As a rapidly developing research area, the science of science (SciSci) is devoted to quantify, understand and predict scientific research and its outputs. While much progress has been achieved on the impact measurement and the collaboration network, the dynamical evolution of research system at mesoscopic level is much less studied. To fill this gap, we built a data-driven framework for studying knowledge evolution. Using the American Physical Society (APS) publications data set, we constructed year-to-year bibliographic coupling networks and identified validated communities --- topical clusters (TCs) --- that represent different research fields in them. We visualized the knowledge evolution in the form of alluvial diagrams and different types of events (birth, death, growth, decay, merging and splitting) are observed. Quantitative analyses suggest that merging and splitting events are closely related with scientific breakthroughs. Furthermore, we introduced the scientific meme into the framework to make the evolution process more comprehensible. Normalized mutual information between memes and TCs can help us pick appropriate memes to represent the research directions of TCs. Having the predictive features describing a given TC and its known evolution in the next year, we can train a machine learning model to predict future changes of TCs. We found the number of papers from certain journals, the degree, closeness, and betweenness to be the most predictive features. Additionally, betweenness of TCs revealed its significant increase for merging events.