Kullback-Leibler Divergence (KLD): From the 17th to the beginning of the 20th century, reference and discourse MWEs tend to behave in opposite directions. In the 20th century, stance expressions become more typical.

**Goals**
- What are the functions MWEs have fulfilled in scientific English writing across 300 years?
- How to characterize the diachronic development of their usage over time?

**Data**
- Royal Society Corpus (RSC) 6.0 (Fischer et al. 2020)
  - Diachronic corpus of scientific English.
  - From 1665 until 1996.
  - 47 837 texts (295 895 749 tokens).

**Multi-word Expressions**
- Two complementary corpus-based approaches:
  1. **Academic Formulas List (AFL)**: most common formulaic sequences in academic English: List of 603 MWEs extracted using the formula teaching worth (FTW) and classified according to Biber et al. (2004).
  2. **Universal Dependencies (UD) method**: Extraction of the 100 most frequent MWEs (fixed dependency relation) from the RSC parsed with Stanza (combined English model). Functional categories annotated manually.

**Frequency-based Trends**
- Upward trend until the early 20th century.
- Referential expressions notably increase in the latter half of the 18th century.
- Stance expressions demonstrate a consistent rise from 1925 onwards.

**Diachronic Changes by Divergence - Functions**
- Kullback-Leibler Divergence (KLD): $D_{KL}(P||Q) = \sum_{x \in X} P(x) \log \left( \frac{P(x)}{Q(x)} \right)$
- From the 17th to the beginning of the 20th century, reference and discourse MWEs tend to behave in opposite directions.
- In the 20th century, stance expressions become more typical.

**Trends in Discourse and Referential Expressions:**
- Topic Elaboration/Clarification: Historical and cultural contexts emphasizing explicit reasoning favor elaborated discourse.
- Specification of Attributes: Evolving academic standards demand precise attribute specification.

**Divergence in Stance Expressions:**
- By 1825, ability expressions become prominent, followed by attitudinal expressions, declining in the 1930s. Epistemic expressions then gain prevalence.
- MWEs increasingly articulate evidence-based reasoning.

**Conclusion and Future Work**
- Dynamic landscape of MWE usage, marked by significant shifts in function that reflect changing priorities and practices within the scientific community over time.
- Future work: (1) increase the number of MWEs; (2) model MWEs at the paradigmatic level; and (3) apply probabilistic measures of processing (e.g. surprisal).