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Network Pharmacology: A Detailed and Systematic Review

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Abstract: The advancement of network pharmacological medicine has spread out new avenues for understanding the complicated bioactive elements found in numerous medicative plants. The dominant paradigm in drug discovery is that the conception of planning maximally selective ligands to act on individual drug targets. However, several effective medication act via modulation of multiple proteins instead of single targets. Systems and network medication and their therapeutic arm, network pharmacological medicine, revolutionize however we tend to outline, diagnose, treat, and, ideally, cure diseases. However, the rational style of polypharmacology faces right smart challenges within the would like for brand spanking new strategies to validate target combos and optimize multiple structure-activity relationships whereas maintaining drug-like properties. Advances in these areas are making the muse of future paradigm in drug discovery: network pharmacological medicine.

REFERENCES

- Bag, A., Bhattacharyya, S.K., Pal, N.K., 2013. Antibacterial potential of hydroalcoholic extracts of Triphala components against multidrug-resistant uropathogenic bacteria--a preliminary report. Ind. J. Exp. Biol. 51, 709-714.
- [2] Hacker, M., Messer II, W.S., Bachmann, K.A., 2009. Pharmacology: Principles and Practice. Elsevier/Academic Press.
- [3] Gertsch J. 2011. Botanical drugs, synergy, and network pharmacology: forth and back to intelligent mixtures. Planta Medica, 77(11): 1086-1098.
- [4] Zhang WJ, Li X. 2016. A cluster method for finding node sets / sub-networks based on between- node similarity in sets of adjacency nodes: with application in finding sub-networks in tumor pathways. Proceedings of the International Academy of Ecology and Environmental Sciences, 6(1): 13-23.
- [5] Hao DC, Xiao PG. 2014. Network Pharmacology: A Rosetta Stone for Traditional Chinese Medicine. Drug Development Research, 75(5): 299-312.
- [6] Wetzel, S., Bon, R.S., Kumar, K., Waldmann, H., 2011. Biology-oriented synthesis. Angew. Chemie-Int. Ed. 50, 1080010826.
- [7] Fang, X., Shao, L., Zhang, H., Wang, S., 2005. CHMIS-C: a comprehensive herbal medicine information system for cancer. J. Med. Chem. 48, 14811488.
- [8] Chandran, U., Mehendale, N., Tillu, G., Patwardhan, B., 2015a. Network pharmacology: an emerging technique for natural product drug discovery and scientific research on ayurveda. Proc. Ind. Natl. Acad. Sci. 81, 561568
- [9] Fang, Y.-C., Huang, H.-C., Chen, H.-H., Juan, H.-F., 2008. TC;MGeneDIT: a database for associated traditional Chinese medicine, gene and disease information using text mining. BMC Compl. Altern. Med. 8, 58.
- [10] Li, S., Zhang, B., Jiang, D., Wei, Y., Zhang, N., 2010. Herb network construction and comodule analysis for uncovering the combination rule of traditional Chinese herbal formulae. BMC Bioinformatics 11, BioMed Central Ltd.
- [11] Li, S., Zhang, B., Zhang, N., 2011. Network target for screening synergistic drug combinations with application to traditional Chinese medicine. BMC Syst. Biol. 5, BioMed Central Ltd.
- [12] Wen, Z., Wang, Z., Wang, S., Ravula, R., Yang, L., Xu, J., et al., 2011. Discovery of molecular mechanisms of traditional Chinese medicinal formula Si-Wu-Tang using gene expression microarray and connectivity map. PLoS

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One 6.

