HERBARIUM

1921–2017

The University of Michigan Herbarium (UMH) is the third-largest university herbarium in North America. It provides stewardship of 1.75 million plant and fungal specimens, including twenty-three thousand type specimens (the designated specimens used in describing new taxa).[1] UMH has globally important collections of lichens, bryophytes (mosses), ferns, marine algae, fungi, and seed plants. It contains complete representation of the Michigan flora and unparalleled collections of taxa from tropical America and elsewhere.

BUILDING OF THE COLLECTIONS, 1837–81

Provisions for the first "collection of specimens" of the University of Michigan were made in 1837, months after the state of Michigan and the U-M Ann Arbor campus were established. Following Regent Henry Schoolcraft's request to build museum cabinets on the new campus, the university received specimens from about nine hundred plant species collected on the Geological Survey led by Douglass Houghton, beginning in 1837 (see Caple and Williams, this volume).[2]

The regents signaled their commitment to botany by hiring Asa Gray as the first U-M professor in 1838, although ultimately Gray's contributions were only symbolic. Because he was hired before the campus had buildings or students, Gray was granted a paid leave of absence in 1839 and $5,000 to acquire books in Europe for the U-M library. In May 1842, with the campus still under construction, Gray moved to Harvard, where he became the most renowned botanist in American history.

Abram Sager, botanist on the Geological Survey, was appointed Gray's successor as professor of botany and zoology in 1842, a position he accepted without a regular salary until he began teaching the university's first courses in botany in 1845.[3] Although Sager resigned in 1855 to become professor of obstetrics and physiology, his interest in plants continued. In 1866, he donated his private collection of twelve hundred species to the university.[4]

Sager's replacement, Alexander Winchell (1855–73), had transferred from physics and civil engineering. As professor of geology, zoology, and botany and curator of the University Museum, Winchell improved the administration of the museum's collections and incorporated specimen-based laboratory sessions into his botany courses.[5]

Mark W. Harrington and Joseph Beal Steere were promising undergraduate students who worked in the museum under Winchell in 1868. Following his graduation, Steere traveled to the Amazon basin, Peruvian Andes, and South East Asia (1870–75) (see Barndt, this volume) where he collected 1,156 botanical specimens (mainly mosses and ferns). Harrington, appointed assistant curator of plants in 1869, was named assistant professor of geology, zoology, and botany in 1873—and charged with expanding the Herbarium. In 1876, he visited the Royal Botanical Gardens in Kew to complete the identification of Steere's fern collections, resulting in the university's first botanical publication.[6] Volney M. Spalding, another Winchell student, assumed Harrington's duties while Harrington was on leave in Europe and China, and succeeded him in 1877.[7]

INSTITUTIONALIZING THE COLLECTIONS, 1881–1920

In 1881, the regents decided that the professor of a subject should be the curator of the associated

collections in the University Museum. The first faculty-curators in the Department of Botany were plant ecologist Volney M. Spalding (1881–1904); Charles Albert Davis (1905–1908), an instructor in forestry with an interest in Michigan flora; and Forest Buffen H. Brown (1908–12), who studied floodplain vegetation in Ypsilanti, Michigan.

By 1912, the growth of the collections required some divisions of space and labor along taxonomic lines. The first division separated cryptogams (spore-producing ferns, fungi, mosses, lichens, and algae) from phanerogams (seed plants). Calvin Henry Kauffman (1912–21) became the first curator of the Cryptogamic Herbarium and Henry Allan Gleason (1912–19) the first curator of the Phanerogamic Herbarium. Both men made lasting contributions. Kauffman's 1918 publication, *Agaricaceae of Michigan*, was considered the most comprehensive treatment of North American Agaricaceae species to date. Gleason's alternative to Fredric Clements's 1916 climax theory of succession—later known as the individualist theory of plant succession—remains a fundamental idea in plant ecology.[8]

The Museum of Zoology also curated botanical specimens, creating its own herbarium in 1912. Its specimens came from the Michigan Biological Survey that had been initiated in 1904 and was led by Alexander Ruthven (see Miller, this volume). Charles Keene Dodge, who had been active in the botanical phase of the survey, contributed five thousand plant specimens and was given the nonsalaried title of associate curator of botany in the Museum of Zoology.[9] After his death in 1918, the university received an additional thirty-five thousand specimens from Dodge's estate.

