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The Physiology of the Joints

Annotated diagrams of the mechanics of the human joints

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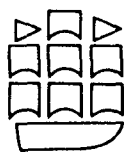
Second Edition

Volume 3

THE TRUNK AND THE VERTEBRAL COLUMN

- 1 The Vertebral Column taken as a whole
- 2 The Bony Pelvis and the Sacro-Iliac Joint
- 3 The Lumbar Vertebral Column
- 4 The Thoracic Vertebral Column and Respiration
- 5 The Cervical Vertebral Column

With 397 original diagrams by the Author



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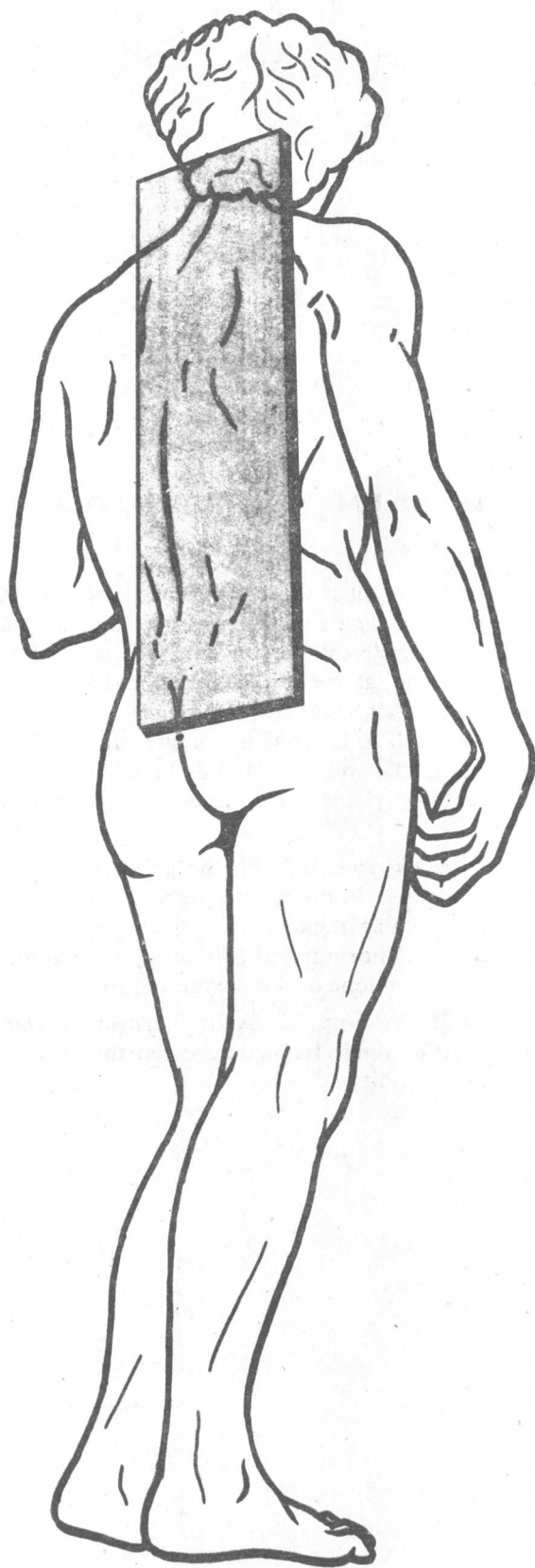
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THE VERTEBRAL COLUMN AS A WHOLE



