

## University Collections as Archives of Scientific Practice

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### **Resumen**

*El objetivo de este artículo es discutir el potencial de las colecciones científicas como archivos de la práctica científica. Sostenemos que las colecciones científicas proveen de fuentes primarias únicas para la investigación en la historia de la ciencia y que habitualmente contienen información acerca de la práctica científica que no es accesible a través de fuentes escritas. Desafortunadamente, el potencial de las colecciones científicas para la historia de la ciencia a menudo permanece sin explotar debido a factores institucionales como la documentación limitada, la visibilidad y la financiación de las colecciones. Se considera a la documentación de las colecciones universitarias en Alemania como un modelo positivo para enfrentar estos desafíos.*

Palabras clave: colecciones científicas - objetos científicos - prácticas científicas - estudios sobre cultura material

### **Abstract**

*The aim of this article is to discuss the potential of scientific collections as archives of scientific practice. We argue that scientific collections provide unique primary sources for research in history of science and that they often contain information about scientific practice that is not accessible through written sources. Unfortunately, the potential of scientific collections in history of science often remains untapped due to institutional factors such as limited documentation, visibility, and funding of collections. We discuss the documentation of university collections in Germany as a positive model to meet these challenges.*

Key words: scientific collections - scientific objects - scientific practice - material culture studies

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Scientific collections preserve the material heritage of the sciences. Their holdings are as diverse as the roles of material objects in scientific practice. For example, scientific collections include fossils, mathematical models, historical maps, DNA samples, astronomical instruments, herbaria, and computers. University collections are an important group of scientific collections that are typically assembled for purposes of research or academic teaching. The history of university collections is unsteady and shaped by the diverse and changing uses of material objects in science.<sup>1</sup> University collections are often created for specific research purposes such as providing instruments for experimental research or objects of investigation such as geological samples, biological specimens, or historical coins. Furthermore, many university collections are created to meet specific needs in academic teaching by providing objects such as mounted animals, archaeological reconstructions, or anatomical models.

Although university collections initially often have well-defined roles in academic practice, their functions change over time. Instruments become outdated, old teaching materials are replaced with new objects, and collected materials become neglected when scientists turn to new topics.<sup>2</sup> Although this process can create existential crises for university collections which have lost their scientific functions, university collections also often gain new importance. On the one hand, collections can gain new functions within their discipline through the emergence of new scientific interests and methods such as genetic research which has revived interest in historical herbaria or carbon dating methods which have allowed new research in paleontological and archeological collections. On the other hand, collections can also gain importance by transforming into archives for the history of science and technology. For example, a collection of astronomical instruments that was founded as research collection in the 18th century may have clearly lost its epistemic potential within astrophysics while simultaneously

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<sup>1</sup> While there is a huge number of case studies of individual university collections and collections at individual universities, macrohistorical accounts of the development of university collections are still hard to find. Marta C. LOURENCO's dissertation *Between Two Worlds* (Paris, 2005) does important work in connecting the dots. We try to provide an overview of the development of German university collections based on quantitative data in David LUDWIG and Cornelia WEBER "A Rediscovery of Scientific Collections as Material Heritage?", *Studies in History and Philosophy of Science Part A*, forthcoming.

<sup>2</sup> Mark MEADOW "Relocation and revaluation in university collections, or, Rubbish Theory revisited" *UMAC Journal* 3, 2010, 3-10.

gaining importance as primary source for the historical understanding of scientific practice in the 18th century.

The goal of this article is threefold. In the *first section*, we want to have a brief look at the history of university collections and describe how they became archives of the material heritage of the sciences. In the *second section*, we describe the importance of university collections as primary sources in the history of science and emphasize their potential as archives of scientific practice. The *third section* discusses the institutional hurdles that cause much of this potential to remain untapped and suggests steps for meeting these challenges by presenting the case study of university collections in Germany.

