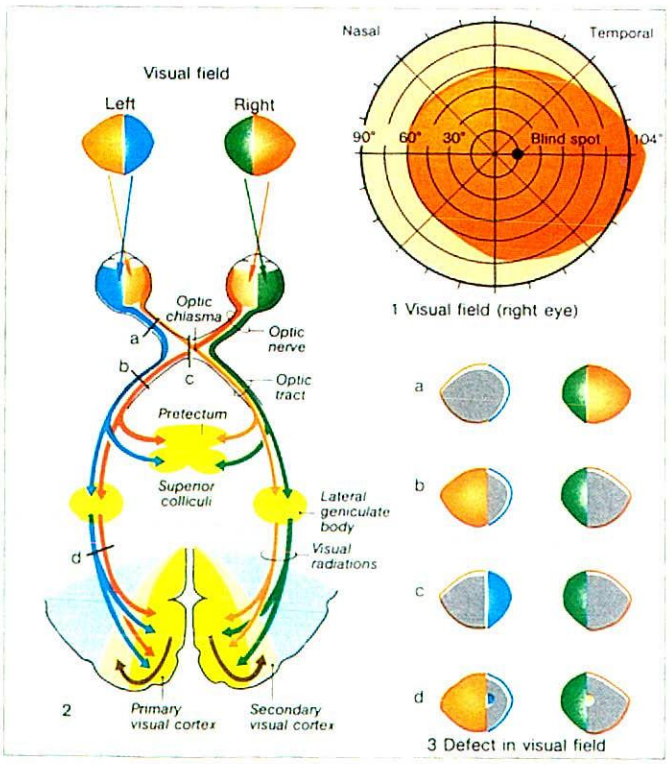
Optics: (1) distant, (2) near light source



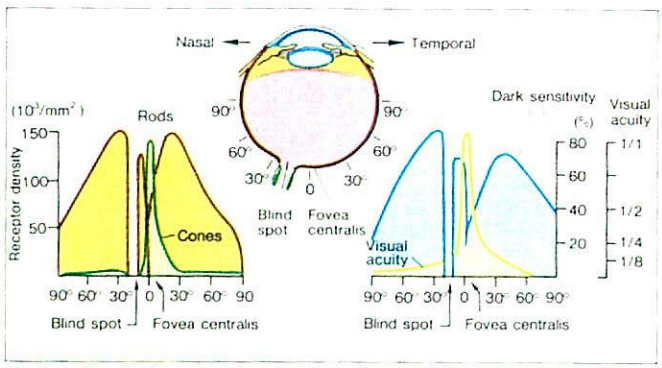
Accommodation in the eye (1) distant, (2) near



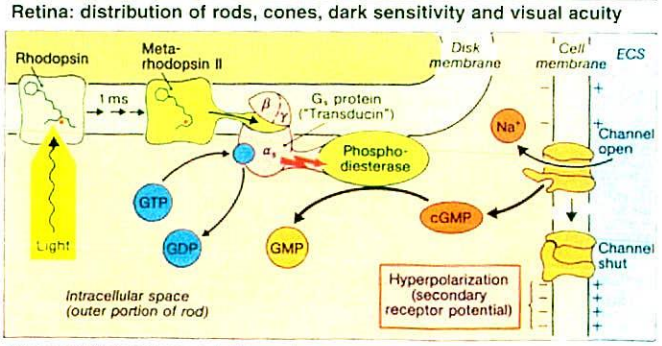
Visual defects



Visual pathway and field



Retina: distribution of rods, cones, dark sensitivity and visual acuity



Transduction process in the rods