# Introduction

"Exploring modularity in biological networks" is a philosophical take on the importance of mathematical models in life science. It stood out from the other papers we looked at because it is more an essay than a paper, regarding the usefulness of network science in the biological field, which we found quite interesting. Often, we are more occupied with how we do science instead of why and to what end we do it, we, therefore, chose this paper as it has a different viewpoint than most papers and further question the usefulness of using mathematical models such as graph theory or network science.

The author of this paper offers philosophical viewpoints on the way science is performed. Notably, she splits science into several subcategories such as explanatory, predictive, integration, and unifying science and states that mathematical models play an especially integral and active role in the fields of exploratory science. This means that mathematical models are used especially to find correlations and other interesting phenomena within biological datasets, rather than to confirm established theses. Initially, these kinds of experiments were opposed to confirmatory experiments (experiment, designed to test and confirm hypotheses), but in recent times it became clear that exploratory experiments are often guided by background science, but lack a firm theoretical framework.

Furthermore, the author heightens the increasing importance of network science through the rise of omics projects, as networks facilitate the processing of a large amount of data acquired by these projects. Network science can be used in a biological context as biological systems provide a high degree of modularity. Modularity is understood as a key feature of biological systems and can be found in many different areas such as protein interaction, signaling pathways neurobiological systems, and ecological systems. Modularity requires parts of the system to be more like one another than the parts are like other clusters. To show modularity graph models are used as they are easy to visualize and represent modular systems quite well. The author defines these models as an instrument which “performs epistemic function in scientific inquiry” meaning that a model is a reduced image of the reality which is still capable of representing relevant features of the original system.

# Discussion

All in all, the author tries to extend and continue previous works on the usability of theoretical network approaches and their role in (exploratory) science. This was done by providing examples from different branches of life science and showing that one network can be used for several exploratory functions like exploring the solution space, reveal new research questions, and providing more insight into (structure of) problems and research questions. Furthermore, this paper stands out of the crowd by not arguing if network analysis and/or graph theoretical approaches can be useful in life science or if network approaches in explanatory science conflicts with mechanistic research like, as other work (Green et al. 2018, DOI: 10.1007/s11229-016-1307-6, Levy and Bechtel. 2013 DOI: 10.1086/670300). By making a case and showings that networks are already in use and have shown to be useful. in the end, this paper is a philosophical essay about the potential use and function of graph theory in different subfields of biology and exploratory science in general rather than a paper about the application of graph theory to solve a specific problem or question. Because of this, it was hard to get a grip on the graph-theoretical aspect and methodology of this paper. But it was interesting to see graph theory can be examined from an abstract point of view even though graph theory is in most cases already an abstraction of the biological reality. which did not occur in the lecture.