## I. Changing attitudes towards university collections

The histories of university collections are extraordinarily diverse as they include different centuries, continents, and virtually all academic disciplines from mathematics and physics to history and theatre. Confronted with this diversity, historians of science often distinguish between different types of university collections. Roughly, one can differentiate between *research collections*, *teaching collections*, and collections that serve the *public presentation of science*. These collection types are not mutually exclusive and many larger institutions that were founded as university museums such as the Ashmolean in Oxford or the Museum for Natural History in Berlin initially incorporated all three functions.<sup>3</sup> In considering the role of university collections for research in the history of science, it is crucial to note that the large majority of collections were not assembled for historical research purposes and that historians' interests in collections are mostly a result of a transformation of their academic roles.

The first organized collections with scientific purposes appear in the 16th century.<sup>4</sup> They include early botanical gardens such as the gardens in Pisa (1543) and Padua (1545) that were primarily used for the collection and preservation of medical herbs and anatomical theaters such as the theatre of the Archiginnasio in Bologna (1585) and the *Theatrum Anatomicum* in Leiden (1594) that were used for practical demonstrations.

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<sup>3</sup> e.g. R.F. OVENELL, *The Ashmolean Museum, 1683-1894*, Oxford, 1986; August BRAUER "Das Zoologische Museum", Max LENZ (ed.) *Geschichte der Königlichen Friedrich-Wilhelms-Universität zu Berlin, Band 3*, Halle, 372-389.

<sup>4</sup> Cornelia WEBER "University Collections", *European History Online*, 2012.

While the further institutionalization of universities in the 17th and 18th century led to the creation of new collections of objects such as herbaria or physical instruments, the end of the early modern period also marks a crucial break in the history of collections. The growth of universities and the development of new disciplines in the late 18th and the early 19th century provoked the ubiquitous emergence of research and teaching collections across virtually all academic disciplines through Europe.<sup>5</sup> Marta Lourenço describes the time between 1800 and 1930 as a “golden age” of university museums and cites David Murray’s *Museums: Their History and their Use* (1904) as expressing a common attitude: “Every Professor of a branch of science requires a museum and a laboratory for his department; and accordingly in all our great universities and other teaching institutions we have independent museums of botany, palaeontology, geology, mineralogy and zoology, of anatomy, physiology, pathology and materia medica, of archaeology – prehistorical and historical, classical and Christian – each subject taught having its own appropriate collection.”<sup>6</sup>

Where university collections often established themselves as indispensable parts of academic practice through the 19th century, much of the 20th century is perceived as a time of “crisis” of university collections. First, the declining visibility of collections is apparent in academic teaching. In Germany, for example, the number of students increased from 33.000 in 1900 to 1.798.800 in 2000. At the same time, our quantitative research on university collections in Germany only shows a moderate growth of collections that clearly indicates a relative marginalization of collection-based teaching.<sup>7</sup> Second, the declining importance of collections is equally striking in research contexts. Of course, collection-based research did not disappear and even expanded in areas where new methods (e.g. carbon dating or molecular biology) and interests (e.g. preservation of biological diversity) led to new applications. However, the relative importance of collections clearly declined with the increasing importance of laboratory settings with short life spans and no ambition to preserve the involved objects beyond

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<sup>5</sup> The picture looks considerably more complex from a global perspective. For example, collecting also had distinctive but very different roles in the colonial sciences which treated colonies often more as sources of scientific objects than as independent centers of academic research and teaching. The global development of modern university collections is therefore often closely entangled with the political and cultural emancipation of colonies. For example, compare Savithri Preetha NAIR. “Science and the Politics of Colonial Collecting: The Case of Indian Meteorites, 1856–70”, *The British Journal for the History of Science* 39, no. 01 (2006): 97–119. For developments in Latin America, see the special issue of *L'Ordinaire latino-américain* “Independencias y museos en América Latina” (ed. Irina PODGORNY).

<sup>6</sup> Marta C. LOURENCO, *Between Two Worlds*, Dissertation, Paris, 2005, 66-69.

<sup>7</sup> David LUDWIG and Cornelia WEBER, “A Rediscovery of Scientific Collections as Material Heritage?”, *Studies in History and Philosophy of Science Part A*, forthcoming.

their immediate experimental use. Still located within the departments of rapidly changing experimental sciences, university collections were all too often the weakest competitor for space and funding.