- [13] Cheng, B.F., Hou, Y.Y., Jiang, M., Zhao, Z.Y., Dong, L.Y., Bai, G., 2013. Anti-inflammatory mechanism of qingfei xiaoyan wan studied with network pharmacology. Yao Xue Xue Bao 48, 686693
- [14] Gu, S., Yin, N., Pei, J., Lai, L., 2013c. Understanding traditional Chinese medicine antiinflammatory herbal formulae by simulating their regulatory functions in the human arachidonic acid metabolic network. Mol. Biosyst. 9, 19311938.
- [15] Li, X., Wu, L., Liu, W., Jin, Y., Chen, Q., Wang, L., et al., 2014c. A network pharmacology study of Chinese medicine QiShenYiQi to reveal its underlying multi-compound, multitarget, multi-pathway mode of action. PLoS One 9, 111. Li, Y., Li, R., Ouyang, Z., Li, S., 2015.
- [16] Wu, L., Wang, Y., Li, Z., Zhang, B., Cheng, Y., Fan, X., 2014. Identifying roles of "Jun-ChenZuo-Shi" component herbs of QiShenYiQi formula in treating acute myocardial ischemia by network pharmacology. Chin. Med. 9, 24.
- [17] Sheng, S., Wang, J., Wang, L., Liu, H., Li, P., Liu, M., et al., 2014. Network pharmacology analyses of the antithrombotic pharmacological mechanism of Fufang Xueshuantong Capsule with experimental support using disseminated intravascular coagulation rats. J. Ethnopharmacol. 154, 735744.
- [18] Sheng, S., Wang, J., Wang, L., Liu, H., Li, P., Liu, M., et al., 2014. Network pharmacology analyses of the antithrombotic pharmacological mechanism of Fufang Xueshuantong Capsule with experimental support using disseminated intravascular coagulation rats. J. Ethnopharmacol. 154, 735744.
- [19] Shi, S.H., Cai, Y.P., Cai, X.J., Zheng, X.Y., Cao, D.S., Ye, F.Q., et al., 2014. A network pharmacology approach to understanding the mechanisms of action of traditional medicine: bushenhuoxue formula for treatment of chronic kidney disease. PLoS One 9.
- [20] Liang, X., Li, H., Li, S., 2014. A novel network pharmacology approach to analyse traditional herbal formulae: the Liu-Wei-Di-Huang pill as a case study. Mol. Biosyst. 10, 10141022
- [21] Liu, P., Duan, J.-A., Bai, G., Su, S.-L., 2014. Network pharmacology study on major active compounds of siwu decoction analogous formulae for treating primary dysmenorrhea of gynecology blood stasis syndrome. Zhongguo Zhong Yao Za Zhi 39, 113120.
- [22] Luo, F., Gu, J., Zhang, X., Chen, L., Cao, L., Li, N., et al., 2015. Multiscale modeling of druginduced effects of ReDuNing injection on human disease: from drug molecules to clinical symptoms of disease. Sci. Rep. 5, 10064.
- [23] Ma, Y., Stern, R.J., Scherman, M.S., Vissa, V.D., Yan, W., Jones, V.C., et al., 2001. Drug targeting mycobacterium tuberculosis cell wall synthesis: genetics of dTDP-rhamnose synthetic enzymes and development of a microtiter plate-based screen for inhibitors of conversion of dTDP-glucose to dTDP-rhamnose. Antimicrob. Agents Chemother. 45, 14071416.
- [24] Ma, T., Tan, C., Zhang, H., Wang, M., Ding, W., Li, S., 2010. Bridging the gap between traditional Chinese medicine and systems biology: the connection of cold syndrome and NEI network. Mol. Biosyst. 6, 613619.
- [25] Morris, J.S., Ph, D., Kuchinsky, A., Pico, A., Institutes, G., 2012. Analysis and Visualization of Biological Networks with Cytoscape. UCSF, p. 65. Nicola, G., Smith, C.A., Lucumi, E., Kuo, M.R., Karagyozov, L., Fidock, D.A., et al., 2007. Discovery of novel inhibitors targeting enoyl-acyl carrier protein reductase in plasmodium falciparum by structure-based virtual screening. Biochem. Biophys. Res. Commun. 358, 686691.
- [26] Ogata, H., Goto, S., Sato, K., Fujibuchi, W., Bono, H., Kanehisa, M., 1999. KEGG: kyoto encyclopedia of genes and genomes. Nucl. Acids Res. 27, 2934. Paolini, G.V., Shapland, R.H.B., van Hoorn, W.P., Mason, J.S., Hopkins, A.L., 2006. Global mapping of pharmacological space. Nat. Biotechnol. 24, 805815. Patwardhan, B., 2014a. Rediscovering drug discovery. Comb. Chem. High Throughput Screen 17, 819.
- [27] Patwardhan, B., 2014b. The new pharmacognosy. Comb. Chem. High Throughput Screen 17, 97. Patwardhan, B., Chandran, U., 2015. Network ethnopharmacology approaches for formulation discovery. Ind. J. Tradit. Knowl. 14, 574580. Patwardhan, B., Mutalik, G., Tillu, G., 2015. Integrative Approaches For Health: Biomedical Research, Ayurveda and Yoga. Academic Press, Elsevier Inc. Pei, L., Bao, Y., Liu, S., Zheng, J., Chen, X., 2013. Material basis of Chinese herbal formulas explored by combining pharmacokinetics with network pharmacology. PLoS One 8, e57414.
- [28] Peng, K., Xu, W., Zheng, J., Huang, K., Wang, H., Tong, J., et al., 2013. The disease and gene annotations (DGA): an annotation resource for human disease. Nucl. Acids Res. 41, 553560

