The development of stratification and segregation in a new scientific field: A study of collaboration among scientists in neuroblastoma research between 1975 and 2016

Using a new data set on scientific collaboration in neuroblastoma research over a period of 41 years, we study how the structure of collaboration ties in an evolving scientific field changes over time. While scientometric, sociological, and network-scientific studies persistently report a concentration of coauthorships among an elite of scholars (preferential attachment) less systematic attention has been paid to the question of how inequality in the distribution of network partners changes as scientific fields mature. We address this research gap by studying how stratification and segregation shape scientific collaboration networks throughout the evolution of a new scientific field. The empirical setting of our study is a specialized community of cancer researchers who began to investigate neuroblastoma—the most common solid cancer in childhood—in the second half of the 1970s.

Guided by concepts from the sociology of knowledge and status theories, we highlight the importance of a field's size and age for processes of stratification and segregation within it. Our article mobilizes exponential random graph models (ERGMs) and stochastic actor-oriented models (SAOMs) to study the evolution of neuroblastoma research over a series of 18 conferences with up to 1197 participating scholars. In particular, the analyses explore whether scientific fields change their social organization over time and focus on the stratification and segregation of collaboration ties. The results illustrate that inequality in the distribution of collaboration ties intensified throughout the field's development and that accumulation processes connected to researchers' years of experience, publication record, and seniority increasingly structured scientific collaborations. Moreover, status homogeneity—the tendency of researchers with similar experience and productivity to collaborate—increased over time.

These results suggest the emergence of a socially closed elite at the center of the network as neuroblastoma research grew and matured. Taken together, our article contributes to network analysis and the science of science in two major ways.

First, modeling the structure of large networks is still in its infancy and riddled with technical problems such as model degeneracy, high requirements of computational power, and lacking comparability of estimates across network models. The article engages with these difficulties by using recently introduced average marginal effects for ERGMs combined with simulation-based explorations of network models. Thereby, our study breaks new ground and addresses ongoing problems at the cutting-edge of network modeling concerning the interpretation and comparison of estimates from an applied perspective.

Second, the article advances the existing literature on networks in science in significant ways. While previous quantitative studies often bracket the contextual antecedents of knowledge production, our work draws upon the sociology of science and status theories to understand under which circumstances stratification and segregation in scientific fields should change. Our theoretical ideas speak to recent accounts that stress the flexibility of network mechanisms across different stages of a context and highlight the importance of fields' size and maturity for their social organization. More broadly, our article demonstrates the potential analytical merits of adopting a dynamic and relational perspective on the developmental trajectories of organizational and cultural fields.