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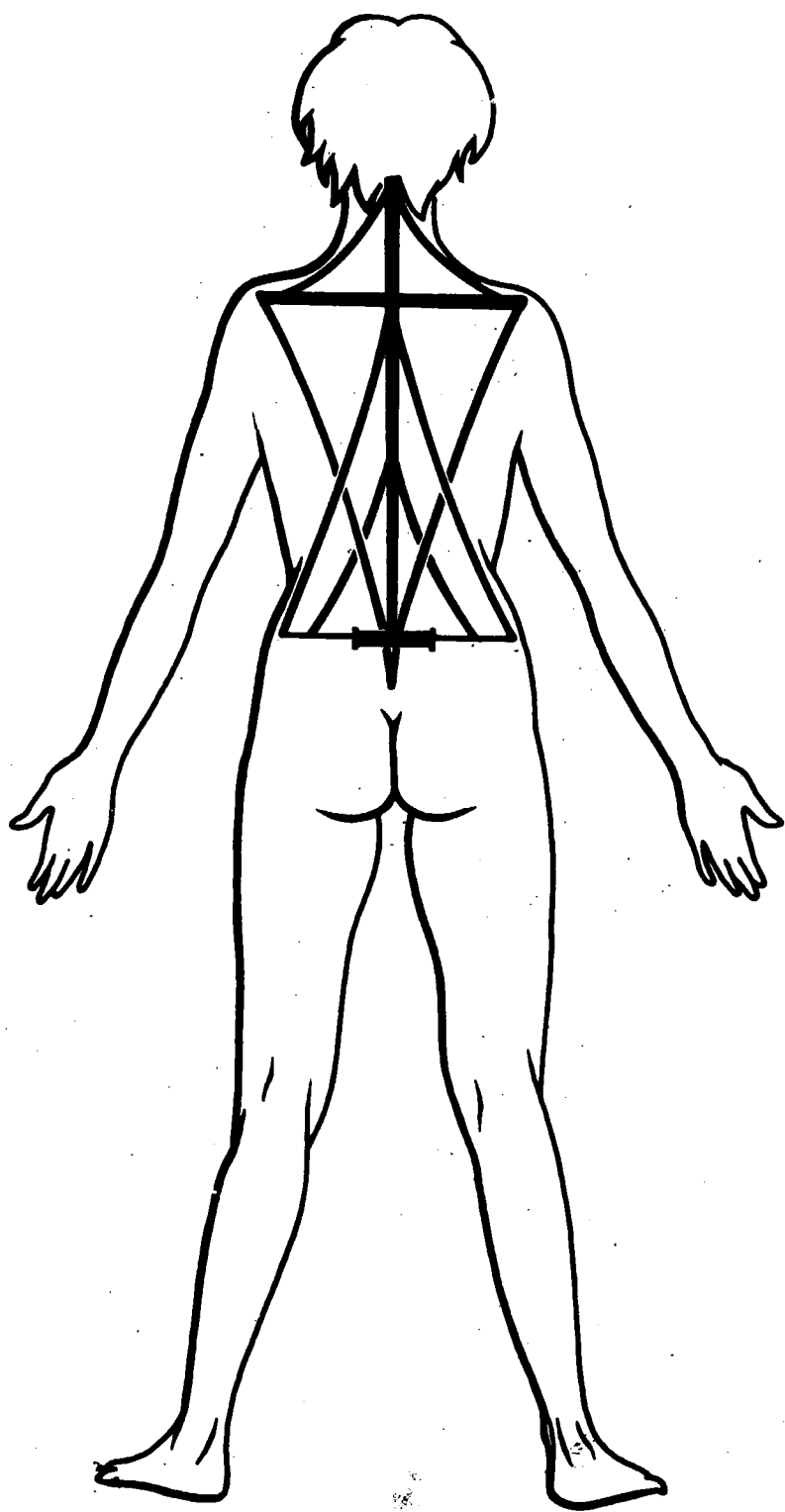
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THE VERTEBRAL COLUMN: A STABILISED AXIS