1913 FIRE

In 1913, the main plant collections were housed in the Botanical Laboratory on the fourth floor of the south wing of historic University Hall, with some collections stored in bundles in the attic. A building fire—at a time when water lines on campus had been closed off for repair—destroyed all the bundled specimens and damaged many of the fourth floor specimens. Because there were no specimen catalogs at that time, it is not known exactly how many specimens were lost. Historical specimens in UMH that exhibit water or smoke stains serve as a reminder of this disastrous event.

Fig. 102. One of 80,000 UMH marine algae specimen that was digitized as part of an NSF initiative (www.macroalgae.org).

UNIVERSITY OF MICHIGAN HERBARIUM, 1921–2017

In 1921, the Phanerogam, Cryptogam, and Museum of Zoology herbaria were united into the newly established University of Michigan Herbarium. UMH had its own budget and its director reported to the president. Thus it had the administrative rank of a school or college within the university. This changed in 1956 when UMH was incorporated into the College of Literature, Science and the Arts (LSA), taking on a rank akin

to a college department. In 2011, UMH became a unit within the Department of Ecology and Evolutionary Biology.

Since their beginnings, the Herbarium's collections have had several homes. Following their initial placement in a professor's house in the 1830s, the collections were moved to Mason Hall (1841), the south wing of University Hall (1891), and the Natural Science (Kraus) Building (1915). In 1928, the Herbarium relocated to the University Museums Building. Due to its burgeoning growth, substantial parts of the collections were moved to the Museum Annex in 1947, but space was still insufficient. With support from the National Science Foundation, the Herbarium moved to the North University Building in 1960, where it remained until the building was razed in 2002.

As a temporary provision in 2001, LSA moved the Herbarium to a warehouse on Varsity Drive, about six miles south of campus. By 2010, it became clear that this location would be permanent and the other natural history collections—the Museums of Zoology, Paleontology, and Anthropological Archaeology—will soon join UMH in the renovated facility, renamed the Research Museums Center (RMC). At that point (expected in 2017), the natural history research museums will be reunited for the first time in seventy years, though in an off-campus location isolated from daily interactions on central campus.

THE BARTLETT COLLECTIONS

An important contributor to the explosive growth of the collections was Harley Bartlett, an unsalaried curator and director of the Matthaei Botanical Garden (see Michener and Reznicek, this volume). In 1957, Bartlett donated his personal collection of nearly five hundred thousand specimens to UMH, almost doubling the size of the collection and changing "the Herbarium from a medium-sized and mostly locally oriented institution to a large and more diversified one, with interests in many parts of the world."[10] Included in the Bartlett donation were the important Asian collections of Walter Koelz and Rup Chand (see Sinopoli, this volume). The full assimilation of the Bartlett material was completed only in 1990.

Transfer to LSA Administration

The Herbarium's transfer to LSA in 1956 provided greater accessibility to graduate students.[11] Between 1950 and 1970, approximately one-third of all PhD graduates in botany had a UMH faculty-curator as a major advisor. The Herbarium's curators (who had joint faculty appointments in the Department of Botany) provided first-rate graduate training in plant systematics. In 1974, UMH was ranked one of the top three herbaria in the United States, alongside the New York and Missouri botanical gardens.[12]

RESEARCH AND COLLECTIONS

The Herbarium's collections are organized into five collection types: fungi, algae, bryophytes and lichens, ferns, and vascular plants. Of these, vascular plants count for by far the largest portion of the collection (1.1 million of 1.7 million specimens). At different periods, each of these groups has had associated faculty-curators.[13] All areas of the collections are used in ongoing research projects and of tremendous scientific importance.

