

A BALANCED APPROACH FOR FACILITATED, STEP LADDER LEARNING OF HUMAN PHYSIOLOGY

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Background: In Pakistan, the 1st Year and 2nd Year examinations are held separately, bifurcating each relevant subject in 2 almost water-tight compartments. The guiding principles by regulatory bodies explicitly spelt out that 'Repetitive teaching of the same contents by different disciplines must be avoided, and the university faculty is free to decide the order in which to teach a subject'. Except few colleges taking marginal advantage of the above guidelines, most are still on board the same old boats. Currently, in 1st Year: General & Cell Physiology, Blood, Nerve & Muscle Physiology, GIT, CVS and Respiration; while in the 2nd Year, Body Fluids & Kidney, Nervous System, Special Senses, Endocrinology and Reproduction are covered. **Disadvantages:** 1) Maximum load of curriculum is shifted to 1st Year when the foliage students are already disturbed by numerous adverse factors. 2) The topics of Biological Membrane, Liver Functions, their tests & Jaundice in 1st Year and the Endocrinology and Acid/Base Balance in 2nd Year are being taught by Physiology & Biochemistry, generating duplication. A balanced approach is suggested to cover General & Cell Physiology, Blood, Nerve & Muscle Physiology, Respiration, Body Fluids & Kidney in 1st Year, while GIT, CVS, Nervous System, Special Senses, and Reproduction in the 2nd Year. Relevance will guide division of duplicated topics amongst Physiology and Biochemistry, avoiding unnecessary repetition. **Advantages:** 1) All prevailing disadvantages are eradicated. 2) All practicals in 2nd Year will be the clinical methods, facilitating clinical clerkship in 3rd year.

INTRODUCTION

For the Medical Education in Pakistan, HEC and PM&DC are the regulatory bodies under the constitutional ordinance. Their directives are mandatory to be followed by the medical institutions.

The HEC and PM&DC selects the medical subject specialists as component of NCRC every three years to revise the booklet on curriculum prescribed for MBBS. As the previous one was published in 2005; the revised booklet is in offing.

In Pakistan, the subjects on Basic Medical Sciences are bisected under the directive of regulatory bodies and examined after 1st Year and 2nd Year respectively.

MATERIALS AND METHODS

The existing Curriculum of MBBS (Revised-2005) prepared by Pakistan Medical & Dental Council and Higher Education Commission, Islamabad¹ was critically analysed for application of the guiding principles. The Physiology and Biochemistry syllabi prescribed for the first 2 years of MBBS were compared for any anomaly. The remedial measures which may be helpful to improve the relevant contents in the booklet awaited will be suggested.

RESULTS

The Guiding Principles by HEC (2002 & 2005):

1. Avoid the duplication of the contents which extend into more than one discipline.

2. Eliminate the repetitive teaching of the same contents by different disciplines.
3. Emphasize what the student must know, and yet ensure that the student is not over burdened.

Paradox in the document on curriculum:

Certain topics with similar contents are being taught by Physiology as well as Biochemistry, generating the prohibited duplicity.

First Year:

Biological Membrane, Liver Functions, Liver Function Tests, Iron metabolism, Fate of Haemoglobin and Jaundice

Second Year:

Endocrinology and Acid/Base Balance

Duplication adds up unnecessary burden on the students, and even muddling and confusion due to the possible difference of opinion by 2 different teachers.

In addition, the students being examined by 2 disciplines for almost the same contents is unjustified.

How to Customize Endocrinology

Physiology and Biochemistry constituted one subject. As the knowledge started swelling, the mitosis resulted into bifurcation of these into separate disciplines at the undergraduate level.

Currently, instead of the respective hormones, the headings relevant to all hormones have been divided, as reflected in the Table-1.

Table-1: Curriculum for Endocrinology in Biochemistry and Physiology for MBBS 2nd Year

| S.# | BIOCHEMISTRY | PHYSIOLOGY |
|-----|---|---|
| 1 | | General Principles (GP)– Classification |
| 2 | Chemistry | |
| 3 | | Biosynthesis |
| 4 | Secretion | |
| 5 | Regulation (of secretion) | Feedback Control (GP) Control of secretion |
| 6 | | Transport |
| 7 | Mechanism of Action | Mechanism of Action (GP) |
| 8 | Effects on Carbohydrates, Lipids, Proteins, Minerals and Water Metabolism | Actions |
| 9 | | Metabolism (of hormones) |
| 10 | Disorders of various endocrine glands. | Diseases in Endocrine System |

In this table, the aspects of endocrines marked for Physiology at S. # 1, 3, 6 and 9 are relevant to Biochemistry. The 5, 7, 8 and 10 being on both the sides, are duplicated. S. # 2 and 4 are already ascribed to Biochemistry.

