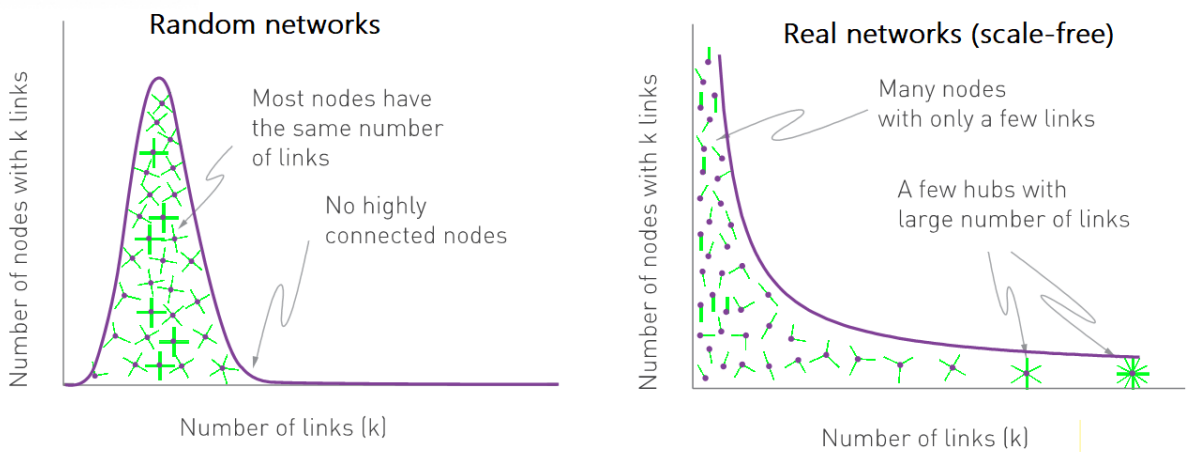
Case 1: Why do we need hub nodes in biological networks?

During his literature study for a paper on cancer biology, Lars read an article on the importance of hub nodes as key regulators in the development of the hallmarks of cancer. In a network science book, he learned that hub nodes are nodes with a high degree and that they tend to be essential.



Lars finds it very interesting that these hub nodes only exist in real networks and decides to focus his paper on how researchers identify and use hub nodes to better understand disease mechanisms. Since he is studying some transcription factors which regulate many different genes, he wonders if hub nodes only exist in undirected networks or if he could use this information also in directed networks.

Recommended literature:

1. Why do we need hub nodes? https://www.nature.com/articles/nrg2450
2. Network Science Book, Chapter 4 - Degree / Scale-free topology (http://networksciencebook.com/chapter/2#degree, http://networksciencebook.com/chapter/4)
3. The OncoPPi network of cancer-focused protein–protein interactions to inform biological insights and therapeutic strategies https://www.nature.com/articles/ncomms14356
4. Why Do Hubs Tend to Be Essential in Protein Networks? https://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.0020088