Fungi (280,000 Specimens)

The world-class fungal collections of UMH are due in large part to U-M's leadership in the field of mycology. Notably, mycologists directed the Herbarium for its first seventy-five years.[14] Calvin Kauffman's work (director from 1921–30) built up collections of mushrooms of the Great Lakes region, but he also collected across North America and internationally. Kauffman's student Edwin Mains (director from 1930–59) studied North American rust fungi (Pucciniomycetes) and earth tongues (Geoglossaceae). In collaboration with C. L. Lundell, Mains also documented fungi from rain forest in British Honduras (now Belize). Bessie Benice Kanouse was appointed as curator of Fungi in 1926 and worked in close association

Fig. 103. Students work on backlog of 30,000 unmounted plant specimens and learn botany fundamentals.

with Mains. Alexander Smith (director from 1959–72), a student of Kauffman and Mains, was a leading expert in mushrooms, puffballs, and boletes. Smith contributed an astounding ninety-two thousand specimens to UMH and wrote the popular *Mushroom Hunter's Field Guide*, which has sold over one hundred thousand copies since its first publication in 1958.

Robert Lynn Shaffer joined Smith as curator of Fungi (1960–93) and directed UMH from 1975–86. He was a leading expert in the systematics of *Russula*, a large and difficult genus of fleshy fungi. Robert Fogel (curator of Fungi, 1978–2003) studied truffles and initiated an online catalog of UMH fungal specimens. Presently, Curator Timothy James (since 2009) holds the Wehmeyer Chair in the Taxonomy of Fungi. In addition to his research on parasitic fungi, fungal genomics, and the phylogeny of basal fungal lineages, James oversees specimen digitization, teaching, and public outreach regarding fungal biology. Collection manager Patricia Rogers, who also manages lichens and bryophyte collections, assists James with fungal specimen curation.

Algae (96,000 Specimens)

The first curator of Algae (nonsalaried) was William Randolph Taylor (1930–66). Taylor studied marine algae from the Pacific and Atlantic basins. He was part of the "Crossroads" atomic project of the US Navy, which performed biological surveys before and following nuclear bomb testing. UMH maintains these collections, including a type specimen collected in 1946 on Elugelab before the island was bombed back into the sea. Following his death, a colleague wrote, "Taylor's death marks the end of an era when a single individual could be an authority of entire phyla of organisms from all parts of the world."[15] Michael Wynne was appointed curator of Algae in 1978 (until 2007). During his career, Wynne described a total of twenty-nine new genera and ninety-two new species of marine algae from around the world. Wynne recently participated in an NSF digitization project to publish eighty thousand UMH macroalgal specimen images and data online.[16]

Bryophytes (163,000 Specimens) and Lichens (57,000 Specimens)

A major boost to the lichen collection was the 1929 purchase, with financial help from Dr. Howard A. Kelley, of the lichen library and herbarium of Professor Bruce Fink of Miami University. Fink's herbarium was rich in types and historical collections. William Campbell Steere, the grandson of Joseph Beal Steere, became first curator of Bryophytes (1945–50) and is credited with transforming bryology from an amateur hobby to a biological profession in North America. Howard Alvin Crum, a doctoral and postdoctoral student

with Steere, was appointed curator of Bryophytes and Lichens from 1965 to 1995; his crowning achievement was the two-volume *Mosses of Eastern North America* (1981) written with Lewis E. Anderson.

Ferns (90,000 Specimens)

UMH has an exceptional worldwide collection of ferns dating to the 1870s Steere collections. Warren Herbert Wagner Jr. was appointed curator of Pteridophytes (nonsalaried) in 1961. Although his academic home was the Department of Botany, Wagner was an important ally of UMH, bringing it attention, graduate students, and collections. Wagner's greatest contribution to the Herbarium was his role in acquiring the fern collection of Professor E. B. Copeland, which contained an inordinate number of type specimens; he was also instrumental in obtaining the collections of the American Fern Society. His wife, Florence Wagner, a research scientist in the Herbarium, studies fern evolution through the lens of cytology.