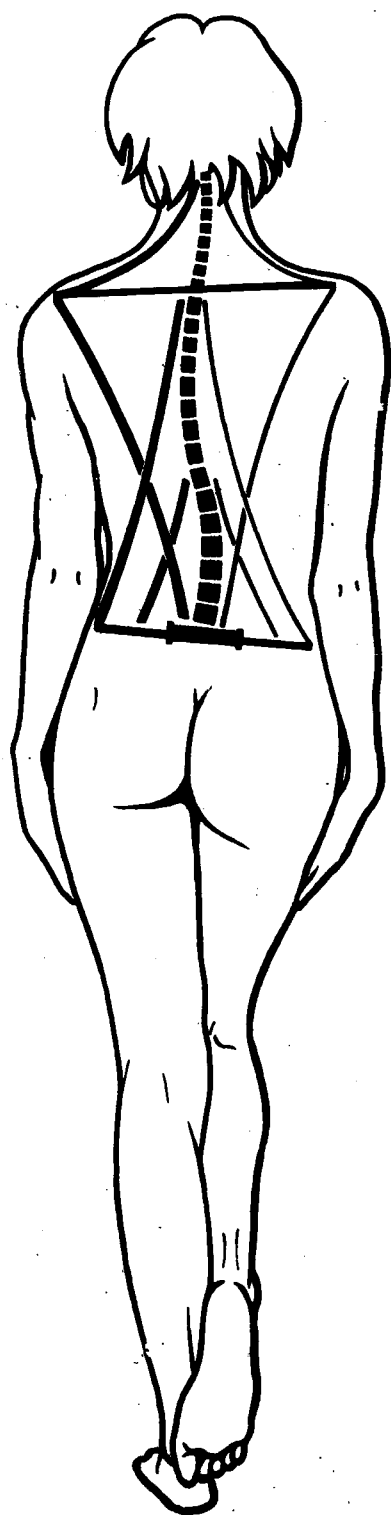
The vertebral column, the axis of the body, must meet two contradictory mechanical requirements: *rigidity* and *plasticity*. This is achieved by the presence of stays built into its very structure. In fact (fig. 1), the vertebral column as a whole can be viewed as the mast of a ship. This mast, resting on the pelvis, extends to the head and, at the level of the shoulders, supports a main-yard set transversely, i.e., the scapular girdle. At all levels there are *ligaments and muscular tighteners* arranged as *stays*, i.e., linking the mast itself to its attachment site, the pelvis. A second system of stays is closely related to the scapular girdle and is diamond-shaped with its long axis vertical and its short axis horizontal. In the *position of symmetry* the forces on either side are in equilibrium and the mast lies straight and vertical.

When the weight of the body rests on one limb (fig. 2), the pelvis tilts to the opposite side and the vertical column is forced to bend: first, in the lumbar region, it becomes convex towards the resting limb, then concave in the thoracic region and convex once more. The muscular tighteners adapt automatically to restore equilibrium and this active adaptation is under control of the extrapyramidal system, which alters the tone of the postural muscles.

The plasticity of the column lies in its make-up, i.e., *multiple components superimposed on one another* and interlinked by ligaments and muscles. Its structure can therefore be altered by the muscular tighteners while it maintains its rigidity.



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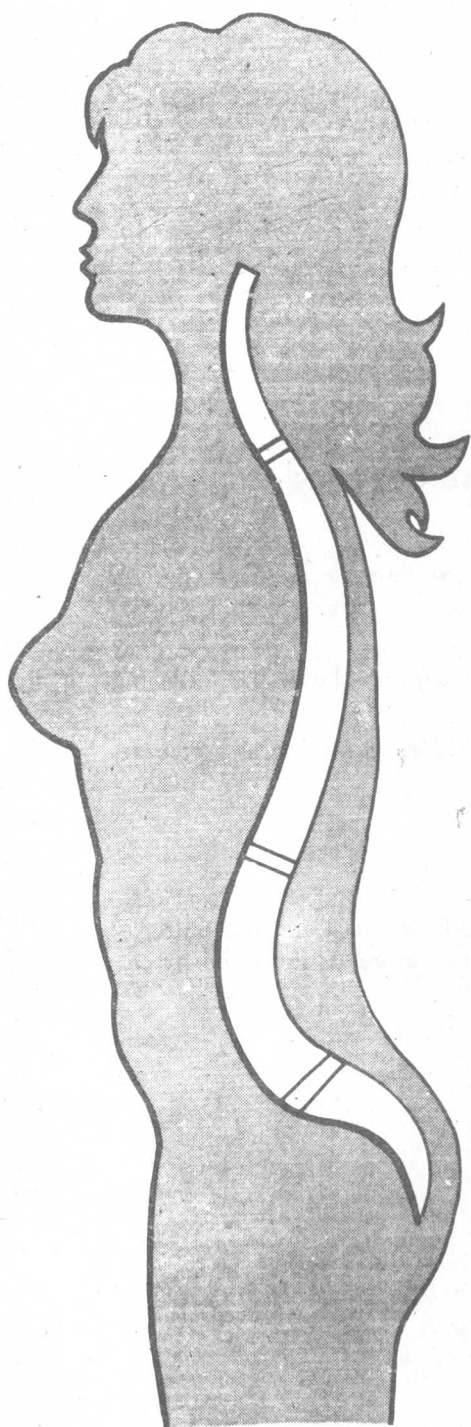


