

Preamble	page xv
Preface	xvii
Acknowledgements	xix

PART I APPROACHES AND METHODS 1

1 **The History and Emergence of Ecotoxicology as a Science 3**

<i>Pamela M. Welbourn and Peter V. Hodson</i>	
Learning Objectives	3
1.1 The Science of Ecotoxicology	3
1.2 Historical Landmarks in the Development of Ecotoxicology	7
1.2.1 <i>Silent Spring</i> and Pesticides	7
1.2.2 Mercury	10
1.2.3 Acidification	10
1.2.4 Industrial Waste Disposal and Brownfields	11
1.2.5 Oil Spills	12
1.2.6 <i>Our Stolen Future</i> and Endocrine Disruptors	12
1.3 The Emergence of the Science of Ecotoxicology	13
1.4 The Turning Point and Formal Regulation of Toxic Substances	15
1.5 Solutions That May Lead to New Problems	16
1.6 Conclusions	17
Summary	18
Review Questions and Exercises	18
Abbreviations	19
References	19

2 **Measuring Toxicity 23**

<i>Peter V. Hodson and David A. Wright</i>	
Learning Objectives	23
2.1 The Basics of Environmental Toxicology	23
2.1.1 Concepts and Definitions	24
2.1.1.1 What Is Toxicity?	24
2.1.1.2 Chemical Structure vs Toxicity	24

2.1.1.3	Nutrients vs Toxicants	25
2.1.1.4	Expressions of Toxicity	26
2.2	Designing a Toxicity Test: What Is the Question?	28
2.2.1	Test Organisms	29
2.2.1.1	Laboratory Cultures of Test Organisms	30
2.2.1.2	Life Stages Tested and Responses Measured	31
2.2.2	Test Media and Routes of Exposure	32
2.2.3	Exposure Gradients	33
2.2.4	Exposure Time	33
2.2.5	Control Treatments	36
2.2.6	Other Test Conditions That Affect Measured Toxicity	36
2.2.7	Characterizing Test Conditions and Chemical Exposures	38
2.2.8	Complexities in Toxicity Testing	39
2.2.8.1	Toxicity Tests for Sparingly Soluble Compounds	39
2.2.8.2	Sediment and Soil Toxicity Tests	39
2.2.8.3	Standard vs ‘Realistic’ Toxicity Tests	41
2.2.8.4	Surrogate Species for Routine Testing	41
2.3	Statistics for Toxicity Tests	42
2.3.1	Regression Analyses for Computing Toxicity	42
2.3.1.1	Data Types and Transformations	43
2.3.1.2	Control Data	44
2.3.2	Hypothesis Testing: Multiple Regression Analyses	44
2.3.3	Predictive Toxicology: Single Compounds	45
2.3.3.1	Acute to Chronic Ratios (ACRs)	46
2.3.3.2	Species Sensitivity Distributions (SSDs)	47
2.3.3.3	Quantitative Structure–Activity Relationships (QSARs)	47
2.3.4	Predictive Toxicology: Mixtures	48
2.3.4.1	Toxic Unit (TU) Model	48
2.3.4.2	Toxic Equivalent Factor (TEF) Model	49
2.3.4.3	Target Lipid Model	49
2.3.4.4	Metal Mixtures	50
2.3.4.5	Dissecting Complex Mixtures	51
2.3.5	Moving Away from Traditional Toxicity Tests	52
	Summary	54
	Review Questions and Exercises	54
	Abbreviations	55
	References	56