It was not until the 1980s that the institutional marginalization of many collections became perceived as a problem in the quickly growing literature on the “crisis of university museums” in the museum studies and an emphatic insistence on their importance for preserving the material heritage of the sciences.<sup>8</sup> These changing perceptions towards the end of the 20th century have both theoretical and institutional implications. On a theoretical level, the rediscovery of scientific collections as material heritage of the sciences has been based on an acknowledgment of the dynamic character of their functions. Even if collections lose their original functions within a specific disciplinary context they gain new importance in other areas such as history of science that warrant their preservation. On the institutional level, this process comes with recognition of their often fragile place at universities and with attempts to make scientific objects accessible for research in the history of science. We will consider both aspects in the following sections.

## II. Archives of Scientific Practice

Despite the all too common institutional marginalization of university collections during the second half of the 20th century, a reconsideration of scientific collections and objects is apparent in the history of science at least since the 1980’s. On the one hand, this revived interest is reflected by a rapidly growing literature on the history of collections and museums<sup>9</sup>, on scientific objects<sup>10</sup> and on material culture in general<sup>11</sup>. On the other hand, this development has also led to creation of journals and societies that are devoted to scientific collections and their objects.<sup>12</sup>

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<sup>8</sup> Alan WARHURST, “Triple Crisis in University Museums”, *Museums Journal* 86, no. 3 (1986): 137–140 and Frank WILLET, “The Crisis in University Museums in Scotland”, *Museums Journal* 86, no. 3, (1986), 141–4. For a more recent account see Rex DALTON, “Natural history collections in crisis as funding is slashed.” *Nature*, 423, 2003, 575.

<sup>9</sup>e.g. Oliver IMPEY and Arthur MACGREGOR (eds.), *The Origins of Museums*, Oxford, 1985.

<sup>10</sup> e.g. Anthony TURNER, *Early Scientific Instruments: Europe, 1400-1800*, London, 1987; Soraya DE CHADAREVIA and Nick HOPWOOD (eds.), *Models: The Third Dimension of Science*, Stanford, 2004; Lorraine DASTON, *Things That Talk: Object Lessons from Art and Science*, Cambridge, Mass., 2007.

<sup>11</sup> e.g. Steven D. LUBAR and David KINGERY, *History from Things: Essays on Material Culture*, Washington DC, 1993.

<sup>12</sup>e.g. “International Committee for University Museums and Collections” (founded 2001) and “Scientific

Arguably, these developments have to be understood in the context of broader issues in the history of science as an academic discipline. Where history of science was traditionally often exclusively understood as a history of scientific theories, historians towards the end of the 20th century increasingly stressed the need for a more inclusive approach that looks beyond the published sources by engaging with the experimental systems and the material basis of science in general. The academic identity of history of science changed by not only aiming at an understanding of the theoretical knowledge of the sciences but also of the practices that produce this knowledge and their entanglement with broader aesthetic, economic, intellectual and political issues.

The shift from a narrow focus on scientific theories to scientific practice in general is by no means limited to historical research but can be found in all disciplines of the science and technology studies.<sup>13</sup> For example, the discussion about scientific practice has been deeply influenced by research in the laboratory studies such as Latour and Woolgar's *Laboratory Life* (1979) or Knorr-Cetina's *The Manufacture of Knowledge* (1981) and by developments in philosophy of science such as such as Ian Hacking's *Representing and Intervening* (1983). Contrary to anthropologists, sociologists, and philosophers of science, however, historians are in the unfortunate situation that they cannot observe the scientific practice they are concerned with. Furthermore, traditional sources of historians of science - books, journals, and archives of written sources - are typically concerned with the theoretical knowledge which makes the historical reconstruction of scientific practice an often tremendously difficult task.

Given this situation, it is not surprising that university collections become increasingly recognized in the history of science as they can serve as important archives of scientific practice that hold primary sources which would remain inaccessible in an exclusive focus on written sources. On the one hand, collections as a whole often document the changing interests and complex interactions of research, teaching, and the public presentation of science. By engaging with their founding histories, functions, and transformations, historians have access to a rich resource of the material basis of the sciences. On the other hand, every individual object in university collections has its own

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Instrument Society" (founded 1983). Both societies publish journals: *Bulletin of the Scientific Instrument Society* and the *University Museums and Collections Journal*. Furthermore, the *Journal of the History of Collections* (founded 1989) has played an important role in putting collections on the agenda of historians of science.

