

A Stimulating Recollection of Low-Frequency Internal Motions (Phonons) in Biomacromolecules

Kuo-Chen Chou

Gordon Life Science Institute, Boston, MA, USA

Email: kcchou@gordonlifescience.org, kcchou38@gmail.com

How to cite this paper: Chou, K.-C. (2020). A Stimulating Recollection of Low-Frequency Internal Motions (Phonons) in Biomacromolecules. *Voice of the Publisher*, 6, 164-166. <https://doi.org/10.4236/vp.2020.64019>

Received: September 15, 2020

Accepted: November 14, 2020

Published: November 17, 2020

Copyright © 2020 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

In this short review paper, the significant and profound impacts of the Chou's low-frequency internal motions in protein and DNA molecules have been briefly presented with crystal clear convincingness.

Keywords

Low-Frequency Phonons, Internal Motions, Biomacromolecules, Significant Impacts, Profound Impacts

The first paper introducing the low-frequency internal motions or phonons was proposed in 1977 [1]. It has stimulated a series of follow-up papers in this very interesting field (see, e.g., [2]-[16], as well as the eight master pieces of papers from the then Chairman of Nobel Prize Committee Sture Forsen [2] [17]-[23].

It is indeed very significant by introducing the concept of low-frequency internal motions (phonons) for studying biomacromolecules and it is indeed very profound by doing the same.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- [1] Chou, K.C. and Chen, N.Y. (1977) The Biological Functions of Low-Frequency Phonons. *Scientia Sinica*, **20**, 447-457.
- [2] Chou, K.C., Chen, N.Y. and Forsen, S. (1981) The Biological Functions of Low-Frequency Phonons: 2. Cooperative Effects. *Chemica Scripta*, **18**, 126-132.

