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The Role of Mathematics on Human Structure

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دور الرياضيات في تركيب الانسان

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BACKGROUND TO THE BOOK

During 10 years research the author focused on the physiological and anatomical problems stemming from surgical anomalies. He came to the conclusion that it is surely the lack of mathematical precision in orthopaedic surgery that causes orthopaedic handicaps. The author firmly believes that if mathematical deductions were applied to orthopaedic knowledge many immediate complications and sequelae could be avoided and people could regain new life in the true sense of the term.

CONTENT OF THE BOOK

The book has 156 pages. It consists of preface and index with 12 chapters as follows:

1. Leonardo de Vinci – the anatomist of great ability
2. Physiological concepts from René Descartes
3. Mathematical explanation of Descartes' concept of the Pineal Gland and the modern view
4. Mechanism of the movements of the Heart – mathematical concepts
5. Cervical deformations – their causes and deductions on mathematical basis
6. Mechanism of the skeletal Shoulder Joint – analyzed by mathematical process
7. Vertebrae and their efficiencies – expressed in mathematical procedure
8. Distribution of forces through the Pelvis by mathematical deductions
9. Human Femur and mathematical examination
10. Structure of the Femoral Condyles distributing weight to the lower part of the leg
11. Structure of Bone Lamellae and distribution of forces on the Hip Joint
12. Role of Ligaments on the movements of the Femur in comparison with the Hip and its mathematical examination.

THE READERSHIP MOST SUITED FOR THIS BOOK

This book would be of value to professionals in the fields of human biomechanics and kinematics. These include physiologists, clinical anatomists, physicians, surgeons, radiologists and researchers. It will help them to calculate physiological movements on the basis of degrees of freedom and, in restorative procedures, to replace bones properly to avoid shortening and extension of limbs and other parts of the human structure and to

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restore the absolute normalcy of the original position.

appropriateness of the content to target readership

The content, within the mentioned limitations below, seems to be appropriately suited for the intended readership. The interdisciplinary approach of the author to express some of the operations and distributions of weight in the human body through mathematics will help in the accurate management of physically handicapped or disabled patients.

comprehensiveness of the content

The book covers a limited number of parts of the human body, such as movements of the heart, the pineal gland, cervical deformities, the vertebrae, pelvis, femur and hip joint. Other areas of mathematical and dimensional importance are, unfortunately, inadequately covered or omitted. For example, it would have been appreciated if the synchronized movements of thoracic elements (respiratory elements), restoration of the cranial bones (neurosurgery) and facial bones (faciomaxillary and plastic surgery), dentistry (orthodontics), pelvi-foetal interrelationships (obstetrics) had also been covered by this book. Indeed, the human body has many aspects relevant to this type of study. These areas are for the author to consider in future publications.

organisation of the content

From the title of the book, "The Role of Mathematics on Human Structure", one expects human 'structure' to be the focus. Yet, the author delves into wide areas of 'function' including blood chemistry, respiratory exchanges and thermodynamic concepts to explain some functional and biochemical reactions. This may well be unavoidable, but then the title should encompass such areas. This would in no way diminish the central interest of the book.

mathematical analysis

This book studies the useful role of applied mathematics for the human body by considering several mathematical expressions, which are illustrated for certain applications. The analyses are useful in most cases, but several statements require careful rewriting or corrections. In particular, pages 21-25 provide a lot of details, but some equations are not well described and are hard to follow. They should be written on similar lines to those in other chapters of the book.

In the following list of examples, some comments and suggestions are to be considered:

1. The following mistakes should be corrected.
   - The equations for ρ and ΔF (see lines 7-10 from the bottom of page 22),
   - " c/L^2" (should be "$1/L^2$"), (at the bottom of page 23)
   - The expressions for α and β (line 4 from the bottom of page 65)
   - The expression for *log r* on page 92.
2. Details and explanations to clarify the methods of obtaining formulas are needed in many areas of the book where unclear mathematical statements are made. It would also be useful to provide some references for some known results. For example, the equations of motion on page 54 should be referred to a suitable book.

GENERAL COMMENTS

quality of content

To simplify a difficult biological process into an easy to understand mathematically applicable concept is not an easy task to achieve. However, the methodical and clear presentation and explanation of such difficult concepts makes this book, in my opinion, a unique publication. Descriptive explanations of the laws of kinematics on body deformations, such as: compression forces on the nucleus pulposus and the tensile stresses on the annulus fibrosus of the intervertebral discs, are clear examples of how such forces can mathematically explain deformities and consequent ailments when the state of "perfect elasticity" of the body can be breached. It does this when it reaches the fatigue state beyond a certain value of the 'elastic limit'. The spelling of a few medical terms needs to be revised. This mars, to some extent, the completeness of a polished work.

quality of illustrations

Illustrations are in black & white and of moderate quality. At times this can hinder understanding of the message, especially when delicate structures are in question, such as cardiovascular and neural structures. Good quality coloured illustrations would have been an asset to the content of the book. Obviously, the publishing cost and consequently the book price would then have been increased.

completeness of content

The author manages to cover adequately certain aspects of disease processes that result in deformations. Examples are provided for the cervical spine, shoulder

joint, femur and hip joint. Detailed management of certain functional disorders can be ascertained mathematically and, therefore, mathematics can play a key role in solving those disorders. I reiterate that one of my main observations about this book is that it deals mainly with the role of mathematics in expressing body functions mainly, as described in the above examples, and not body *structures* as the book title indicates.

OTHER COMMENTS

PAPER AND BINDING QUALITIES

The paper and binding qualities are a disappointment. A work of this calibre should have been printed on good quality glossy paper. Also, a hardback and better binding qualities would have added value to the book. This would indeed influence, to some degree, the net sale price of the book.