

# BULLETIN

of the  
Hunt Institute  
for Botanical Documentation

Carnegie Mellon University, Pittsburgh, Pennsylvania

Vol. 9 No. 2 Spring 1995

## "NATURAL-HISTORY PAINTINGS FROM RAJASTHAN" AND UPCOMING EXHIBITIONS

In 1980 the Hunt Institute borrowed from four London institutions botanical paintings by Indian artists who had worked under English patronage during the late 18th and early 19th centuries. More recently the Institute participated in Carnegie Mellon University's International Festival by devoting one-half of our gallery to contemporary Indian artworks from our collection. The last issue of our journal *Huntia* contained the first of a number of articles on various aspects of Indian art. The subject of one such article, by S. P. Verma of Aligarh Muslim University, is the famous painting of a tulip by Ustad Mansur, ca. 1613.

The Institute's "Natural-history paintings from Rajasthan" exhibition attests to our continuing interest in Indian art. On display from 17 November 1994 until 24 February 1995, the exhibition featured 97 artworks by six artists from the desert state in northwest

ern India. From the city of Jaipur were Damodar Lal Gurjar, Jaggu Prasad, brothers Ramesh and Suresh Sharma and Vijay Kumar. From the city of Bikaner was Mahaveer Swami, who visited the Institute, through the generosity and cooperation of India's Ministry of Culture and the Indo-U.S. Subcommission on Education and Culture, to demonstrate his traditional technique of miniature painting at the time of our exhibition opening. He showed examples of the old paper on which he prefers to paint and also his variety of natural pigments, including various stones, minerals, gums, plant products, lamp black, and gold and silver leaf. Particularly interesting were the artist's samples of mercury for red, cow urine for bright yellow and indigo for blue. He uses gum arabic to bind the pigments, which he mixes in conveniently shaped clam shells. The week following his visit to the Institute, Swami repeated his presentation at the Arthur M. Sackler Gallery, Smithsonian Institution, Washington, D.C.

The Rajasthani exhibition artists chose as their subjects a lively assortment of flowers, fruits, still-lives, bonsai, birds, animals, elephant and camel fights, and interesting figures, such as a Sufi calligrapher with cat, a prince with his dog and a princess with a black buck. Swami's delicate artworks in particular invited close examination. Upon viewing some of them through a magnifying glass, *Pittsburgh Post-Gazette* art critic Donald Miller, in his 18 November 1994 review, wrote that "the paintings take on an intensive life. They are extraordinarily detailed. What appears to be stippling is carefully applied brush touches and the finest of lines in compositions built up, not from pencil sketches, but brush sketches of the total composition."

A 46-page catalogue with color reproductions contains several essays on various as-

pects of Rajasthani art and culture (see "Recent publications," p. 11). The catalogue was made possible with generous donations from Peoples Travel Agency, Harish Saluja and Sri Venkateswara Temple, all in Pittsburgh; Julia Bell Fine Gift & Stationery Products (Newton, Massachusetts); and other benefactors.

A very interesting aspect of the exhibition centered around the copying of artworks and photographs. The history of Mughal and Rajput art is replete with references to copying. Artworks were kept in families not only for decorative or aesthetic purposes but also for the instruction of future generations of artists. Artists working under the Mughal Emperors Akbar (reigned 1556-1605) and Jahangir (r. 1605-1627) frequently copied works from old masters and even European prints. Tracing in the emperors' workshops was done not only for study but to meet the great demand for copies of popular subjects. For the exhibition the Institute has matted two pages of photomechanical reproductions from books with the corresponding Indian artworks they inspired — one of a bonsai of Japanese red pine and the other of a snakebird or water turkey. If the paintings

[Please see "Exhibitions," p. 2]



Watercolor "Grasshopper and butterfly on hibiscus" after a Chinese drawing, ca. 1807, by Vijay Kumar Sharma

### IN THIS ISSUE

Exhibitions .....	1-2
Bukovnik exhibition .....	3
Delectus Huntiana .....	4-5, 10
Notes from the field .....	6-7
Flora of North America .....	8-9
Lawrence Award .....	11
Recent publications .....	11



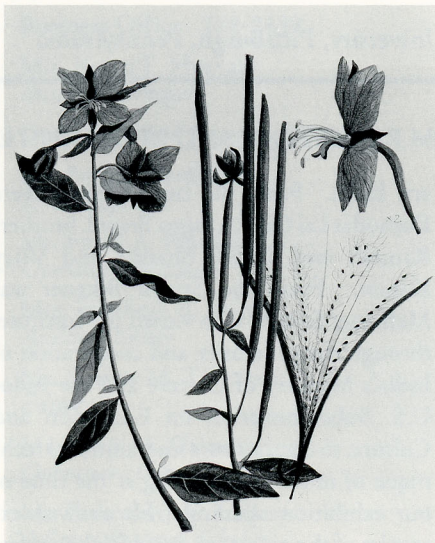
## EXHIBITIONS (CONT.)

seem to be short on originality, the technique is superb. In other instances a large contemporary French oil painting of a bouquet and an early Dutch (?) painting of livestock have, in Indian hands, been transformed into miniature paintings on wooden panels. Additional inspirations for artworks in this exhibition include a stipple engraving of a Redouté rose, a Chinese painting of a hibiscus and grasshopper, fruits from books by contemporary artists and traditional themes of decorative flowers, a runaway buffalo and animal fights.

