

## **Part I Bone and Basics Sciences**

|                                                                                         |     |
|-----------------------------------------------------------------------------------------|-----|
| <b>1 Anatomy of the Skeletal System</b> .....                                           | 3   |
| Rauf Yousaf                                                                             |     |
| <b>2 Physiology of Bone Formation, Remodeling, and Metabolism</b> .....                 | 29  |
| Usha Kini and B.N. Nandeesh                                                             |     |
| <b>3 Pathophysiology of Bone Metastases</b> .....                                       | 59  |
| Hans Van der Wall, Barry Elison, Clayton Frater, Warwick Bruce, and Stephen Clarke      |     |
| <b>4 Skeletal Tracer Kinetics: Science and Practice</b> .....                           | 85  |
| Glen M. Blake, Michelle Frost, Amelia E.B. Moore, Muhammad Siddique, and Ignac Fogelman |     |
| <b>5 Biochemical Markers in Bone Diseases</b> .....                                     | 109 |
| Geeta Hampson                                                                           |     |

## **Part II Bone and Conventional Radiology**

|                                                                                                            |     |
|------------------------------------------------------------------------------------------------------------|-----|
| <b>6 Basics of CT</b> .....                                                                                | 135 |
| Kathryn L. Adamson and Bruce R. Walmsley                                                                   |     |
| <b>7 Basic Principles of MRI</b> .....                                                                     | 149 |
| Philippa Tyler and Sajid Butt                                                                              |     |
| <b>8 Radiological Imaging in Metastatic Bone Disease and Myeloma: Current Status and Limitations</b> ..... | 173 |
| Zaid Viney                                                                                                 |     |
| <b>9 Radiological Imaging of Primary Benign and Malignant Bone Tumours</b> .....                           | 195 |
| Sajid Hasan Butt, Thillainayagam Muthukumar, and Philippa Tyler                                            |     |
| <b>10 Radiological Imaging in Trauma and Sports Injuries: Current Status and Limitations</b> .....         | 259 |
| Hans Van der Wall, Robert Loneragan, Louise Wong, Ahmed M. Mayat, and John K. Pereira                      |     |

|                                                                                        |            |
|----------------------------------------------------------------------------------------|------------|
| <b>11 Radiological Imaging in Arthritis: Current Status and Limitations . . . . .</b>  | <b>307</b> |
| Hans Van der Wall, Robert Loneragan, Louise Wong,<br>Les Barnsley, and Siri Kannangara |            |

### **Part III Radionuclide Bone Imaging: Science and Practice**

|                                                                                     |            |
|-------------------------------------------------------------------------------------|------------|
| <b>12 Basic Principles of SPECT and PET Imaging . . . . .</b>                       | <b>345</b> |
| Lefteris Livieratos                                                                 |            |
| <b>13 Technical Challenges and Pitfalls in Hybrid Imaging . . . . .</b>             | <b>361</b> |
| Lefteris Livieratos                                                                 |            |
| <b>14 Bone Scintigraphy: SPECT and PET Tracers . . . . .</b>                        | <b>369</b> |
| James R. Ballinger                                                                  |            |
| <b>15 Bone Scintigraphy: Patterns, Variants, Limitations and Artefacts. . . . .</b> | <b>377</b> |
| Malavika Nathan, Gopinath Gnanasegaran,<br>Kathryn Adamson, and Ignac Fogelman      |            |
| <b>16 Soft Tissue Uptake in Radionuclide Bone Scintigraphy . . . . .</b>            | <b>409</b> |
| Fahim Ul Hassan, Malavika Nathan,<br>Gopinath Gnanasegaran, and Ignac Fogelman      |            |

### **Part IV Bone Scintigraphy in Benign Bone Disease**

|                                                                                         |            |
|-----------------------------------------------------------------------------------------|------------|
| <b>17 Bone Scintigraphy in Metabolic Bone Disease . . . . .</b>                         | <b>435</b> |
| Gary J.R. Cook, Gopinath Gnanasegaran, and Sue C. Chua                                  |            |
| <b>18 Bone Scintigraphy in Arthritis . . . . .</b>                                      | <b>445</b> |
| Hans Van der Wall, Michael Magee, Manuel Cusi,<br>Warwick Bruce, and Siri Kannangara    |            |
| <b>19 Bone Scintigraphy in Trauma and Sport Injuries . . . . .</b>                      | <b>481</b> |
| Hans Van der Wall, Manuel Cusi, Barry Elison,<br>Clayton Frater, and Warwick Bruce      |            |
| <b>20 SPECT and PET in the Assessment of Bone Infections . . . . .</b>                  | <b>523</b> |
| Christopher J. Palestro                                                                 |            |
| <b>21 Nuclear Medicine in the Assessment of Painful Joint Prostheses . . . . .</b>      | <b>561</b> |
| Erik Vegt, Wim Schreurs, Martin Gotthardt, and Wim J.G. Oyen                            |            |
| <b>22 Radionuclide Bone Imaging in Skeletal Tuberculosis . . . . .</b>                  | <b>583</b> |
| Rakesh Kumar, Varun Shandal, Shamim Ahmed Shamim,<br>and Arun Malhotra                  |            |
| <b>23 Hybrid Imaging in the Management of Complex Foot and Ankle Problems . . . . .</b> | <b>597</b> |
| Hosahalli K. Mohan, Sanjay Vijayanathan,<br>and Ignac Fogelman                          |            |

|                                                                                              |     |
|----------------------------------------------------------------------------------------------|-----|
| <b>24 Wrist Registration: Conventional Radionuclide and SPECT/CT Imaging</b> . . . . .       | 609 |
| Gopinath Gnanasegaran, Peter Jackson, Bo Povlsen,<br>Sanjay Vijayanathan, and Ignac Fogelman |     |