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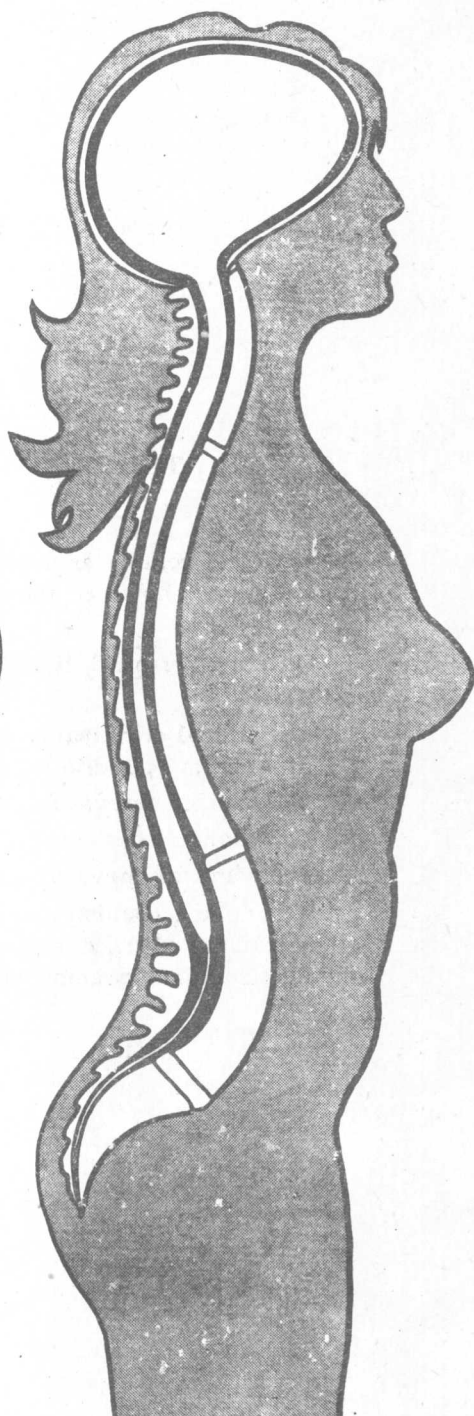
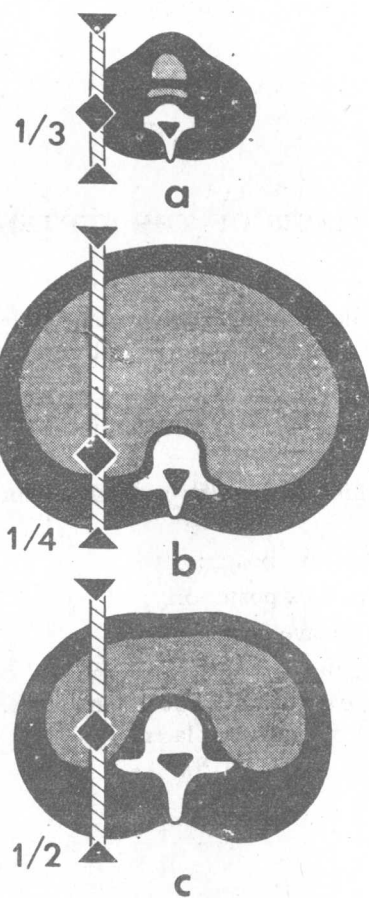
THE VERTEBRAL COLUMN; AXIS OF THE BODY AND PROTECTOR OF THE NEURAXIS