The text book on Physiology being followed in most of the medical colleges in the country is the Text Book of Medical Physiology by Guyton & Hall

(11th Edition).² In this book, the chapters on Endocrinology span from pp. 905 to 992. In this section the material exclusively relevant to Physiology is displayed in Table-2.

The Endocrinology in chapters 74 to 79 (pp 905 to 994) constitute 90 pages. In this section the exclusive Physiology part is only 6 pages, i.e., less than 7%, where in, except for a total 1 page on Growth, rest all is covered when other important systems of the body are taught.

To remove these weaknesses, duplication and injustice; clear cut delineation is not impossible.

Endocrinology is not irrelevant to Physiology. Requirement is to assess the content-relevance of **individual** hormones; to Physiology or Biochemistry?

Keeping in view the logical sequencing of the topics in Biochemistry, metabolism and then the endocrines as regulators of metabolism constitute a nice and coherent package for the undergraduate students.

Table-2: The text on Endocrinology exclusively relevant to Physiology in the Text Book of Medical Physiology by Guyton & Hall (11th Edition): Chapter 74–79

| S.# | Hormone | Page# | Relevance | Pages | Remarks |
|-----|---------------------------|--------------------------|---|---------------|---|
| 1 | Growth Hormone | 923 | Cartilage & Bone Growth | 0.50 | |
| 2 | Hormones of Thyroid Gland | 936— *937— | Growth *Cardio vascular | 0.25 *1.00 | *Discussed in the Physiology of CVS |
| 3 | Adrenocortical Hormones | 948–9..... 953–4..... | Renal effects Haematological effects | 1.50 2.00 | Discussed in the Physiology of Kidney and Blood |
| 4 | Insulin | 967 | Growth | 0.25 | |

Table-3: Suggested Curriculum for Endocrinology with Content-Relevance to Biochemistry and Physiology

| Biochemistry | Physiology |
|--|--|
| Classification of Hormones. General principles of secretion, regulation and the mechanism of action. All aspects about the hormones of: Hypothalamus (<i>Except ADH and Oxytocin</i>) Anterior Pituitary (<i>Except Prolactin and Gonadotropins</i>) Thyroid Parathyroid Pancreas Adrenal Cortex Biosynthesis, Transport, Metabolic Actions and Metabolism of: Mineralocorticoids Catecholamines Sex steroids | All aspects about: The Physiology of Growth (pp. 923, 936, 967) ADH Oxytocin Prolactin Gonadotropins Placental Hormones (<i>Except the sex steroids</i>) Non-metabolic Actions, Regulation and Disorders of: Mineralocorticoids Catecholamines Sex steroids |

It will be appreciated that the entire time currently ascribed to endocrinology (in Physiology) will now be spared because the responsibility portrayed for physiology in this grouping is already covered in other topics, like regulation of body fluids, reproductive and renal physiology and ANS.

Grouping of the Topics for the First and Second Year of MBBS

As it has been already mentioned that in Pakistan, the subjects of Basic Medical Sciences are bisected under

the directive of regulatory bodies and examined after First Year and Second Year respectively.

The flexibility to modify the grouping and making the universities independent to change grouping will probably fail the objective of uniformity at its own end.

Facility of migrations dictates that all the universities must adopt a uniform division of the curriculum and also the sequencing of the topics to be taught in all the academic years, more importantly during the first 2 years due to bisection.

The Pakistan Medical and Dental Council recognised medical colleges in Pakistan:

Public Sector: 23+

Private Sector: 30+ (With few more in the pipeline)

Hence accepting the ground realities, we will have to predetermine important principles, and then go ahead for the grouping without defying those principles.

1. Extend relatively more facilitation during 1st Year, to

- a. Help the foliage students tide over their latency of adjustment in a unique social/academic environment.
- b. Absorb the late inductions.
- c. Impact morale boosting on the 2nd Year consequent upon the naturally encouraging results from the lighter 1st Year.
- d. Time consumption in
 - i) Delayed admission process
 - ii) Further inductions in the next 1 or 2 months
 - iii) During a lecture, grooming the students for etiquettes, ethics peculiar to a medical institution.
 - iv) Adjustments in the newer environments
 - v) Language barrier especially for the students hailing from the rural areas.
 - vi) Registering a tremendous number of unfamiliar medical terminologies.
 - vii) Certain very basic concepts need more time devotion and repetitions due to their global application, like, the Genesis & maintenance of RMP, the Nernst Equation, electrical events in the excitable tissues, muscular mechanics, etc.