A reduced version of "Natural-history paintings from Rajasthan" was displayed at Wave Hill, a 28-acre public garden overlooking the Hudson River and palisades in the north-west Bronx, New York, from April to May 1995.

From April to 14 July 1995 the Institute will display 55 botanical watercolors by British artists Dr. Andrew P. Brown and John Wilkinson. The 20 watercolors by botanist Andrew Brown (1948- ), a graduate of Oxford University and Cambridge University and a teacher at Westminster School, London, were prepared from drawings of wildflowers made during the Westminster School 1985 Expedition to the Gates of the Arctic National Park in the Brooks Range of Alaska. The collection was shown two years later at the Linnean Society of London. The 35 artworks by John Wilkinson (1934- ) are the originals of his illustrations for *Collins handbook to trees of Britain and Europe* (Lon-

don, 1978), with text by Alan Mitchell. The paintings include trees that can be seen in the woods, forests, hedges, parks, gardens and town streets of the British Isles and northern Europe. Wilkinson has held a number of one-man exhibitions in London. He has also



*Epilobium latifolium* by Andrew Brown

illustrated guides to mushrooms and toadstools, butterflies and moths, and the countryside. Both artists have won medals for their watercolors from the Royal Horticultural Society, London.

An exhibition of artworks by San Francisco painter Gary Bukovnik is being organized for 21 August through 22 October 1995. In November the Institute will present its 8th International Exhibition of Botanical Art & Illustration, at which time the catalogues

from the eight Internationals will list at least 1,685 artworks by over 700 artists. In 1996 the Institute will exhibit the original paintings by Raymond Booth for his and Don Elick's *Japonica magnifica* (the exhibition made possible by PaineWebber Group Inc.), and selections from the impressive collection of contemporary botanical artworks acquired by Dr. Shirley Sherwood of London.

The Institute has added four new exhibitions to its travel show program: "Orchids from the Hunt Institute collection" (based on our 1990-1991 exhibition), "Pretty deadly: Poisonous plants of forest, field and garden" (based on our 1991 collaborative exhibition at The Carnegie Museum of Natural History in Pittsburgh), "Ensigns of the rainbow goddess: Artworks of Iris from the Hunt Institute collection" (based on our 1993-1994 exhibition) and "Cacti by Peter Liska." We continue to circulate "Marilena Pištola: Botanical watercolors," "Flora portrayed: Classics of botanical art from the Hunt Institute collection" and "Orchids from the Hunt Institute collection" will be on display at the American Museum of Natural History in New York from late June through the end of 1995.

—James J. White

## BULLETIN OF THE HUNT INSTITUTE FOR BOTANICAL DOCUMENTATION

Carnegie Mellon University  
5000 Forbes Avenue  
Pittsburgh, Pennsylvania 15213-3890

Editor: Sharon M. Tomasic  
Designer: Autumn M. Farole  
Photographer: Frank A. Reynolds

Published biannually by the Institute.  
Subscription rates: U.S. \$4.00 per volume; elsewhere \$5.00, airmail \$6.00. Hunt Institute Associates receive the *Bulletin* as a benefit of membership.

All correspondence regarding subscriptions, missing issues, and announcements for publication in the *Bulletin* should be directed to the editor.

The *Bulletin* does not publish book reviews. Books for review in the Institute's journal, *Huntia*, should be directed to Ms. Charlotte Tancin, its book reviews and announcements editor, at the Institute.

©1995 by the Hunt Institute for Botanical Documentation. All rights reserved.  
ISSN 0192-3641.



## INSTITUTE WELCOMES NEW STAFF MEMBER

We are pleased to announce that Stephanie L. Dickey joined the Institute staff in January 1995 as office assistant. A graduate of Brashear High School, Ms. Dickey worked for Carnegie Mellon University and Kelly Temporary Services and was employed by Mellon Bank as an operations clerk before coming to the Institute. Ms. Dickey will be responsible for providing clerical and secretarial support to the Institute's administration and staff.