<sup>13</sup> For this process in the science and technology studies in general, see Andrew PICKERING's highly influential anthology *Science as Practice and Culture*, Chicago Press, 1992.

biography<sup>14</sup> which connects to its uses in experimental systems as instruments or objects of inquiry, in academic teaching, and in broader cultural contexts such as public museums or world fairs. The objects tell stories about issues such as the interests and indifferences of scientists, changing aesthetic standards, the emergence of new disciplines, the global trade of scientific objects, the decline of old research programs, the standardization of scientific knowledge for academic teaching, or the strategies of public presentation of science.<sup>15</sup>

University collections have the potential of serving as important archives of scientific practice that provide information which would not be accessible given an exclusive focus on written sources. Of course, this characterization should not be misunderstood as a simple dichotomy of university collections as archives of scientific practices and libraries as archives of theoretical knowledge. Written resources clearly often provide detailed information on scientific practice in experiment descriptions, textbooks, discussions of methodology, personal letters, inventories of collections and so on. However, even without oversimplified dichotomies, it seems reasonable to stress the distinct potential of university collections for understanding of the history of scientific practice. Unfortunately, this potential often remains untapped due to institutional hurdles that we will address in the next section.

### III. Meeting the Institutional Challenges

While there can be little doubt about the historical significance of university collections, important challenges remain with respect to their use in the history of science. Some of these challenges arise due to historians' unfamiliarity with material objects as primary sources. As Kingery puts it: "Learning from things requires rather more attention than reading texts and the grammar of things is related to, but more complex and difficult to decipher than, the grammar of words."<sup>16</sup> Other problems are connected to the fragile institutional position of scientific collections in general and

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<sup>14</sup>Lorraine DASTON(ed.), *Biographies of Scientific Objects*, Chicago, 2000.

<sup>15</sup>For an exemplary discussion of the different function of scientific objects see David LUDWIG, "Mediating Objects. Scientific and Public Functions of Models in Nineteenth-Century Biology", *History and Philosophy of the Life Sciences*, 35 (2013), 139-166.

<sup>16</sup>W. D. KIGERY (ed.), *Learning from things. Method and theory of material culture studies*, Washington DC, 1996.



university collections in particular.<sup>17</sup> As most university collections were founded to meet specific non-historical needs in research and teaching, they often remain located within departments that do not utilize them anymore. Sometimes, this creates an existential threat to collections in situations where a department moves into a new building or wants to use the space for a new laboratory or a new classroom. And even if a collection is not threatened in its existence, it still often remains largely invisible as no department member has the necessary interest or knowledge to document the collection or to make it accessible to external scholars.

In order to successfully use university collections in historical research, several institutional steps are necessary. First, it is of crucial importance to document university collections and scientific objects. Second, it is necessary that universities become aware of the potential of their collections and ensure their preservation. Third, university collections have to move beyond only preserving objects by seeking an active role as research infrastructures.<sup>18</sup> Often, university libraries can serve as role models as it has become common for them to seek an active role in the digitalization, organization, and presentation of knowledge that clearly reaches beyond preservation in the narrow sense. In the following, we will use the example of recent developments in Germany to outline how these challenges can be met.

In 2004, the Helmholtz-Zentrum für Kulturtechnik at Humboldt Universität Berlin started a project to document university collections in Germany.<sup>19</sup> The collaborative work in this multi-year project has so far led to the documentation of 1116 collections at German universities of which 809 still exist.<sup>20</sup> The presentation of these results in an open access online database allows historians of science for the first time to search specific kinds of collections along their research interests such as specific disciplines, universities, and time periods. The collection and preservation of this data is a first step in making collections accessible as it was until recently very common that German universities did not even have an overview of their own collections. While an overview of university collections is a first and indispensable step, it does not solve the problem that individual scientific objects often remain poorly documented and virtually

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<sup>17</sup>e. g. Jane WEEKS “The loneliness of the university museum curator”, *Museum International* 52(2), 2000, 10-14 and Peter STANBURY, “University museums and collections”, *Museum International* 52(2), 2000, 4-9.