Vascular Plants (1,100,000 Specimens)

The vascular plant collection is the largest in the Herbarium, and the focus of most of our curators, research scientists, and collection managers. John Henry Ehlers, a botany instructor with interest in Michigan flora, was named curator of Phanerogams from 1916 to 1939. In 1934, U-M established an agreement with the Carnegie Institute to perform a biological survey of the Mayan area of Central America. As a result, UMH hired Cyrus Longworth Lundell in 1934. In addition to botany, Lundell had interests in Mayan culture and archeology. During an aerial survey in 1931, he had discovered a lost Mayan city, which he named Calakmul; it was the first of sixteen Mayan sites he would discover. Lundell named 450 plant species from Guatemala, including ancestors of squash, cacao, pinto beans, and other crop plants. Lundell succeeded Ehlers in 1939 (until 1944) as curator of Phanerogams and Ferns.

Elzada Clover was another colorful historical figure associated with UMH. Having received her PhD from U-M Department of Botany, Clover was appointed assistant curator at the Botanical Gardens and assistant professor in botany in 1935. She was among the first botanists to catalog plants in the Grand Canyon along the Colorado River—and she and U-M teaching assistant Lois Jotter were the first women to raft the entire length of the Grand Canyon. Clover's cacti collections, which include type specimens, were an important contribution to UMH.

Rogers McVaugh, appointed curator of Vascular Plants in 1946 (until 1979), was renowned for his work with neotropical plant groups, especially the flora of western Mexico. His collaboration with former student William R. Anderson culminated in the eight-volume series *Flora Novo-Galiciana* covering a large portion of western Mexico. Largely because of McVaugh's efforts, UMH has arguably the best collection of Mexican vascular plants outside Mexico.

Edward Groesbeck Voss, a McVaugh student, was hired in 1955 to work on the *Flora of Michigan*, on which he spent the next forty years. He was appointed as curator in Vascular Plants in 1960. In 1972, the Michigan senate passed a resolution to honor Voss for the publication of the first volume of *Michigan Flora*. The second volume was honored with the Henry Gleason Award from the New York Botanical Garden. The third (and final) volume was published in 1996.

William R. Anderson was appointed as associate curator of Vascular Plants in 1974 (until 2002) and served as UMH director from 1986 to 1999. Anderson specialized in the tropical family Malpighiaceae. His wife, Christiane Anderson, was appointed assistant research scientist in 1979 and worked on the same family. The Andersons' research and collections extended the strengths of UMH more firmly into tropical South America.

Anton A. Reznicek joined the Herbarium as an assistant curator in 1978 and is currently the sole full-time curatorial appointment in the unit. He is a sedge specialist and U-M's foremost expert on Michigan flora. Richard K. Rabeler joined the staff as an adjunct research investigator and collection manager in 1987. His research focuses on systematics of the Caryophyllaceae.

Fig. 104. This 1905 specimen of Clavaris fusiformis is one of over 200,000 digitized UMH fungal collections. This specimen was photographed beside its field notebook entry and an H. V. Kriegel painting of the fresh specimen.

In 2005, Christopher W. Dick was appointed assistant curator of Vascular Plants; he advances biogeographic research in Central and South American forests. Paul E. Berry was appointed as curator in 2006 and served as director from 2006 to 2015. Berry edited the eight-volume *Flora of the Venezuelan Guayana*, and his current research focuses on the hyper-diverse genera *Croton* and *Euphorbia*. Dick took over the role of director in 2015 and will likely be the last UMH director, given that UMH and UMMZ are anticipated to merge under a single directorship in 2017.

MICHIGAN FLORA OUTREACH

Botanical clubs and volunteers from Ann Arbor have been closely associated with the U-M col-

lections since its inception. Alexander Winchell, in his report on Michigan flora in 1861, acknowledged the contributions of Mary H. Clark, who had developed an herbarium associated with a seminary for young ladies. Mark Harrington recognized volunteer work of Ann Arbor citizens in the 1870s. The tradition of engaging the public in education and botanical exploration continues to this day. Anton Reznicek, while writing the *Manual of the Michigan Flora* with Ed Voss, established the Michigan Flora website,[17] which features continuously updated information on Michigan's nearly three thousand native and introduced vascular plant species. Reznicek and Collections Manager Beverly Walters have vetted thousands of plant photos for the site, and they have solicited thousands of specimens from citizen botanists that have extended range limit data for many Michigan species.

