

# Contents

Preface	ix
Acknowledgments	xi
Contributors	xiii
<b>SECTION 1: Introductory Materials</b>	<b>1</b>
<b>1 Radiopharmaceuticals, Nuclear Medicine, and Nuclear Pharmacy: An Overview</b> <i>Kara Weatherman, Richard Kowalsky</i>	3
<b>2 Early History of Nuclear Pharmacy</b> <i>Stanley Shaw, Clyde Cole, Kara Weatherman, Richard Kowalsky</i>	19
<b>SECTION 2: Physics and Radiation Safety</b>	<b>39</b>
<b>3 Principles of Radioactivity</b> <i>Kara Weatherman, Richard Kowalsky</i>	41
<b>4 Radionuclide Production</b> <i>Kara Weatherman, Richard Kowalsky</i>	61
<b>5 Interactions of Radiation With Matter</b> <i>Jessica Comstock, Kara Weatherman, Richard Kowalsky</i>	81
<b>6 Radiation Detection and Instrumentation</b> <i>Kara Weatherman, Richard Kowalsky, Joseph C. Hung</i>	95

<b>7</b>	<b>Radiation Safety</b>	139
	<i>Jessica Comstock, Kara Weatherman, Richard Kowalsky</i>	
<b>8</b>	<b>Radiation Biology and Risk</b>	173
	<i>Stanley M. Shaw, Kara Weatherman, Richard Kowalsky</i>	
<b>SECTION 3: Radiopharmaceutical Chemistry</b>		<b>205</b>
<b>9</b>	<b>Radiopharmaceutical Chemistry: General Topics</b>	207
	<i>Ross Weatherman, Kara Weatherman, Richard Kowalsky</i>	
<b>10</b>	<b>Radiopharmaceutical Chemistry: Technetium Agents</b>	231
	<i>Ross Weatherman, Kara Weatherman, Richard Kowalsky</i>	
<b>11</b>	<b>Radiopharmaceutical Chemistry: Non-technetium Agents</b>	269
	<i>Ross Weatherman, Kara Weatherman, Richard Kowalsky</i>	
<b>12</b>	<b>Radiopharmaceutical Chemistry: PET Agents</b>	295
	<i>Ashley Mishoe, Steve Zigler</i>	
<b>SECTION 4: Radiopharmacy Practice Considerations</b>		<b>325</b>
<b>13</b>	<b>The Nuclear Pharmacy</b>	327
	<i>Kristina M. Wittstrom</i>	
<b>14</b>	<b>Quality Control of Radiopharmaceuticals</b>	345
	<i>Joseph C. Hung</i>	
<b>15</b>	<b>Radiopharmaceutical Preparation Problems</b>	381
	<i>James A. Ponto</i>	
<b>16</b>	<b>Radiolabeled Blood Products</b>	391
	<i>Wendy Galbraith, Kara Weatherman, Richard Kowalsky</i>	
<b>17</b>	<b>PET Radiopharmaceutical Manufacturing and Distribution</b>	407
	<i>Ashley Mishoe, Steven Zigler</i>	

<b>SECTION 5: Regulatory Considerations</b>	<b>437</b>
<b>18</b> Licensing and Regulatory Control – Radioactivity and Radioactive Materials <i>Neil A. Petry</i>	439
<b>19</b> Licensing and Regulatory Control – Radiopharmaceutical Oversight <i>Neil A. Petry</i>	459
<b>20</b> Mechanisms of Localization of Radiopharmaceuticals <i>James A. Ponto</i>	489
<b>SECTION 6: Clinical Applications</b>	<b>513</b>
<b>21</b> Pregnancy, Pediatric and Breastfeeding Considerations <i>James A. Ponto</i>	515
<b>22</b> Adverse Reactions to Radiopharmaceuticals <i>James A. Ponto</i>	537
<b>23</b> Nonradioactive Pharmaceuticals Used in Nuclear Medicine <i>Vivian Loveless, Kara Weatherman, Richard Kowalsky</i>	545
<b>24</b> Brain <i>Richmond Delacruz, Kara Weatherman, Richard Kowalsky</i>	575
<b>25</b> Thyroid <i>Dao Le, Kara Weatherman, Richard Kowalsky</i>	617
<b>26</b> Heart <i>Eric Smith, Kara Weatherman, Richard Kowalsky</i>	637
<b>27</b> Lung <i>Kara Weatherman, Richard Kowalsky</i>	679
<b>28</b> Liver, Spleen, and Gastrointestinal System <i>Wendy Galbraith, Dale Brannon, Kara Weatherman, Richard Kowalsky</i>	705

<b>29</b> Kidney	749
<i>Wendy Galbraith, Dale Brannon, Kara Weatherman, Richard Kowalsky</i>	
<b>30</b> Bone	779
<i>Richmond Delacruz, Kara Weatherman, Richard Kowalsky</i>	
<b>31</b> Total-Body SPECT and Related Procedures	799
<i>Eric Smith, Kara Weatherman, Richard Kowalsky</i>	
<b>32</b> PET Whole Body Imaging Procedures	831
<i>Leslie Flynt, Kara Weatherman, Richard Kowalsky</i>	
<b>33</b> Therapeutic Applications of Radioactive Agents	877
<i>George Hinkle, Kara Weatherman, Richard Kowalsky</i>	
Index	897