The spinal column in effect constitutes the **central pillar of the trunk** (fig. 3). Though in the *thorax* (inset b) it lies more posteriorly, i.e., within the posterior quarter of the thorax, in the *neck* (inset a) it lies more centrally, i.e. at the junction of the anterior two-thirds and posterior one-third of the neck. In the *lumbar region* (inset c) it lies centrally. These variations in position can be explained by local factors. In the neck the column supports the head and must lie as close as possible to its centre of gravity. In the thorax it is forced posteriorly by the internal organs, especially the heart. In the lumbar region, where it must support the whole weight of the upper trunk, it lies centrally once more and juts into the abdominal cavity.

In addition to supporting the trunk, the vertebral column **protects the neuraxis** (fig. 4): its canal, which starts at the foramen magnum and contains the medulla oblongata and the spinal cord, acts as a flexible and efficient casing. However, this protection afforded to the spinal cord is not absolute and, at certain levels and under certain circumstances, the spinal cord and its roots can be damaged by these protective structures.



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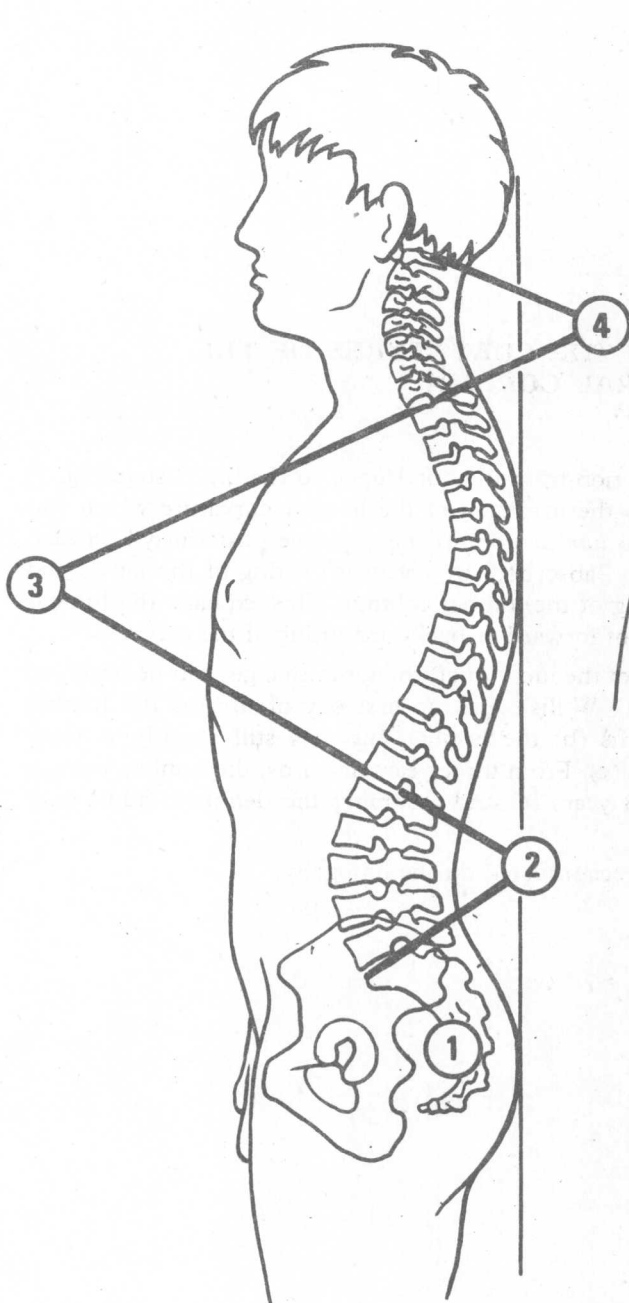
THE CURVATURES OF THE VERTEBRAL COLUMN

The vertebral column as a whole is *straight* when viewed *from the front or the back* (fig. 5). In some people, however, there may be a slight lateral curvature which remains within physiological limits.