- [3] Chou, K.C. and Kiang, Y.S. (1985) The Biological Functions of Low-Frequency Phonons: 5. A Phenomenological Theory. *Biophysical Chemistry*, **22**, 219-235. [https://doi.org/10.1016/0301-4622\(85\)80045-4](https://doi.org/10.1016/0301-4622(85)80045-4)
- [4] Chou, K.C. (1987) The Biological Functions of Low-Frequency Phonons: 6. A Possible Dynamic Mechanism of Allosteric Transition in Antibody Molecules. *Biopolymers*, **26**, 285-295. <https://doi.org/10.1002/bip.360260209>
- [5] Chou, K.C. and Maggiora, G.M. (1988) The Biological Functions of Low-Frequency Phonons: 7. The Impetus for DNA to Accommodate Intercalators. *British Polymer Journal*, **20**, 143-148. <https://doi.org/10.1002/pi.4980200209>
- [6] Chou, K.C. (1984) The Biological Functions of Low-Frequency Phonons. 4. Resonance Effects and Allosteric Transition. *Biophysical Chemistry*, **20**, 61-71. [https://doi.org/10.1016/0301-4622\(84\)80005-8](https://doi.org/10.1016/0301-4622(84)80005-8)
- [7] Chou, K.C. (1984) Biological Functions of Low-Frequency Vibrations (Phonons). 3. Helical Structures and Microenvironment. *Biophysical Journal*, **45**, 881-889. [https://doi.org/10.1016/S0006-3495\(84\)84234-4](https://doi.org/10.1016/S0006-3495(84)84234-4)
- [8] Chou, K.C. (1983) Identification of Low-Frequency Modes in Protein Molecules. *Biochemical Journal*, **215**, 465-469. <https://doi.org/10.1042/bj2150465>
- [9] Chou, K.C. (1985) Low-Frequency Motions in Protein Molecules: Beta-Sheet and Beta-Barrel. *Biophysical Journal*, **48**, 289-297. [https://doi.org/10.1016/S0006-3495\(85\)83782-6](https://doi.org/10.1016/S0006-3495(85)83782-6)
- [10] Chou, K.C. (1989) Low-Frequency Resonance and Cooperativity of Hemoglobin. *Trends in Biochemical Sciences*, **14**, 212-213. [https://doi.org/10.1016/0968-0004\(89\)90026-1](https://doi.org/10.1016/0968-0004(89)90026-1)
- [11] Chou, K.C. (1984) Low-Frequency Vibrations of DNA Molecules. *Biochemical Journal*, **221**, 27-31. <https://doi.org/10.1042/bj2210027>
- [12] Chou, K.C. (1983) Low-Frequency Vibrations of Helical Structures in Protein Molecules. *Biochemical Journal*, **209**, 573-580. <https://doi.org/10.1042/bj2090573>
- [13] Chou, K.C. (1986) Origin of Low-Frequency Motion in Biological Macromolecules: A View of Recent Progress of Quasi-Continuity Model. *Biophysical Chemistry*, **25**, 105-116. [https://doi.org/10.1016/0301-4622\(86\)87001-6](https://doi.org/10.1016/0301-4622(86)87001-6)
- [14] Chou, K.C. (1985) Prediction of a Low-Frequency Mode in Bovine Pancreatic Trypsin Inhibitor Molecule. *International Journal of Biological Macromolecules*, **7**, 77-80. [https://doi.org/10.1016/0141-8130\(85\)90035-2](https://doi.org/10.1016/0141-8130(85)90035-2)
- [15] Chou, K.C., Maggiora, G.M. and Mao, B. (1989) Quasi-Continuum Models of Twist-Like and Accordion-Like Low-Frequency Motions in DNA. *Biophysical Journal*, **56**, 295-305. [https://doi.org/10.1016/S0006-3495\(89\)82676-1](https://doi.org/10.1016/S0006-3495(89)82676-1)
- [16] Chou, K.C. (1988) Review: Low-Frequency Collective Motion in Biomacromolecules and Its Biological Functions. *Biophysical Chemistry*, **30**, 3-48. [https://doi.org/10.1016/0301-4622\(88\)85002-6](https://doi.org/10.1016/0301-4622(88)85002-6)
- [17] Chou, K.C. and Forsen, S. (1980) Diffusion-Controlled Effects in Reversible Enzymatic Fast Reaction System: Critical Spherical Shell and Proximity Rate Constants. *Biophysical Chemistry*, **12**, 255-263. [https://doi.org/10.1016/0301-4622\(80\)80002-0](https://doi.org/10.1016/0301-4622(80)80002-0)
- [18] Chou, K.C. and Forsen, S. (1980) Graphical Rules for Enzyme-Catalyzed Rate Laws. *Biochemical Journal*, **187**, 829-835. <https://doi.org/10.1042/bj1870829>
- [19] Chou, K.C., Forsen, S. and Zhou, G.Q. (1980) Three Schematic Rules for Deriving Apparent Rate Constants. *Chemica Scripta*, **16**, 109-113.
- [20] Chou, K.C., Li, T.T. and Forsen, S. (1980) The Critical Spherical Shell in Enzymatic Fast Reaction Systems. *Biophysical Chemistry*, **12**, 265-269.

[https://doi.org/10.1016/0301-4622\(80\)80003-2](https://doi.org/10.1016/0301-4622(80)80003-2)

- [21] Li, T.T., Chou, K.C. and Forsen, S. (1980) The Flow of Substrate Molecules in Fast Enzyme-Catalyzed Reaction Systems. *Chemica Scripta*, **16**, 192-196.
- [22] Chou, K.C., Carter, R.E. and Forsen, S. (1981) A New Graphical Method for Deriving Rate Equations for Complicated Mechanisms. *Chemica Scripta*, **18**, 82-86.
- [23] Chou, K.C. and Forsen, S. (1981) Graphical Rules of Steady-State Reaction Systems. *Canadian Journal of Chemistry*, **59**, 737-755. <https://doi.org/10.1139/v81-107>