

# Contents

<b>Chapter 1 – A GLOBAL VIEW OF THE SPINAL COLUMN .....</b>	<b>2</b>
The spinal column: a stayed axis.....	4
The spinal column: axis of the body and protector of the neuraxis.....	6
A global view of the spinal curvatures.....	8
The development of the spinal curvatures.....	10
Structure of the typical vertebra .....	12
The spinal curvatures.....	14
Structure of the vertebral body.....	16
The functional components of a vertebra.....	18
The elements of intervertebral linkage.....	20
Structure of the intervertebral disc.....	22
The nucleus pulposus likened to a swivel.....	24
The preloaded state of the disc and the self-stabilization of the disco-vertebral joint.....	26
Water imbibition by the nucleus pulposus.....	28
Compressive forces acting on the disc.....	30
Variations in disc structure related to cord level.....	32
Elementary movements in the intervertebral disc.....	34
Automatic rotation of the spine during lateral flexion.....	36
Global ranges of movement during flexion-extension of the spine.....	38
Global ranges of lateral flexion of the spine.....	40
Global ranges of axial rotation of the spine.....	42
Clinical assessment of the global ranges of spinal movements.....	44
<b>Chapter 2 – THE PELVIC GIRDLE .....</b>	<b>46</b>
The pelvic girdle in the two sexes.....	48
Mechanical model of the pelvic girdle.....	50
Architecture of the pelvic girdle.....	52
The articular surfaces of the sacroiliac joint.....	54
The auricular facet of the sacrum and the various spinal types.....	56
The sacroiliac ligaments.....	58
Nutation and counternutation.....	60
The various theories of nutation.....	62
The pubic symphysis and the sacrococcygeal joint.....	64
The influence of position on the joints of the pelvic girdle.....	66
The pelvic wall.....	68
The pelvic diaphragm.....	70
The female perineum.....	72
The volumes of the abdominal and pelvic cavities.....	74
Labour.....	76
Micturition and defecation in the female.....	78
The male perineum.....	80
External landmarks of the pelvis: the lozenge of Michaelis and the plane of Lewinneck.....	82

<b>Chapter 3 – THE LUMBAR SPINE .....</b>	<b>84</b>
Global view of the lumbar spine .....	86
Structure of the lumbar vertebrae .....	88
The ligamentous complex of the lumbar spine .....	90
Flexion-extension and lateral flexion of the lumbar spine .....	92
Rotation in the lumbar spine.....	94
The lumbosacral hinge and spondylolisthesis .....	96
The iliolumbar ligaments and the movements at the lumbosacral hinge .....	98
The trunk muscles seen in horizontal section.....	100
The posterior muscles of the trunk.....	102
The role of the third lumbar and twelfth thoracic vertebrae .....	104
The lateral muscles of the trunk .....	106
The muscles of the abdominal wall: the rectus abdominis and the transversus abdominis.....	108
The muscles of the abdominal wall: the internal and external oblique muscles.....	110
The muscles of the abdominal wall: the curve of the waist .....	112
The muscles of the abdominal wall: rotation of the trunk .....	114
The muscles of the abdominal wall: flexion of the trunk.....	116
The muscles of the abdominal wall: straightening of the lumbar lordosis .....	118
The trunk as an inflatable structure: the Valsalva manoeuvre.....	120
The statics of the lumbar spine in the standing position.....	122
The sitting and asymmetrical standing positions: the musician's spine.....	124
The spine in the sitting and recumbent positions .....	126
Range of flexion-extension of the lumbar spine.....	128
Range of lateral flexion of the lumbar spine .....	130
Range of rotation of the thoracolumbar spine .....	132
The intervertebral foramen and the radicular collar.....	134
The various types of disc prolapse .....	136
Disc prolapse and the mechanism of nerve root compression .....	138
Lasègue's sign .....	140
<b>Chapter 4 – THE THORACIC SPINE AND THE THORAX.....</b>	<b>142</b>
The typical thoracic vertebra and the twelfth thoracic vertebra.....	144
Flexion-extension and lateral flexion of the thoracic spine .....	146
Axial rotation of the thoracic spine .....	148
The costovertebral joints.....	150
Rib movements at the joints of costal heads .....	152
Movements of the costal cartilages and of the sternum .....	154
The deformations of the thorax in the sagittal plane during inspiration.....	156
Mode of action of the intercostal and sternocostal muscles.....	158
The diaphragm and its mode of action .....	160
The respiratory muscles.....	162
Antagonism-synergism between the diaphragm and the abdominal muscles.....	164
Airflow in the respiratory passages .....	166
Respiratory volumes .....	168
The physiopathology of breathing .....	170
Respiratory types: athletes, musicians and others .....	172
The dead space.....	174

