

Contents

Foreword	<i>page</i> xvii
Preface	xix
Acknowledgements	xxi
Gene Names	xxiii
1 Painting a Clear Picture	1
What is Cancer?	2
What Causes Cancer?	3
Are All Cancers Equally Bad?	6
Malignant versus Benign	6
Warts and All	8
Why Do Some Children Get Cancer?	9
How Many Different Cancers Are There?	10
Is There A Difference Between Men and Women?	11
Can You Catch Cancer from Someone Else?	11
Do Metastases Metastasize?	12
How Does Cancer Kill?	13
Can Plants Get Cancer?	13
Can We Cure Cancer?	14
Can Cancer be Modelled?	14
Admiring the Picture	16
2 Ancient History	19
The Greeks Had a Word for It	20
Chinese Science	22
The Coming of Science	23

Scientific Observation and the Practice of Medicine	24
The Advance of Surgery	26
The Coming of Cell Biology	29
3 Counting Cancer	35
The Big Picture	35
The Global Picture	36
The UK	39
What's the Cause?	40
The USA	41
Counting the Cost of Cancer	42
Have We Made Any Progress?	45
Not a Pretty Picture	47
4 From DNA to Protein	48
Atoms and Molecules	49
Our Genetic Material	49
The Double Helix	50
Deciphering the Code	52
The Central Dogma	53
Coding Power	54
Shape Is All	55
Controlling RNA Expression	55
The Road to Sequencing DNA	56
Genetic Maps	57
Assembling the Toolkit	58
The Sequencing of DNA	60
5 What Is a Cell?	64
Talking to Cells	66
Steroid Hormones	69
Je Pense, Donc Je Suis un Blancmange	70
Perturbing Cellular Balance	70
The Cycle That Makes Two Cells from One	71
Major Kinase Targets in the Cell Cycle Clock	72

6 Mutations	76
The First Experiment	78
The Age of Oncogenes	80
The First Human Oncogene	80
Making Mutant Proteins	81
A Single Base Change: Minimal Mutations in Molecular Switches – RAS	82
Missing Bits: Deaf to the World – EGFR	84
Patching Proteins: Chromosome Translocations Make Novel Proteins	86
Revelations from Leukaemia	86
Replacing the Controller	88
Multiplying Genes	88
Genes Go Missing: <i>RB1</i>	90
Tumour Protein 53	92
The Double Life of p53	93
Exploding DNA	93
Micro RNAs	95
Genetic Variations	96
Viruses	97
DNA Viruses	97
RNA Viruses	98
The Pan-Cancer Project	98
Playing Games	99
The Genomic Cancer Message	101
7 Causes of Cancer That Can be Controlled	103
And Another Thing	103
Controversial or What . . . ?	105
Alcohol and Cancer	105
Diet	107
Obesity	118
Tea (and Coffee)	128
Tobacco	129

8 Causes of Cancer That Are Difficult to Control, Accidents ... and Other Things	134
Infection	134
Radiation	135
Abnormal Exposures	137
Ultraviolet Radiation	141
Low-Frequency Magnetic Fields	142
High-Frequency Magnetic Fields: Mobile Phones	143
Radon	144
Stress	144
Where Do We Stand and What Can We Do?	145
9 Treating Cancer by Chemotherapy	147
Sound Familiar?	148
Screening	148
Mammography	149
Diagnosis, Staging, Grading and Monitoring	151
Imaging	151
Chemotherapy for Cancer	154
A New Era	155
Inhibiting Proliferation	156
Selective Oestrogen Receptor Modulators	158
Oncoproteins: Growth Factors, Receptors, Signal Pathways	160
Kinase Inhibitors	161
Metabolism	163
Apoptosis	164
Angiogenesis	165
Metastasis	166
Controlling Metastatic Take-Off	168
Breaking the Barrier	168
Shooting the Messenger	169
Infection by Oncogenic Viruses	170
Therapeutic Vaccines	171
Tumour Agnostic Drugs	171
The Tumour Microenvironment	172
A Serious Case of Corruption	172

10 The Road to Utopia?	174
Cancer Therapy: Immunotherapy	174
Checkpoint Inhibitors	175
Gene Therapy	177
What Is CRISPR-Cas9?	178
Liquid Biopsy	181
Breath Biopsy	182
Sponge on a String	182
Epigenetics	184
The Dutch Famine	185
Finding Cancer by Epigenetics	185
Epigenetic Drugs	186
Nano-oncology	187
Roboclot	187
3D Tumour Printing	190
Targeted Alpha-Particle Therapy	190
Synthetic Lethality	190
Personal versus Impersonal Medicine	192
The Next Genomic Era	193
Cancer Mosaics	195
Breast Cancer Mutational Signatures	196
The Breast Tumour Microenvironment	197
Contemplating the Portrait	197
Concluding Remarks	200
Summary of Common Misunderstandings	202
References	204
Figure Credits	215
Index	217

Colour plates can be found between pages 200 and 201.