

Contents

1. Early Evolution of the Foot	1
From Fins to Feet	1
Foot Diversity	4
Primate Feet	10
Vertical Clinging and Leaping	11
Suspension	12
Quadrupedalism	13
Bipedalism	14
Pads, Claws and Nails	15
Ancient Primates	16
Miocene Primates	18
References	22
2. Recent Evolution of the Human Foot	27
Hominin Evolution: An Overview	27
Terminology	27
Defining Hominins	28
Organising the Hominin Fossil Record	30
Evolution of Bipedalism within the Hominin Clade	34
Scenarios Favouring Selection for Bipedalism	36
Review of Individual Hominin Fossil Taxa	37
Primitive Hominins	38
Archaic Hominins	40
Megadont Archaic Hominins	52
Archaic Homo	56
Anatomically Modern Homo	69
Summary	70
References	71
3. How the Foot Works	81
Structure	81
Function	83
The Subtalar Joint	87
The Midtarsal or Transverse Tarsal Joint	88
How the Longitudinal Arch Works	89
Flat Feet	92
Vibrations in the Human Skeleton	92
Shock Absorption	94
The Importance of the Toes in Walking	95
The Sole	96

Summary	99
References	99
4. The Development of Gait	103
Prenatal Movements	104
The Infant	104
Newborn Stepping	104
Gait	107
Running	109
Centre of Gravity	109
Changes in the Limbs	110
The Foot	111
Common Variations Which Disappear with Growth	113
Mechanical Work in Walking	113
Bound Feet	114
Summary	115
References	116
5. The Measurement of Footprints (Pedobarography)	117
Force Plate	119
Pressure Transducers	120
Modified Force Plates	121
Laboratory Practice	126
Loading of the Normal Foot	128
Assessment of Foot-pressure Patterns from a Pedobarograph Using Techniques of Imaging Analysis	129
The Effect of High and Low Heels	130
The Effect of Obesity on Patterns of Foot Pressure	130
Shear Forces	131
Plantar Pressures in the Great Apes	132
Summary	134
References	134
6. The Foot in Action	137
The Armless or the Foot as a Hand	137
Footedness	137
Running	138
Ballet Dancing	144
The Foot in Microgravity	147
Tightrope Walking	147
Firewalking	150
Kicking	151
Swimming	153
References	154

7. Amputations and Prostheses	157
Degree of Loss: Simple to Radical	157
Amputation of the Great Toe (Hallux)	157
Amputation of All Toes	158
Partial Amputations of the Foot	158
Disarticulation at the Ankle (Syme's Amputation)	159
Biomechanics of Midfoot and (Syme's Amputation)	160
Calcanectomy	161
Prosthetic Feet	161
Energy Return Feet	167
Phantom Limb	170
References	171
Index	175