Thoracic compliance.....	176
The elasticity of the costal cartilages .....	178
The mechanism of coughing and the Heimlich manoeuvre.....	180
The laryngeal muscles and the protection of the airways during swallowing.....	182
The glottis and the vocal cords: phonation.....	184

## **Chapter 5 – THE CERVICAL SPINE ..... 186**

The cervical spine taken as a whole .....	188
Diagrammatic representation of the first three cervical vertebrae.....	190
The atlanto-axial joints .....	192
Flexion-extension in the lateral and median atlanto-axial joints.....	194
Rotation in the lateral and median atlanto-axial joints.....	196
The articular surfaces of the atlanto-occipital joint.....	198
Rotation in the atlanto-occipital joints .....	200
Lateral flexion and flexion-extension in the atlanto-occipital joint .....	202
The suboccipital ligaments of the spine .....	204
The suboccipital ligaments .....	206
The suboccipital ligaments (continued).....	208
The structure of a typical cervical vertebra.....	210
The ligaments of the lower cervical spine .....	212
Flexion-extension in the lower cervical spine .....	214
The movements at the uncovertebral joints .....	216
Orientation of the articular facets: the composite axis of lateral flexion-rotation .....	218
Combined lateral flexion-rotation in the lower cervical spine .....	220
Geometric illustration of the movement of lateral flexion-rotation .....	222
Mechanical model of the cervical spine.....	224
Movements of lateral flexion-rotation in the mechanical model.....	226
Comparison of the model and the cervical spine during movements of lateral flexion-rotation.....	228
Compensations in the suboccipital spine.....	230
Ranges of movements of the cervical spine .....	232
Balancing the head on the cervical spine .....	234
Structure and function of the sternocleidomastoid muscle .....	236
The prevertebral muscles: the longus colli.....	238
The prevertebral muscles: the longus capitis, the rectus capitis anterior and the rectus capitis lateralis.....	240
The prevertebral muscles: the scalene muscles .....	242
Global view of the prevertebral muscles .....	244
Flexion of the head and of the neck .....	246
The posterior neck muscles .....	248
The suboccipital muscles.....	250
Actions of the suboccipital muscles: lateral flexion and extension .....	252
Rotatory action of the suboccipital muscles.....	254
The posterior neck muscles: the first and fourth planes .....	256
The posterior neck muscles: the second plane .....	258
The posterior neck muscles: the third plane.....	260
Extension of the cervical spine by the posterior neck muscles.....	262
Synergism-antagonism of the prevertebral muscles and the sternocleidomastoid muscle .....	264
The ranges of movements of the cervical spine taken as a whole .....	266
Relationship of the neuraxis to the cervical spine.....	268

Relationship of the cervical nerve roots to the spine .....	270
The vertebral artery and the neck blood vessels .....	272
The importance of the vertebral pedicle: its role in the physiology and pathology of the spine.....	274

**Chapter 6 – THE HEAD .....** **276**

The cranium .....	278
The cranial sutures .....	280
The cranium and the face .....	282
The visual field and localization of sounds.....	284
The facial muscles .....	286
The movements of the lips.....	288
Lip movements (continued) .....	290
Facial expressions .....	292
The temporomandibular joints.....	294
The structure of the temporomandibular joint.....	296
The movements of the temporomandibular joint .....	298
Muscles of jaw closure .....	300
The muscles involved in jaw opening.....	302
The role of muscles in mandibular movements.....	304
The eyeball: a perfect enarthrosis.....	306
The ocular muscles in horizontal and vertical eye movements.....	308
The ocular muscles in eye convergence .....	310
The mechanical problem of the oblique glance.....	312
The oblique glance: the role of the oblique muscles and of the trochlear nerve .....	314

**APPENDICES.....** **317**

Mass, weight and barycentres.....	318
How to localise barycentres.....	320
Joint hypermobility .....	322
The law of parsimony: Occam’s razor .....	324
Bibliography.....	326
Index .....	327
Mechanical model of the cervical spine .....	335