

The Five-Steps Rule and Its Impacts on Molecular Biology

Kuo-Chen Chou

Gordon Life Science Institute, Boston, Massachusetts 02478, United States of America

***Corresponding author**

Kuo-Chen Chou, Gordon Life Science Institute, Boston, Massachusetts 02478, United States of America.

Submitted: 23 Apr 2021; Accepted: 27 Apr 2021; Published: 30 Apr 2021

Citation: Kuo-Chen Chou (2021) *The Five-Steps Rule and Its Impacts on Molecular Biology*, *Stem Cell Res Int* 4(2): 01-02.

In 2011 the 5-steps rule [1] was proposed. Ever since then, it has been stimulating the development in many areas of molecular biology (see e.g. [1-46]), indicating the “5-steps rule” is extremely important. It can be schematically expressed in Figure 1.

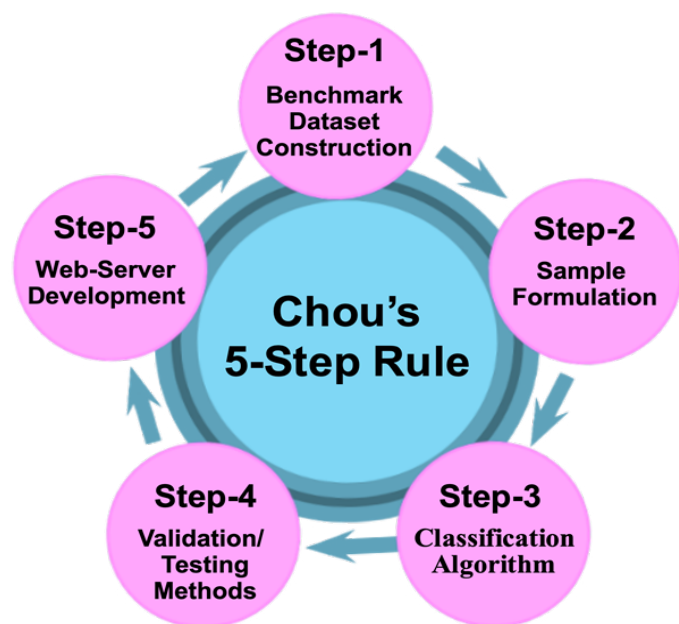


Figure 1: Adapted from International Academic & Research Consortium with permission.

References

1. KC Chou (2011) Some remarks on protein attribute prediction and pseudo amino acid composition (50th Anniversary Year Review, 5-steps rule), *J. Theor. Biol.* 273: 236-247.
2. O Barukab, YD Khan, SA Khan, KC Chou (2019) iSulfo-Tyr-PseAAC: Identify tyrosine sulfation sites by incorporating statistical moments via Chou's 5-steps rule and pseudo components *Current Genomics*, 20: 306-320.
3. Y Chen, X Fan (2019) Use Chou's 5-Steps Rule to Reveal Active Compound and Mechanism of Shuangsheng Pingfei San on Idiopathic Pulmonary Fibrosis, *Current Molecular Medicine*. 19: 511-563.
4. KC Chou (2019) Recent progresses in predicting protein sub-cellular localization with artificial intelligence tools developed via the 5-steps rule, *Medicinal Chemistry*.
5. KC Chou (2019) Impacts of pseudo amino acid components and 5-steps rule to proteomics and proteome analysis, *Current Topics in Medicinal Chemistry (CTMC)* (Special Issue ed. G.P Zhou), 19: 2283-2300.
6. KC Chou (2019) Artificial intelligence (AI) tools constructed via the 5-steps rule for predicting post-translational modifications, *Trends in Artificial Intelligence (TIA)*. 3: 60-74.
7. KC Chou (2019) Recent Progresses in Predicting Protein Sub-cellular Localization with Artificial Intelligence (AI) Tools Developed Via the 5-Steps Rule, *Japanese Journal of Gastroenterology and Hepatology*. 2: 1-4.
8. KC Chou (2019) An Insightful 10-year Recollection Since the Emergence of the 5-steps Rule, *Current Pharmaceutical Design*, 25: 4223-4234.
9. X Du, Y Diao, H Liu, S Li (2019) MsDBP: Exploring DNA-binding Proteins by Integrating Multi-scale Sequence Information via Chou's 5-steps Rule, *Journal of Proteome Research*. 18: 3119-3132.
10. A Dutta, A Dalmia, A R, KK Singh, A Anand (2019) Using the Chou's 5-steps rule to predict splice junctions with interpretable bidirectional long short-term memory networks, *Comput Biol Med.* 116: 103558.
11. W Hussain, SD Khan, N Rasool, SA Khan, KC Chou et al (2019) SPalmitoylC-PseAAC: A sequence-based model developed via Chou's 5-steps rule and general PseAAC for identifying S-palmitoylation sites in proteins, *Anal. Biochem.* 568: 14-23.
12. W Hussain, YD Khan, N Rasool, SA Khan, KC Chou et al (2019) SPrenylC-PseAAC: A sequence-based model developed via Chou's 5-steps rule and general PseAAC for identifying S-prenylation sites in proteins, *J. Theor. Biol.* 468: 1-11.
13. S Ilyas, W Hussain, A Ashraf, YD Khan, KC Chou et al (2019) iMethylK-PseAAC: Improving accuracy for lysine methylation sites identification by incorporating statistical moments and position relative features into general PseAAC via Chou's 5-steps rule, *Current Genomics*.

