

# Contents

<b>Chapter 1</b>	<b>The Breakfasts of Superheroes</b>	<b>1</b>
	<i>Mark Lorch</i>	
1.1	Introduction	1
1.2	Food for All	2
1.3	A Super Side-Effect	2
1.4	Fast Food and Flash Diets	4
1.5	Feeding the Flames	6
1.6	Spider-Man's Breakfast	7
	References	13
<b>Chapter 2</b>	<b>The Evolution of Superpowers</b>	<b>15</b>
	<i>Louise K. Gentle</i>	
2.1	Introduction	15
2.2	Natural Selection	16
2.3	Genetics	17
2.4	Non-Selective Evolution	20
2.5	Superpowers	23
2.5.1	Vision	23
2.5.2	Hearing	25
2.5.3	Electric and Magnetic Senses	26
2.5.4	Shapeshifting	27

---

The Secret Science of Superheroes

Edited by Mark Lorch and Andy Miah

© The Royal Society of Chemistry, 2017

Published by the Royal Society of Chemistry, [www.rsc.org](http://www.rsc.org)

	2.5.5 Absorbing Powers	28
	2.5.6 Chemical Weapons	29
	2.6 Conclusions	30
	References	30
<b>Chapter 3</b>	<b>The Hallmarks of Hulk</b>	<b>33</b>
	<i>Isabel Pires</i>	
	3.1 Introduction	33
	3.2 All About the Hulk	34
	3.3 We Have to Talk About Cancer: A Note by the Author	34
	3.4 In the Beginning There Was Mutation!	37
	3.5 Growth Without End	39
	3.6 Hungry Gasping Cells!	41
	3.7 Changing Back to Bruce Banner: The Power of Genetic Switches	44
	3.8 It is Easy Being Green!	45
	3.9 Some Final Thoughts ...	47
	References	47
<b>Chapter 4</b>	<b>Supervillainy 101: Choosing Between a Zombie, Vampire or Werewolf Apocalypse</b>	<b>49</b>
	<i>J. Verran and M. Crossley</i>	
	4.1 An Introduction to Epidemiology	49
	4.2 The Lifecycle of Disease	55
	4.3 Disease Transmission	57
	4.4 Emerging Issues and Disease Evolution	60
	4.5 Prevention and Control	62
	4.6 Conclusions	65
	References	66
<b>Chapter 5</b>	<b>How to Build a Super Soldier</b>	<b>68</b>
	<i>Akshat Rathi</i>	
	5.1 Introduction	68
	5.2 The Story of the Star-Spangled Avenger	70
	5.3 How to Create Super Powers in Mere Mortals	70
	5.3.1 Seeing More than Others	70
	5.3.2 Catch Me If You Can	72

	5.3.3 Super Size Me	73
	5.3.4 Keep up with Me	76
	5.3.5 Show Me the Muscle Power	76
	5.3.6 No Shut Eye	78
	5.3.7 By Mere Thought	79
	References	80
<b>Chapter 6</b>	<b>The Real World Super Metal</b>	<b>82</b>
	<i>Paul R. Coxon</i>	
	6.1 Introduction	82
	6.2 Jon Osterman: Where Is He from and an Accident	85
	6.3 Lithium: A History	85
	6.4 What Are Lithium Batteries? How Do They Work?	90
	6.5 How Do We Get Lithium Today? Top Lithium-Producing Countries	91
	References	92
<b>Chapter 7</b>	<b>Is It a Ceramic? Is It Graphene? No It's Vibranium!</b>	<b>93</b>
	<i>Mark J. Whiting</i>	
	7.1 Supermaterials	93
	7.2 Observing Vibranium	94
	7.3 Stronger Than Steel	96
	7.4 As Dense as Aluminium	101
	7.5 Elements: New and Old	101
	7.6 Is It a Composite?	104
	7.7 High-Entropy Alloys	106
	7.8 Bad Vibes	107
	7.9 Concluding Remarks	108
	References	109
<b>Chapter 8</b>	<b>The Science of Super Suits</b>	<b>111</b>
	<i>Suze Kundu</i>	
	8.1 Introduction	111
	8.2 Bat Fashion	112
	8.2.1 The Bat Gloves	112