→ Relatively lesser time remains available for overall academic activities.

- 2) The body systems demanding intra-topic and the inter-topic integrations over a wider range should be grouped in 2nd year.
- 3) The practicals should remain proportionately equal for both the years, keeping them integrated with their related topics in theory.
- 4) The practicals based on the clinical methods should be adjusted in second year, facilitating the students' clinical clerkship.
- 5) The grouping should generate minimum objections and yet achieve the maximum objectives.

Keeping in view the approach of principles, let us have a look on currently in vogue division of the body systems for the first 2 years of MBBS. The figures in the tables indicate the number of hours.

Table-4: Current grouping of the body systems in first 2 years of MBBS

| 1 st Year MBBS | | |
|---------------------------|------------|-----------|
| Topic | Lectures | Practical |
| General & Cell Physiology | 10 | 2 |
| Blood | 30 | 32 |
| Nerve & Muscle | 20 | 6 |
| GIT | 16 | |
| CVS | 45 | 20 |
| Respiration | 30 | 8 |
| Total | 151 | 68 |
| 2 nd Year MBBS | | |
| Topic | Lectures | Practical |
| Body Fluids & Kidney | 30 | |
| Nervous System | 45 | 12 |
| Special Senses | 16 | 14 |
| Endocrinology | 30 | |
| Reproduction | 15 | 2 |
| Total | 136 | 28 |

It becomes quite obvious at the very first glance that we could not evolve the curriculum commensurate with our specifications. The students in their First Year have to bear approximately 35% more burden than the Second Year.

Here, most of the knowledge gained during the first year is more relevant to the commonly occurring diseases, which gets rusted during the second year and becomes almost unavailable for application during the clinical years.

[This fact is now being realized by few institutions. One remedy being adopted is admirable to shift the GIT to the Second Year. But the other one is terrible. To reduce the practical load of 1st Year, the practicals on Nerve and Muscle are shifted to Second Year with the plea that being the excitable tissue, these match with the CNS. While performing the practicals on Nerve and Muscle, the primary objective is to exhibit the mechanical properties of the skeletal muscles learnt during the theory of the Nerve & Muscle physiology. Hence this divorce is not legitimate.]

Table-5: Proposed grouping of the body systems in first 2 years of MBBS

| 1 st Year MBBS | | |
|---------------------------|------------|-----------|
| Topic | Lectures | Practical |
| General & Cell Physiology | 10 | 2 |
| Membrane Physiology | 5 | |
| Nerve & Muscle | 20 | 6 |
| Blood | 30 | 32 |
| Respiration | 30 | 8 |
| Body Fluids & Kidney | 30 | |
| TOTAL | 125 | 48 |
| 2 nd Year MBBS | | |
| Topic | Lectures | Practical |
| GIT (Motility) | 12 | |
| CVS | 45 | 20 |
| Nervous System | 45 | 12 |
| Special Senses | 16 | 14 |
| Reproduction | 15 | 2 |
| TOTAL | 133 | 48 |

In this system of grouping the glimpses out of the chapter 16 about the capillary dynamics and the Starling Equilibrium for capillary exchange will need to be taught before starting the Body Fluids and Renal Physiology.

CONCLUSIONS

1. During the 1st Year MBBS, facilitation is extended with more time available for repeated discussions/presentations, and thus the students are enabled to provide encouraging results, in spite of their undeniable initial difficulties. It will provide them a morale boosting effect.
2. During the 2nd Year MBBS, when the academic pressure is gradually mounted, the students can easily absorb the added pressure, having been adjusted and conversant with the medical terminologies.
3. The duplication amongst the Physiology and Biochemistry is removed. It will eradicate all the

problems inherent in teaching the same topics by two disciplines.

4. In the second year, those systems (including GIT by the Biochemistry) will be taught which are involved in the diseases of common occurrence. It will facilitate the students to effectively apply their acquired knowledge and skills, being fresh, to learn preclinical and the clinical subjects.
5. The practical work in second year will be altogether clinically oriented, helping the students to learn the clinical methods at an early stage. It will facilitate their clinical clerkship in 3rd year MBBS.

REFERENCES

1. Pakistan Medical & Dental Council & Higher Education Commission, Islamabad. Curriculum of MBBS, Revised 2005.
2. Guyton AC, Hall JE. Endocrinology and Reproduction. In: Guyton & Hall Text Book of Medical Physiology. 11th ed. Philadelphia: WB Saunders Company. pp 905–1041.

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