14. Z Jun, SY Wang (2019) Identify Lysine Neddylolation Sites Using Bi-profile Bayes Feature Extraction via the Chou's 5-steps Rule and General Pseudo Components, *Current Genomics*, 20: 592-601.
15. S Khan, M Khan, N Iqbal, T Hussain, KC Chou et al (2019) A Two-Level Computation Model Based on Deep Learning Algorithm for Identification of piRNA and Their Functions via Chou's 5-Steps Rule Human Genetics. 19: 756-799.
16. J Lan, J Liu, C Liao, DJ Merkler, Q Han (2019) A Study for Therapeutic Treatment against Parkinson's Disease via Chou's 5-steps Rule, *Current Topics in Medicinal Chemistry*. 19: 2318-2333.
17. R Liang, J Xie, C Zhang, M Zhang, H Huang et al (2019) Identifying Cancer Targets Based on Machine Learning Methods via Chou's 5-steps Rule and General Pseudo Components, *Current Topics in Medicinal Chemistry*. 19: 2301-2317.
18. Y Liang, S Zhang (2019) Identifying DNase I hypersensitive sites using multi-features fusion and F-score features selection via Chou's 5-steps rule, *Biophys Chem*. 253:106227.
19. A Wiktorowicz, A Wit, A Dziewierz, L Rzeszutko, D Dudek et al (2019) Calcium Pattern Assessment in Patients with Severe Aortic Stenosis Via the Chou's 5-Steps Rule, *Current Pharmaceutical Design*. 25: 6-31.
20. L Yang, Y Lv, S Wang, Q Zhang, Y Pan et al (2019) Identifying FL11 subtype by characterizing tumor immune micro-environment in prostate adenocarcinoma via Chou's 5-steps rule, *Genomics*. 112: 1500-1515.
21. MA Akmal, W Hussain, N Rasool, YD Khan, KC Chou et al (2020) Using Chou's 5-steps rule to predict O-linked serine glycosylation sites by blending position relative features and statistical moment, *IEEE/ACM Trans Comput Biol Bioinform*, PP.
22. H Bouziane, A Chouarfia (2020) Use of Chou's 5-steps rule to predict the subcellular localization of gram-negative and gram-positive bacterial proteins by multi-label learning based on gene ontology annotation and profile alignment, *J Integr Bioinform*.
23. P Charoenkwan, N Schaduangrat, C Nantasenamat, T Picham, W Shoombuatong (2020) iQSP: A Sequence-Based Tool for the Prediction and Analysis of Quorum Sensing Peptides via Chou's 5-Steps Rule and Informative Physicochemical Properties, *Int. J. Mol. Sci*. 21: 75.
24. Y Chen, X Fan (2020) Use of Chou's 5-Steps Rule to Reveal Active Compound and Mechanism of Shuangshen Pingfei San on Idiopathic Pulmonary Fibrosis, *Curr Mol Med*. 20: 220-230.
25. KC Chou (2020) Other Mountain Stones Can Attack Jade: The 5-Steps Rule, *Natural Science*. 12: 59-64.
26. KC Chou, Proposing 5-Steps Rule Is a Notable Milestone for Studying Molecular Biology, *Natural Science*. 12: 74-79.
27. KC Chou (2020) The Significant and Profound Impacts of Chou's 5-Steps Rule, *Natural Science*. 12: 633-637.
28. KC Chou (2020) Analyze the Role of the "5-Steps Rule" Guidelines in Stimulating the Drug Development (Short Communication), *Scholarly Journal of Food and Nutrition (SJFN)*. 3: 385-386.