The current faculty and staff look forward to continuing the tradition of public engagement, stewardship, and primary research into the plants and fungi of Michigan and the Great Lakes region.

Fig. 105. 1914 specimen of balsam willow (Salix pyrifolia) from the herbarium of C. K. Dodge.

UMH IN THE TWENTY-FIRST CENTURY

By the year 2000, UMH had accumulated an enormous wealth of specimens numbering approximately 1.75 million. However, basic data associated with these specimens were largely hidden from the outside world. Few specimens were data based, and even this scant information (with the exception of some fungal collections) was not available online.

UMH began specimen digitization efforts (imaging, transcribing label information, assigning geographic coordinates) on its extensive (>23,000) type collections in 2011 with funding from the Mellon Foundation. Since then, the National Science Foundation has supported UMH with seven awards for specimen digitization. These projects have focused on macroalgae, lichens and bryophytes, micro- and macrofungi, and select vascular plant groups. UMH has completely digitized and published data online for more than five hundred thousand specimens. These specimen data are the foundation of research in systematics and macroecology as well as for conservation, education, and public outreach. Our institutional goal is to database the entire collection. This will allow the public, and future curators, to better understand and explore our collections, their usage and scientific value, and target collections for future research.

The unification of the research museums at the RMC will create many opportunities for collaboration. For example, with the establishment of a molecular genetics lab, students and postdocs will be able to study genomes of any of the millions of plant, fungal, and animal specimens under our stewardship. A micro-CT scan facility will enable researchers to examine the internal structures of fossils, woody fruits, and dried flowers. A newly established liquid nitrogen facility will enable us to curate tissue samples and DNA. This will provide U-M researchers with opportunities to study bio-

logical diversity using genomic or transcriptomic (expressed gene) data sets.

The Herbarium will continue to train the next generation of biodiversity scientists by offering undergraduate internships and graduate student curatorial assistant (GSCA) scholarships. These opportunities introduce students to the fascinating history, diversity, and research potential of the U-M natural history collections.

Entry prepared by Christopher W. Dick.

3600 Varsity Drive. The Herbarium can be visited by appointment.

https://www.lsa.umich.edu/herb

Notes

1. The following account does not include all of the many individuals who have contributed to the growth of the Herbarium, nor does it mention many important specimen acquisitions. For more detailed period histories, see Mains for 1837–1954, McVaugh and Shaffer for 1940–74, and Berry for 1974–2013.
2. Mains, 1442. Schoolcraft and Houghton had taken part in other expeditions in the Great Lakes region. Houghton, Abram Sager, and John Wright who accompanied Houghton on the First Geological Survey of Michigan as zoologist and botanist had all studied under botanist Amos Eaton at the Rensselaer Institute.
3. Mains, 494.
4. See Winchell, 7. No specimens from the Sager collection seem to have survived. Sager's herbarium may have been destroyed in the 1913 fire of the first University Museum, otherwise lost, or deaccessioned.
5. Mains, 495–96.
6. See Harrington.
7. Harrington's expertise and research interests included astronomy, and after his resignation he became a professor of mathematics and astronomy in China. When he returned to U-M in 1879, the university named him professor of astronomy and director of the Detroit Observatory. See Mains, 497.
8. Gleason never did enjoy fame as an ecologist. He left Michigan in 1919 to focus on his taxonomic interests at the New York Botanical Garden
9. Mains 1447–48. After Dodge's death in 1918, Ruthven appointed Cecil Billington honorary curator of this collection until 1921.
10. McVaugh and Shaffer.
11. Ibid.
12. Ibid.
13. In 2016, the Herbarium had two faculty-curators (Berry and Dick), two research scientists (Rabeler and Anderson), and one full curator (Reznicek) working on vascular plants; one faculty curator (James) works on fungi.
14. The mycologists who directed UMH were Calvin Henry Kauffman, 1921–30; Edwin Butterworth Mains, 1930–59; Alexander Hanchett Smith, 1959–72; and Robert Lynn Shaffer, 1975–86.
15. Hillis.
16. See www.macroalgae.org
17. See http://michiganflora.net

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