

CONTENTS

Introduction	1
1. Flexibility of Macromolecules and Their Physical Properties	7
1.1. Methods of Studying the Flexibility of Macromolecules	7
1.2. Early Studies on the Conformational Statistics of Polymer Chains . .	16
References	24
2. Internal Rotation and Rotational Isomerism	29
2.1. Brief Survey of Experimental Data	29
2.2. Theories of the Restricting Potential	33
2.3. Calculation of the Restricting Potential in the Simplest Molecules . .	38
References	46
3. Conformations of Macromolecules and Mechanism of Their Flexibility . .	49
3.1. Crystal Structures of Typical Macromolecules	49
3.2. Crystal Structures of Polymers and Intramolecular Interactions . .	72
3.3. Short-Range Order in Free Macromolecules and the Mechanism of Their Flexibility	84
References	101
4. Statistics of One-Dimensional Cooperative Systems	107
4.1. Matrix Method of the One-Dimensional Ising Model	107
4.2. Ising Model and Markoff Chains	119
References	127
5. Theory of the Dimensions and Dipole Moments of Macromolecules: General Methods	129
5.1. Methods of Averaging Vector Properties of Macromolecules	129
5.2. Distribution Functions for the Vector Properties of Macromolecules . .	139
References	151
6. Theory of the Dimensions and Dipole Moments of Macromolecules: Equations for Real Chains	155
6.1. Dimensions and Dipole Moments of Macromolecules with Independent Conformations of Neighboring Monomer Units	155
6.2. Dimensions and Dipole Moments of Macromolecules with Correlated Conformations of Neighboring Monomer Units	166
References	180
7. Comparison of the Theory with Experiment and Conformations of Typical Macromolecules in Solution	183
7.1. Conformations of Isotactic and Syndiotactic Macromolecules	183
7.2. Conformations of Macromolecules with Symmetric Side Groups . . .	198
References	205
8. Conformations of Macromolecules and Mechanical Properties of Polymers	209
8.1. Theory of Stretching of Macromolecules	209
8.2. Rotational Isomerization of Macromolecules during Stretching and Energetic Effects in Stretched Polymers in the Bulk State	214

8.3. Interpretation of Thermomechanical Curves for Real Types of Polymers..	223
8.4. Other Methods of Studying Rotational Isomerization of Macromolecules during Stretching	230
8.5. Concluding Remarks on the Conformations of Macromolecules Which Do Not Have a Secondary Structure	236
References	239
9. Theory of Conformational Transitions in Polypeptide Chains.	243
9.1. Helix-Coil Transitions in Molecules of Biopolymers	243
9.2. Conformational Partition Function of a Polypeptide Chain.	247
9.3. Theory of Helix-Coil Transitions in Polypeptide Chains	255
9.4. Changes in Polypeptide Chain Dimensions during Helix-Coil Transitions	269
References	275
10. Effect of External Factors on Conformational Transitions in Polypeptide Chains	277
10.1. Effect of Specific Interactions with the Solvent	277
10.2. Helix-Coil Transitions in Chains Which Contain Ionizable Groups.	280
10.3. Effect of an External Force.	290
References	295
11. Theory of Conformational Transitions in Polynucleotide Chains	297
11.1. Conformational Partition Function of a DNA Molecule	297
11.2. Calculation of the Partition Function and Theory of the Thermal Denaturation of DNA	305
11.3. Theory of the Acid and Alkaline Denaturations of DNA	313
References	322
Conclusion	325
Appendix.	329
Author Index	333
Subject Index.	343