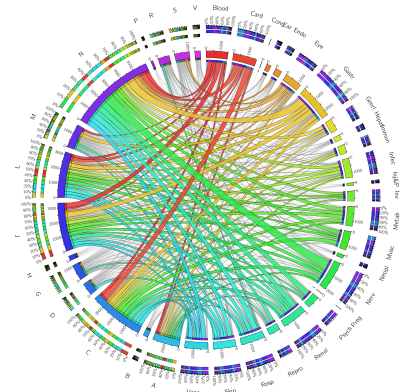


# The Deep Connection between Drugs and Side Effects

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Identifying potential adverse drug reactions (ADRs) for known drugs and new molecules is crucial for drug discovery and public health. The visualization displays a drug-ADR interaction network with 746 drugs, 817 ADRs, and 24,803 connections, extracted from the SIDER Side Effect database.



The drugs with the same ATC (Anatomical Therapeutic Chemical) levels were bundled together (left), while the ADRs with the same SOC (System Organ Class) levels were bundled together (right), using an edge bundling technique. The length of the bars of the ATC levels on the outer ring represents the percentage of SOC levels at each ATC level, and vice versa.

From this figure, nervous system agents (N) have a broad range of ADRs, covering most of the SOC categories. Significantly, nervous system agents usually cause nervous system disorders. Cardiovascular drugs (C) often cause heart diseases. The drugs apply to sensory organs (S) lead to eye disorders frequently. Such observations suggest that integrating drug/ADR semantic information into the association identification pipelines can potentially improve the prediction performance. The visualization appears as Figure 1 in the following paper:

Cao, D-S., N. Xiao, Y-J. Li, W-B. Zeng, Y-Z. Liang, A-P. Lu, Q-S. Xu, and A. F. Chen. (2015). Integrating multiple evidence sources to predict adverse drug reactions based on a systems pharmacology model. *CPT: Pharmacometrics & Systems Pharmacology*, 4(9), 498-506.

The paper is freely available from: <https://doi.org/10.1002/psp4.12002>

Data and code are available on GitHub: <https://github.com/road2stat/MEF>

ATC Code: **A**: Alimentary tract and metabolism; **B**: Blood and blood forming organs; **C**: Cardiovascular system; **D**: Dermatologicals; **G**: Genito-urinary system and sex hormones; **H**: Systemic hormonal preparations, excluding sex hormones and insulins; **J**: Anti-infectives for systemic use; **L**: Anti-neoplastic and immunomodulating agents; **M**: Musculo-skeletal system; **N**: Nervous system; **P**: Anti-parasitic products, insecticides and repellents; **R**: Respiratory system; **S**: Sensory organs; **V**: Various