29. L Du, Q Meng, H Jiang, Y Li (2020) Using Evolutionary Information and Multi-Label Linear Discriminant Analysis to Predict the Subcellular Location of Multi-Site Bacterial Proteins via Chou's 5-Steps Rule, *IEEE Access*. 8: 56452-56461.
30. Z Ju, SY Wang (2020) Prediction of lysine formylation sites using the composition of k-spaced amino acid pairs via Chou's 5-steps rule and general pseudo components, *Genomics*. 112: 859-866.
31. M Kabir, S Ahmad, M Iqbal, M Hayat (2020) iNR-2L: A two-level sequence-based predictor developed via Chou's 5-steps rule and general PseAAC for identifying nuclear receptors and their families, *Genomics*. 112: 276-285.
32. C Koyunoglu (2020) Use Chou's 5-Steps Rule to Reveal Why SARS+ MERS= COVID-19, *J Biochem Analyt Stud*.
33. W Lin, X Xiao, W Qiu, KC Chou (2020) Use Chou's 5-Steps Rule to Predict Remote Homology Proteins by Merging Grey Incidence Analysis and Domain Similarity Analysis, *Natural Science* 12: 181-198.
34. D Nguyen, T Ho-Quang, L Nguyen Quoc Khanh, V Dinh-Phan, YY Ou (2020) Use Chou's 5-steps rule with different word embedding types to boost performance of electron transport protein prediction model, *IEEE/ACM Trans Comput Biol Bioinform*, PP.
35. RP Pandey, S Kumar, S Ahmad, A Vibhuti, VS Raj et al (2020) Use Chou's 5-steps rule to evaluate protective efficacy induced by antigenic proteins of Mycobacterium tuberculosis encapsulated in chitosan nanoparticles, *Life Sci*. 256: 117961.
36. T Roy, P Bhattacharjee (2020) A LabVIEW-based real-time modeling approach via Chou's 5-steps rule for detection of abnormalities in cancer cells, *Gene Reports*. 100788.
37. H Vundavilli, A Datta, C Sima, J Hua, R Lopes et al (2020) Using Chou's 5-steps rule to Model Feedback in Lung Cancer *IEEE Journal of Biomedical and Health Informatics*, 21: 1-24.
38. L Yang, Y Lv, S Wang, Q Zhang, Y Pan et al (2020) Identifying FL11 subtype by characterizing tumor immune micro-environment in prostate adenocarcinoma via Chou's 5-steps rule, *Genomics*. 112:1500-1515.
39. S Zhang, T Xue (2020) Use Chou's 5-steps rule to identify DNase I hypersensitive sites via dinucleotide property matrix and extreme gradient boosting, *Molecular Genetics and Genomics*. 295.
40. Z Zhang, L Wang (2020) Using Chou's 5-steps rule to identify N(6)-methyladenine sites by ensemble learning combined with multiple feature extraction methods, *J. Biomol. Struct. Dyn*. 1-11.
41. XF Zhao, Z Min, X Wei, Y Ju (2020) Using the Chou's 5-steps rule, Transient Overexpression Technique, Subcellular Location, and Bioinformatic Analysis to verify the Function of Vitis vinifera O-methyltransferase 3 (VvOMT3) Protein, *Plant Physiology and Biochemistry* 151: 621-629.
42. MKM Asma Ehsan 1, Yaser Daanial Khan3, Yu-Ming Chu4,5, Kuo-Chen Chou6 (2021) PredISCs: Using Chou's 5-Steps Rules to Predict Iron-Sulfur (2Fe-2S) Cluster Binding Sites in Protein. 1-15.
43. H Wang, Y Ding, J Tang, Q Zou, F Guo (2021) Identify RNA-associated subcellular localizations based on multi-label learning using Chou's 5-steps rule, *BMC Genomics*, 22: 22-56.

Copyright: ©2021 Kuo-Chen Chou. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.