<sup>18</sup>cf. Peter STROHSCHNEIDER, “Faszinationskraft der Dinge. Über Sammlung, Forschung und Universität”, *Denkströme. Journal der Sächsischen Akademie der Wissenschaften*, 8, 2012, pp. 9-26.

<sup>19</sup><http://universitaetssammlungen.de>

<sup>20</sup><http://universitaetssammlungen.de/dokumentation/statistik>



inaccessible to interested scholars. Since 2010, the Helmholtz Center has taken a further step with the documentation of individual scientific objects through a pilot project that focuses on scientific models. Currently, the online database allows research on 2570 material models and their histories.<sup>21</sup> Documenting objects in collaborative online databases provides a highly effective strategy of meeting the challenge that scientific objects are often scattered over a large number of small collections that are difficult to access.

While the documentation and digital presentation of collections and scientific objects is clearly an attractive way of making collections accessible for historical research, it is also extraordinarily time consuming. Unfortunately, most small collections have no resources to undertake documentation or even digital presentation projects. In 2012, the Federal Ministry of Education and Research in Germany decided to tackle this problem with the creation of a coordination center whose task it is to make university collections visible and accessible for research.<sup>22</sup> On the one hand, the goal of the project is to build a network of university collections that provides the basis for mutual support and also allows smaller collections without many resources to establish themselves with a clear-defined role at universities. On the other hand, the project also aims at a digital information system that makes decentrally collected data and research accessible through a general portal for university collections in Germany.

Clearly, the institutional situations vary between universities, countries, and continents and approaches that have proven effective in Germany may not work everywhere. The database of the International Committee for University Museums and Collections (UMAC) provides some preliminary clues about differences in documentation.<sup>23</sup> For example, the UMAC-database includes 854 collections in Germany compared to 62 collections in Spain due to different states of documentation.

Furthermore, there are considerable differences within countries as different universities pay attention to their collections to different degrees. Often, individual universities start programs that largely increase the visibility of their collections while the collections of other nearby universities remain largely invisible. Examples of

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<sup>21</sup>[http://universitaetssammlungen.de/modelle\\_](http://universitaetssammlungen.de/modelle_)

<sup>22</sup><http://wissenschaftliche-sammlungen.de/en> cf. Cornelia WEBER, "Recent recommendations by the German Council of Science and Humanities on scientific collections as research infrastructures. A report", *University Museums and Collections Journal* 5, 2012, pp. 95-99.

<sup>23</sup><http://publicus.culture.hu-berlin.de/collections/>

universities with well-documented collections include McGill University<sup>24</sup>, the Universidade de Lisboa<sup>25</sup>, the Universiteit Gent<sup>26</sup>, or the Universidad Nacional de Córdoba that started a program in 2008 to “propende a desarrollar e incentivar las áreas de preservación de las colecciones, la investigación sobre los temas que son de competencia de los museos, la exhibición de su patrimonio, la realización de acciones educativas no formales, y toda otra actividad pertinente a las funciones museológicas universitarias.”<sup>27</sup> While initiatives at individual universities are of great importance, it is usually also necessary to provide support on a more general (e.g. national) level to ensure preservation and documentation.

While the state of documentation varies from university to university and country to country, the challenges of insufficient funding and limited expertise in documentation and presentation are ubiquitous in all contexts. The example of German university collections can therefore show possible steps in meeting the institutional challenge of transforming university collections into accessible archives of scientific practice.

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<sup>24</sup>cf. <http://www.mcgill.ca/historicalcollections/>

<sup>25</sup>e.g. Ana Mehnert PASCOAL, Catarina TEIXEIRA, & Marta C. LOURENCO, *The University of Lisbon's cultural heritage survey (2010–2011)*, 5, 2012, 101-110.

<sup>26</sup>e.g. Dominik VERSCHELDE & Dominique ADRIAENS, “Past and current identity of the Zoology Museum of Ghent University”, *UMAC-Journal*, 5, 2012, 39-46.

<sup>27</sup><http://www.unc.edu.ar/investigacion/cienciaytecnologia/museos-de-la-universidad-nacional-de-cordoba>