	8.2.2 The Bat Boots	115
	8.2.3 The Batsuit	116
	8.2.4 The Bat Hood	119
	8.2.5 The Bat Cape	119
	8.2.6 The Bat Supersuit	121
	8.3 Iron Man	122
	8.3.1 Not-Iron Man	122
	8.3.2 Insulating a Superhero	124
	8.3.3 How to Pick a Suit	125
	8.4 The Reality of Supersuits	126
	References	128
<b>Chapter 9</b>	<b>Why Doesn't the Invisible Woman Bump Into Things?</b>	<b>130</b>
	<i>Kat Day</i>	
	Acknowledgements	138
	References	138
<b>Chapter 10</b>	<b>The Flash: The Fastest Man on Fire</b>	<b>141</b>
	<i>Brian Mackenwells</i>	
	10.1 Just How Fast is The Flash?	141
	10.2 Crashing and Burning	142
	10.3 Beat the Heat	143
	References	148
<b>Chapter 11</b>	<b>You've Got to Learn to Be More Flexible: The Mechanics of Marvellous</b>	<b>149</b>
	<i>David Jesson</i>	
	11.1 Introduction	149
	11.2 Naturally Flexible	150
	11.3 Mechanical Characterisation	152
	11.4 How to Avoid Whiplash in Your (Super) 'Quick Change Act'	156
	11.5 The Mechanics of Marvelous: Part 1 – Just a Moment	157
	11.6 The Mechanics of Marvellous: Part 2 – A Moment's Deflection	161

	11.7 Concluding Remarks	163
	References	165
<b>Chapter 12</b>	<b>Big Data, Big Heroes and Bad Computers</b>	<b>167</b>
	<i>Rob Miles</i>	
	12.1 Introduction	167
	12.2 Will Artificial Intelligence Enslave Us all?	168
	12.3 Computers and Programs	168
	12.4 Artificial Intelligence – The Rise of the ‘Computer Brain’	169
	12.5 Speech Recognition as an Application of Artificial Intelligence	170
	12.6 How Your Brain Works	170
	12.7 Building Electronic Brains	171
	12.8 The Need for Speed	171
	12.9 Broken Thoughts	172
	12.10 Building Understanding into Machines – How Do We Make ‘Jarvis’?	173
	12.11 How Do We Make a Human Computer?	174
	12.12 Building Understanding	175
	12.13 When Good Software Goes Bad	175
	12.14 Giving Software an Agenda	176
	12.15 How Can You Use Computers to Take Over the World?	177
	12.16 Big Data and Reading the Mind of Humanity	177
	12.17 Turning Our Devices Against Us	179
	12.18 The Internet of Bad Things	179
	References	182
<b>Chapter 13</b>	<b>The Wonder-ous Truth: The Workings of Wonder Woman’s Lasso</b>	<b>183</b>
	<i>Felicity Heathcote-Márcz</i>	
	13.1 What is the Lasso of Truth?	183
	13.2 The Woman Behind the Rope	184
	13.3 Truth and the Lasso	187

13.4	Submit or Lasso!	188
13.5	When the Truth Is Not Admissible in Court	190
13.6	Breaking the Lasso	190
13.7	How Might a Real-Life Lasso of Truth Work?	191
13.8	Nectar of Truth	191
13.9	Our 'Patch-Lasso'	192
13.10	The Lasso and Death	194
	References	195
<b>Chapter 14</b>	<b>Super Frequently Asked Questions</b>	<b>197</b>
	<i>Karl Byrne</i>	
14.1	Introduction	197
14.2	Is It Possible to Climb up a Wall Like Spider-Man?	198
14.3	If You Cut Wolverine in Half, Would He Grow Back as Two Wolverines?	199
14.4	Is There a Link Between Superpowers and Having an Alliterative Name?	201
14.5	Is It Possible for a Normal Person to Become Batgirl?	202
14.6	Why Are so Many Superheroes and Villains Scientists?	203
14.7	How Does Superman Have His Haircut?	204
14.8	Why Doesn't Magneto Ever Need a Towel?	205
14.9	Why Doesn't Frozone's Hand Freeze?	206
14.10	Conclusions	207
	References	207
	<b>Subject Index</b>	<b>209</b>