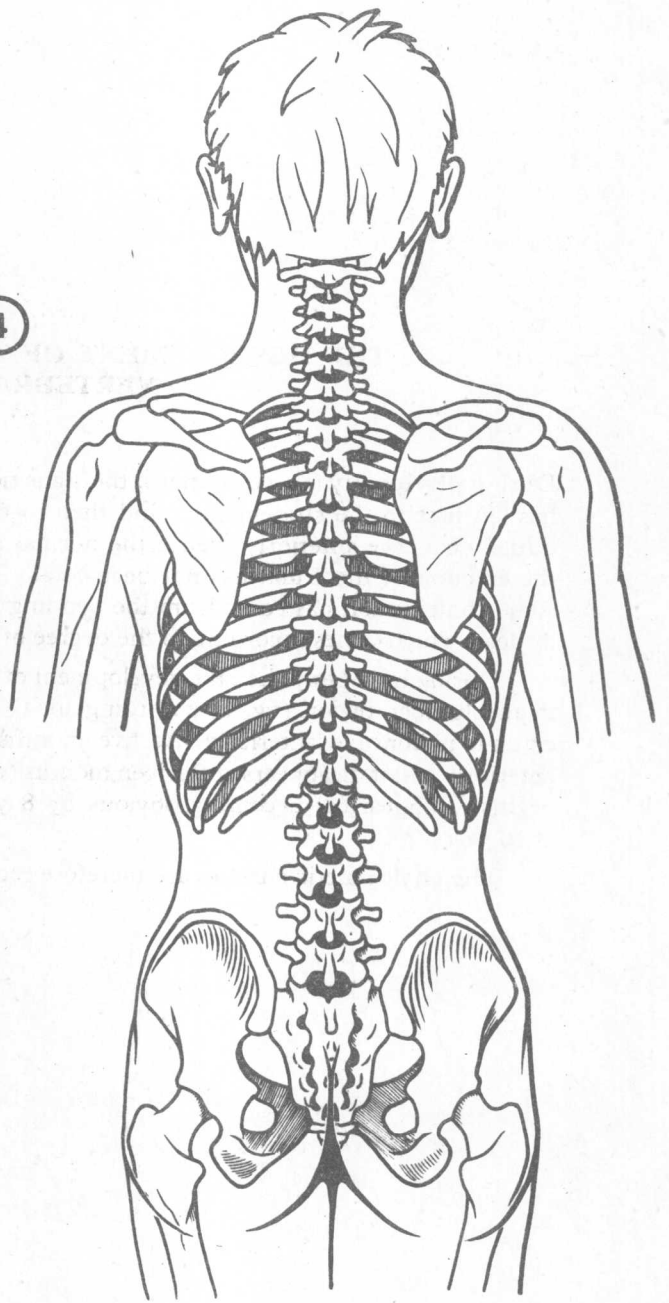
On the other hand, *in the sagittal plane* (fig. 6) the vertebral column shows the following *four curvatures*:

1. **the sacral curvature**, which is fixed as a result of total fusion of the sacral vertebrae. It is concave posteriorly;
2. **the lumbar curvature**, concave posteriorly;
3. **the thoracic curvature**, convex posteriorly;
4. **the cervical curvature**, concave posteriorly;

When one is standing normally, the posterior part of the head, the back and the buttocks lie tangential to a vertical plane, e.g., a wall. The extent of these curvatures is indicated by the solid lines and their meaning will be discussed later.



6



5