

POINT OF VIEW

The time has come for Natural History Collections to claim co-authorship of research articles

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Natural History Collections (NHC) contain an estimated 3 billion specimens (Brooke, 2000) curated by museums and universities worldwide. NHC offer an incredible and unparalleled sampling of global biodiversity of all taxonomic groups acquired over the past 500 years thanks to the efforts of generations of naturalists and curators. Despite the negative connotation of “antiquity”, which museum collections sometimes incorrectly convey due to poor communication about the importance of these collections and the lack of public knowledge about their scientific and historical significance, NHC represent not only a huge and ever-growing library of the living world, but also a currently valuable and unique resource for many research disciplines. NHC, often originally assembled to provide material for comparative purposes, traditionally were used to support anatomical, morphological, taxonomic, and systematic research. Other new applications have progressively emerged in response to societal demands and scientific challenges, usually taking advantage of technological advances. An important advance was the invention of the polymerase chain reaction (PCR) in the 1980s: the molecular revolution offered the opportunity to study an apparently infinite number of DNA characters from optimally dried specimens (Gaudeul & Rouhan, 2013). Technical barriers imposed by low-quality, degraded DNAs found in poorly dried or very old specimens have in many instances been overcome by next-generation sequencing (NGS) technologies. Consequently, an additional wealth of genetic and phylogenetic data derived from NHC became available beginning in the 2000s (Wandeler & al., 2007; Millar & al., 2008; Staats & al., 2013; Andreasen & al., 2014; Buerki & Baker, 2015; Parks & al., 2015; Suchan & al., 2016; Zedane & al., 2016; Silva & al., 2017). Other novel applications applied to NHC include, but are not limited to, isotopic and other chemical element analyses (Gritcan & al., 2016; Körner & al., 2016). In addition to specimens as biological objects for study, information derived from specimen labels has been recognised and exploited as another gold mine in

the “big data” era that we have entered. Indeed, NHC provide outstanding data for statistical and model-based investigations about ecology, biogeography, and conservation biology including documentation of species decline, invasive species range extensions, impacts of global change, and the origins and distribution of disease agents (Lane, 1996; Shaffer & al., 1998; Funk, 2003; Lister & al., 2011; Lavoie, 2013; DiEuliis & al., 2016; Willis & al., 2017).

The scientific attractiveness of NHC has dramatically increased because of the current high potential to access both material and data. Indeed, setting up the optimal species sampling or dataset for a study is often a critical bottleneck. NHC allow investigators to save time and energy and, in some cases, can even give them access to otherwise missing resources (e.g., historical data that allow a contrast between the past and present, extinct species data or information on species occurring in politically unstable or remote regions). As such, NHC often are a key tool to understanding our world. While many researchers therefore logically turn to NHC to request destructive sampling of specimens or to request large datasets, there is an ironically alarming trend to ignore the contributions of these collections and their staff both in terms of scientific considerations and funding (Dalton, 2003; Gropp, 2003; Funk, 2014; Deng, 2015; Kemp, 2015; Nowogrodzki, 2016). This discrepancy between high potential and weak support is exacerbated by the lack of visibility of NHC in the resulting academic publications, particularly when NHC staff are not directly involved in the scientific exploitation of the material or of the data they provide. Although NHC have been opening up new frontiers in many research areas, their critical contributions to scientific research articles is frequently only stated in the acknowledgements and as such their fundamental contributions to research and discovery are very difficult to track. Consequently, the actual role of NHC remains largely overlooked and undervalued. This could ultimately impede their sustainability and future capacity to support scientific research.

We argue that NHC could gain a proper and legitimate visibility through a full co-authorship of scientific articles in those instances where the NHC contribution is critical. This contribution can be determined on a case-by-case basis. The underlying tasks that justify such co-authorship include acquiring and maintaining collections, taxonomic identifications, curation, handling of specimens, and long-term preservation of vouchers. Unfortunately, all of these time- and cost-consuming processes are often ignored even though they involve numerous skills and practices, specialised knowledge, and taxonomic expertise based on a broad and collective experience acquired through generations. The NHC, as an Institution/group name only, should be listed as an author of articles derived from their collections. An example of such a citation might be “Weber M., Martin P., *City Herbarium (Herbarium code) & Smith R.*” where Weber, Martin, and Smith are scientists who conducted the research, but not staff members of the *City Herbarium*.

We see at least five benefits that would accrue from implementing this idea. They include: (i) encouraging NHC managers and curators to provide scientists with material (as far as it does not diminish the scientific value of a specimen) and data; (ii) promoting more NHC-based research, contributing to an acceleration in the pace of species discovery and allowing a wealth of investigations on biodiversity that could provide crucial information to confront environmental threats; (iii) proposing a more scientific, appropriate alternative to the sale of samples, DNA, or data, which does not appear to conform to the ideal of academic, non-commercial research; (iv) avoiding the assignment of co-authorship to a given staff member of the NHC as simply a pay-back or even an incentive for providing samples or data (by including the NHC as an author there would be a better reflection of the true but invisible expertise provided by the past and present scientific communities to collectively enrich and curate a collection); and (v) improving the recognition of the scientific value of NHC that could help raise more core funding for their routine functioning, especially funding from national governments or the private sector. Ultimately, this would hopefully prevent further closures of NHC and raise awareness of the importance of training and recruiting high-level taxonomists to further collect material in the field and curate NHC as has already been advocated by others (Wen & al., 2015; Ferreira & al., 2016).

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