## **Part V Bone Scintigraphy in Bone Metastases**

|                                                                                                                                                |     |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>25 Prostate Cancer: Role of Conventional Radionuclide and Hybrid Bone Imaging</b> . . . . .                                                 | 635 |
| Mohsen Beheshti and Werner Langsteiger                                                                                                         |     |
| <b>26 Breast Cancer: Role of Planar, SPECT and PET in Imaging Bone Metastases</b> . . . . .                                                    | 661 |
| Michael S. Hofman and Rodney J. Hicks                                                                                                          |     |
| <b>27 Lung, Thyroid, Renal Cancer, Myeloma and Neuroendocrine Cancers: Role of Planar, SPECT and PET in Imaging Bone Metastases.</b> . . . . . | 691 |
| Sue S.C. Chua, Gopinath Gnanasegaran, and Gary J.R. Cook                                                                                       |     |
| <b>28 Conventional Nuclear Medicine and Hybrid Imaging in Monitoring the Treatment of Skeletal Malignancy</b> . . . . .                        | 717 |
| Suat-Jin Lu, Gopinath Gnanasegaran, Ignac Fogelman,<br>and Gary J.R. Cook                                                                      |     |
| <b>29 Potential Applications and Limitations of SPECT-CT in Classifying Bone Lesions in Patients with Cancer</b> . . . . .                     | 735 |
| Tara Barwick, Gopinath Gnanasegaran, and Ignac Fogelman                                                                                        |     |
| <b>30 Primary Bone and Soft Tissue Tumours: Role of SPECT.</b> . . . . .                                                                       | 751 |
| Shalini A. Amukotuwa and Stephen M. Schlicht                                                                                                   |     |
| <b>31 Primary Bone and Soft Tissue Tumours: Role of 18FDG PET</b> . . . . .                                                                    | 777 |
| Gary J.R. Cook, Gopinath Gnanasegaran, and Sue S.C. Chua                                                                                       |     |
| <b>32 Radioisotopes in the Treatment of Bone Metastases</b> . . . . .                                                                          | 787 |
| H. Bulstrode and J. Buscombe                                                                                                                   |     |
| <b>33 Radionuclide Bone Marrow Imaging in Cancer Patients</b> . . . . .                                                                        | 795 |
| Sandip Basu, Ayse Mavi, and Abass Alavi                                                                                                        |     |

## **Part VI Paediatric Bone Scintigraphy**

|                                                                           |     |
|---------------------------------------------------------------------------|-----|
| <b>34 Pediatric Bone Scintigraphy: Variants and Limitations</b> . . . . . | 815 |
| Helen R. Nadel                                                            |     |
| <b>35 Paediatric Bone Scintigraphy: Benign Bone Disease.</b> . . . . .    | 827 |
| Kevin London and Robert Howman-Giles                                      |     |

|           |                                                                |            |
|-----------|----------------------------------------------------------------|------------|
| <b>36</b> | <b>Paediatric Bone Scintigraphy: Bone Metastases</b> . . . . . | <b>855</b> |
|           | Robert Howman-Giles and Kevin London                           |            |
| <b>37</b> | <b>Hybrid Bone Imaging in Pediatrics</b> . . . . .             | <b>879</b> |
|           | Helen R. Nadel                                                 |            |

## **Part VII Bone and Miscellaneous Scenarios**

|           |                                                                                        |             |
|-----------|----------------------------------------------------------------------------------------|-------------|
| <b>38</b> | <b>Bone Densitometry: Science and Practice</b> . . . . .                               | <b>893</b>  |
|           | Glen M. Blake and Ignac Fogelman                                                       |             |
| <b>39</b> | <b>Radiosynovectomy: Science and Practice</b> . . . . .                                | <b>915</b>  |
|           | Peter Schneider                                                                        |             |
| <b>40</b> | <b>Radiosynoviorthesis (Radiation Synovectomy)<br/>of Knee Joint</b> . . . . .         | <b>935</b>  |
|           | Gynter Mödder                                                                          |             |
| <b>41</b> | <b>Common Orthopaedic Presentations</b> . . . . .                                      | <b>953</b>  |
|           | Sujith Konan, Sugama Chicklore, and Fares S. Haddad                                    |             |
| <b>42</b> | <b>Radiological Imaging in Infection: Current<br/>Status and Limitations</b> . . . . . | <b>983</b>  |
|           | Angus O'Connor                                                                         |             |
|           | <b>Index</b> . . . . .                                                                 | <b>1023</b> |