Workshop: The Future of Systematics in Data-Centric Biology

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Location: Marine Biological Laboratory, Woods Hole, MA
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Description: When and why does future progress in biology require taking taxonomy seriously? This workshop aims to redraw conventional boundaries for where systematics can make the most fruitful contributions to future biology. The life sciences are rapidly moving away from 20th century paradigms that led to the relative isolation of disciplines and toward an increasingly integrative approach. For example, many biologists are expanding beyond the traditional set of model organisms to embrace comparative research across a wider range of species. At the same time, climate change is threatening the stability of ecosystems and the sustainability of human development. Meeting these new challenges will require us to understand and question historical barriers among fields while also reconceptualizing how systematics works in order to accommodate major new discoveries about the diversity of life. For this reason, the workshop aims to integrate insights from the disciplines of biology, history, and philosophy to address the theme of systematics's future in data-centric biology.

In order for taxonomy to meet its full potential as the primary basis for data integration in biology, we need a better understanding of where accurate taxonomic knowledge matters most to biology. All information about species, including about the traits and locations of organisms in nature, are linked via taxonomic names. The work of collecting, classifying, and comparing organisms had great prestige in 19th century biology and was pivotal to many great scientific advances in that time. In the twentieth century, though, the dominant culture of biology came to prioritize experimental manipulation over observation and the molecular over the organismal. However, recent work in the history of biology suggests that these value perceptions do not correspond to the actual contributions of comparative and integrative research in this period. Nonetheless, the twentieth century has left a legacy where many biologists understand comparative and integrative research in their fields as largely independent from ongoing research in systematics. How did these divisions among comparative and integrative research emerge in biology, and to what extent do they reflect valid boundaries between fields or approaches?

We also need a better understanding of how new discoveries are challenging us to reconceptualize taxonomic classification, especially the Linnaean system as the traditional basis for organizing taxonomic knowledge. In biodiversity informatics, for instance, the current aggregation paradigm imposes a single, uncontextualized naming system onto all submitted data, fracturing the high-quality, coherent data packages generated by expert taxonomists. Taxonomic hierarchies express scientific theories about relationships among units of biodiversity, but taxonomists often use conflicting theories of classification or nomenclatural systems. How have biologists managed to translate knowledge across disagreements and arrive at shared judgments of progress, and how will existing practices need to change in the future? In a different context, metagenomics is transforming the face of microbial and viral taxonomy, but the Linnaean system may not be a good fit for these domains of life. Similarly, population genomics is providing a much richer picture of hybridization and gene flow, but the complexity of the underlying speciation continuum may prove too complex to capture using traditional Linnaean ranks. However, we have only a partial understanding of how contemporary work relates historically to earlier research on subspecies, trinomials, ecotypes, and theories of the "stages" of speciation.

Possible topics of interest:

- What nomenclatural system will best ensure data stability in microbiomics or virology?
- Where will human expertise and analysis play a role in post-genomics classification?
- How have new technologies altered the scientific value of taxonomic names?
- Where are the boundaries of the Linnaean system and can it grow past them?
- Where does taxonomy make an important difference to phylogenetics?
- How does incorporating novel taxonomic research advance conservation biology?
- Can taxonomy accommodate the multi-scale complexity of the speciation process?
- Why did trinomials fail to catch on and will interest in speciation today be any different?
- How can we represent forms of progress in taxonomy using computational reasoning?
- How do biologists represent and manage uncertainty and conflict in classifications?
- Can we integrate the results of "integrative taxonomy" into biological databases?