Biochemistry in Morocco: Review of the state of teaching

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HEADLINES
Which category of students get the Biochemistry education?

Students enrolments and Statistics?

What kind of Diploma? Methods of teaching?

Teaching aids?

Constraints?

Recommendations

Annex I: main Elements of Biochemistry Syllabus

Which category of students get the Biochemistry education?

Graduate level at the university

Faculties of Sciences (Master degree in Biology)
* 2nd year of the Four years of the master Biology (obligatory module)
* 3rd year of the Four years of the master in Biology (obligatory module)
* 4th year of the Four years of the master in Biology (obligatory module)

Faculties of Applied Sciences (Master degree in Applied Biology)
This included Biotechnology, Molecular Biology, Food Technology, Environment, and related education where biochemistry is tool for this kind of education.

Faculty of Medicine et de Pharmacy
* 1st year of the Seven years of the Doctorate in Medicine (obligatory module)
* 2nd year of the Seven years of the Doctorate in Medicine (obligatory module)

Which category of students get the Biochemistry education?

Graduate level at the Institutes of Engineering (Max 5 years of education)
* Engineer of chemistry
* Food and agriculture technology

Graduate level at the Institutes of professional Education (Max 2 years of education)
* Laboratory technicians and assistants
* Food technology technicians

Students enrolments and Statistics?

15 Schools of engineering
2453 students in 1999 — 210 students are graduated as engineers in fields where Biochemistry is involved.

15 Universities
44691 students in 1999, this included all the specializations: human sciences, Economy, …… and Sciences ……… 5000 students were studying in fields where Biochemistry is involved

Source: Ministere de l’Enseignement Superieur et de la Recherche Scientifc, Maroc

What kind of Diploma?

Graduate level
- Bachelor Degree in Biology and Biochemistry
- Diploma of Engineer in Biotechnology and Food technology, agriculture, veterinary.
- Diploma of technician of laboratory
- Diploma of industrial technician

Post-graduate level
- Master degree in Biochemistry
- PhD in Sciences and applied Sciences
Methods of teaching?

Main courses and Complement Exercises
* Biochemistry I: Structural Biochemistry*
* Biochemistry II: Metabolic Biochemistry*
* Biochemistry III: Enzymology
* Biochemistry IV: Genetics

(See details in annex I)

Auxiliary disciples
* Organic Chemistry

Practical Training
* Technique of Chromatography
* Technique of Electrophoresis
* Dosage of Carbohydrates
* Dosage of Proteins* Enzymology

Teaching facilities:
* Mostly using classic approach
* Blackboard, Overhead projector; slide projector;
  * ppt projector (rarely)

Laboratory facilities:
* Big difference in the equipment according to:
  1 - The age and the location of the educational institution, and
  2 - the sector of activity that to which belong the educational institution
* The main equipment: Centrifuges, Thin Couche Chromatography, Spectrophotometer...

Constraints?
Absence of ideal methods for the education of the Bioc
* No typical approach is user in biochemistry education—— big difficulties to explain by the description of multiple experiences outside the laboratory
* The absence of education of the Latin and the Greek ——— huge effort required to learn the special vocabulary to the biochemistry

Lack of the education of modern biochemistry due to :
* Difficult acquisition of concepts of structures in the space ———— difficult understanding of the real structure of molecules and the definition of their implication in the different biological and cellular processes.

* Existence of methodological frontiers between the biochemistry, and the other disciplines 9molecular biology, physiology, biophysics, histology ....) ——— Lack of integration of the biochemistry in the global understanding of the functioning of the human beings.

Recommendations
* Enough means should be allowed for biochemistry education
* Exchange with different external and friends departments
* Participate to the training sessions and educational courses that dedicated to specific research project.
* Increase the equipment of the labs in order to cover all the needs in biochemistry education

Annex I

Main Elements of Biochemistry Syllabus

Biochemistry I

Materiaux biologiques de base en biochimie
Lipides, detergents et membranes biologiques
Oxides, osides et glucides
Acides amines peptides et proteinsBases azoéees et acides nucleiques
Transporteurs d’electrons
Transporteurs de groupements…
Vitamines et molecules essentielles

2. Organisation des molecules dans les cellules

2.1 Paroi cellulaire
2.2 Membrane plasmique
2.3 Cytoplasme
2.4 Noyau cellulaire
2.5 Reticulum endoplasmique
2.6 Appareil de Golgi
2.7 Mitochondrie
2.8 Chloroplaste
2.9 Inclusions, lysosome et Peroxysome

Biochemistry II

1. Structure des lipides

2. Structure des glucides

3. Structures des proteines
3.1 Niveaux d’organisation structurale des protéines et classification
3.2 Acides aminés. Structures et propriétés physico-chimiques
3.3 Polypeptides et hormones peptidiques
3.4 Sequençage dune protéine et évolution
   3.5 Structures secondaires des chaînes peptidiques. Helice alph et feuillet beta
3.6 Structure tertiaire des protéines
3.7 Structure quaternaire des protéines

4. Structure des acides nucleiques
   4.1 Mononucleotides, oligonucleotides et polynucleotides (AND et ARN)
   4.2 Nucleosomes, chromatine, chromosome et génome
   4.3 Réplication du AND
   4.4 Réaction de polymérisation en chaine (PCR)
   4.5 Transcription et régulation des genes
   4.6 Maturation des ARN
   4.7 Traduction, chargement des ARNt, code génétique, traduction du ARNm par les ribosomes
   4.8 Maturation et transport des protéines

Biochemistry III
1. Enzymes. Catalyseurs biologiques
2. Métabolisme des lipides
3. Métabolisme des glucides
4. Métabolisme des protéines
5. Métabolisme des acides nucleiques

Biochemistry IV
1. Régulation des genes et transmission de signaux
   1.1 Régulation des genes chez les procaryotes
   1.2 Régulation des genes chez les eucaryotes
   1.2.1 Interactions protéines-acides nucleiques
   1.2.2 Modification de la chromatine
   1.2.3 Complexe d’initiation
   1.2.4 Promoteur
   1.2.5 Facteurs de transcription
   1.3 Maturation des messagers et contrôles post-transcriptionnels
   1.4 Perception et transmission de signaux

2. Biologie moleculaire et genie genetique