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- [29] Wu, L., Wang, Y., Nie, J., Fan, X., Cheng, Y., 2013. A network pharmacology approach to evaluating the efficacy of Chinese medicine using genome-wide transcriptional expression data. Evid. Based Complement. Alternat. Med. 2013, 915343.
- [30] Wu, L., Wang, Y., Li, Z., Zhang, B., Cheng, Y., Fan, X., 2014. Identifying roles of "Jun-ChenZuo-Shi" component herbs of QiShenYiQi formula in treating acute myocardial ischemia by network pharmacology. Chin. Med. 9, 24.
- [31] Wu, X., Jiang, R., Zhang, M.Q., Li, S., 2008. Network-based global inference of human disease genes. Mol. Syst. Biol. 4, 189.
- [32] Xiang, Z., Sun, H., Cai, X., Chen, D., Zheng, X., 2015. The study on the material basis and the mechanism for anti-renal interstitial fibrosis efficacy of rhubarb through integration of metabonomics and network pharmacology. Mol. Biosyst. 11, 10671078.
- [33] Xu, H., Zhang, Y., Lei, Y., Gao, X., Zhai, H., Lin, N., et al., 2014a. A systems biology-based approach to uncovering the molecular mechanisms underlying the effects of dragon's blood tablet in colitis, involving the integration of chemical analysis, ADME prediction, and network pharmacology. PLoS One 9, e101432.
- [34] Xu, H.-Y., Wang, S.-S., Yang, H.-J., Bian, B.-L., Tian, S.-S., Wang, D.-L., et al., 2014b. Study on action mechanism of adjuvant therapeutic effect compound Ejiao slurry in treating cancers based on network pharmacology. Zhongguo Zhong Yao Za Zhi 39, 31483151.
- [35] Xu, Q., Qu, F., Pelkonen, O., 2011. Network Pharmacology and Traditional Chinese Medicine. In: Hiroshi, Sakagami (Ed.), Alternative medicine. InTech, pp. 277297. Yang, H., Xing, L., Zhou, M.-G., et al., 2012. Network pharmacological research of volatile oil from Zhike Chuanbei Pipa Dropping Pills in treatment of airway inflammation. Chinese Traditional and Herbal Drugs 43, 11291135.
- [36] Xu H, Zhang Y, Lei Y, Gao X, Zhai H, Lin N, et al. A systems biology-based approach to uncovering the molecular mechanisms underlying the effects of dragon's blood tablet in colitis, involving the integration of chemical analysis, ADME prediction, and network pharmacology. PLoS One. 2014;9:e101432.
- [37] Li B, Tao W, Zheng C, Shar PA, Huang C, Fu Y, et al. Systems pharmacology-based approach for dissecting the addition and subtraction theory of traditional Chinese medicine: An example using Xiao-Chaihu-Decoction and Da-Chaihu Decoction. Comput. Biol. Med. Elsevier; 2014;53C:1929.
- [38] Zi, T., Yu, D., 2015. A network pharmacology study of Sendeng-4, a Mongolian medicine. Chin. J. Nat. Med. 13, 108118.
- [39] Zhou, W., Wang, Y., 2014. A network-based analysis of the types of coronary artery disease from traditional Chinese medicine perspective: potential for therapeutics and drug discovery. J. Ethnopharmacol. 151, 66-77.
- [40] From Zi, T., Yu, D., 2015. A network pharmacology study of Sendeng-4, a Mongolian medicine. Chin. J. Nat. Med. 13, 108118.
- [41] Zhou, W., Wang, Y., 2014. A network-based analysis of the types of coronary artery disease from traditional Chinese medicine perspective: potential for therapeutics and drug discovery. J. Ethnopharmacol. 151, 6677.
- [42] Gu, S., Yin, N., Pei, J., Lai, L., 2013c. Understanding traditional Chinese medicine antiinflammatory herbal formulae by simulating their regulatory functions in the human arachidonic acid metabolic network. Mol. Biosyst. 9, 19311938.
- [43] Ru, J., Li, P., Wang, J., Zhou, W., Li, B., Huang, C., et al., 2014. TCMSP: a database of systems pharmacology for drug discovery from herbal medicines. J. Cheminform 6, 13.
- [44] Sanderson, K., 2011. Databases aim to bridge the East-West divide of drug discovery. Nat. Med. 17, 1531, Nature Publishing Group, a division of Macmillan Publishers Limited. All Rights Reserved.
- [45] Banerjee, P., Erehman, J., Gohlke, B.-O., Wilhelm, T., Preissner, R., Dunkel, M., 2015. Super natural II--a database of natural products. Nucl. Acids Res. 43, D935D939.