## Gary Bukovnik: Watercolors and Monoprints

21 August through 22 October 1995

*New work from his recent exhibition at the Jakopič Gallery in Ljubljana, Slovenia, will be presented in a collaborative exhibition at the Hunt Institute and Concept Art Gallery*

Cleveland-born and -educated Gary Bukovnik is a Slovene-American artist who has lived in San Francisco for 20 years. The "Watercolors and Monoprints" exhibition, recently exhibited at the Jakopič Gallery in Ljubljana, Slovenia, was organized by Slovenska Izselsjenska Matica, a government agency that maintains ties with Slovene immigrants and people of Slovene descent in order to promote cultural exchange.

In selecting flowers as his principal subject, Bukovnik expresses his ardent and long-term artistic interest in flowers and blooming plants. Brooklyn Museum curator Barry Walker has remarked that Bukovnik "has taken from the past what he could use and filtered it through a twentieth-century sensibility. In the process, he has redefined the way we look at flowers." Although he uses several media, including lithography and aquatint, he primarily works in watercolor and monotype. Bukovnik creates floral images of great depth and intensity. Hunt Institute curator James White suggests that in a Bukovnik watercolor one may see "both delicate and strong lines used to rough in the composition, brilliant color, large scale, and sometimes an interesting container (or more often a simple glass of water), usually set against a deliberate absence of background. In some of his compositions, the space left unpainted is as important as that painted. Bukovnik's intention is to have his images appear easily drawn, never labored. His work is romantic, emotional, and intense." Judith Gordon, in an opening essay for the 1990 book *Flowers: Gary Bukovnik watercolors and monotypes*, has hailed Bukovnik's paintings as "the work of an artist who is as well-acquainted with the form of flowers as with their spirit."

Bukovnik's artwork is represented in diverse private, corporate, and public collections, including those of the H. J. Heinz Com-



"Wildflowers II," watercolor, 1993

pany, Citibank, Atlanta Botanical Garden, the Smithsonian Institution, and the Metropolitan Museum of Art, as well as Hunt Institute, and has been featured in numerous one-person and group exhibitions in this country and in Europe. He also donates his art to community and civic organizations such as the San Francisco Symphony.

Gary Bukovnik will present a watercolor demonstration at Concept Art Gallery on Saturday, 16 September 1995, at 10:00 a.m. Concept Art Gallery is located at 1031 S.

Braddock Avenue in Pittsburgh. The gallery hours are Tuesday through Saturday from 10:00 a.m. to 5:30 p.m., Thursday from 10:00 a.m. to 8:00 p.m. and Sunday from 12:00 p.m. to 5:00 p.m. Please contact Concept Art Gallery at (412) 242-9200 for details on the watercolor demonstration.

The Hunt Institute gallery is open Monday through Friday from 9:00 a.m. to 12:00 p.m. and 1:00 p.m. to 5:00 p.m. For more information on this exhibition, phone the Hunt Institute at (412) 268-2434.



## DELECTUS HUNTIANA 16: AN ORIGINAL TURPIN DRAWING

Filling a gap in its collection of botanical art, the Institute in 1988 acquired its first original drawing, in pencil and wash, by noted French botanist and botanical artist Pierre Jean François Turpin (1775-1840). Signed "Turpin del." at lower left, with the number 105 pencilled at top right, it is titled "Lotus sericea." Inscribed on the reverse is "Bon à être gravé. Vu en comm<sup>on</sup> le 20 juin 1808. Beretrollet." *Dorycnium hirsutum* (L.) Sér. is the scientific name of the plant depicted.

Responding to my query that perhaps the drawing might be associated with other originals or with published plates in the Muséum National d'Histoire Naturelle, Paris, botanists Alicia Lourteig and G. Aymonin extensively searched the herbaria and library, but did not locate an exact match. Presumably our drawing had not been reproduced until it was published (reversed) on page 208 of the new edition of Blunt and Stearn's *The art of botanical illustration* (1994). Mr. Aymonin reported that the plant depicted, a European species, was identifiable as a cultivated plant since it is a reduced, low-growing plant with tufted inflorescence.

At the time we acquired this drawing, we selected from a group including three others by Turpin ("Centaurea alexandriera," "Fucus denticulatus" and "Rottbolla hirsuta"); two by C. G. Sauvage ("Artemisia judaica" [see reproduction of drawing, labelled an engraving, on page 352 of Elisabeth Hardouin-Fugier and Etienne Grafe's *French flower painters of the 19th century*] and "Artemisia quadriflosculosa"); and one by Pancrace Bessa ("Trayalus"), all in a similar size and style and inscribed and dated 1808 or 1809 on the reverse.

We note few other extant paintings by Turpin:

- (1) There is a large number of artworks in the library of the Muséum National d'Histoire Naturelle.
- (2) The Lindley Library of the Royal Horticultural Society possesses the originals for Poiret and Turpin's *Leçons de flore*, 1819-1820, and also a volume of 25 paintings on vellum, reported by Alice Coats in *The treasury of flowers* to be mostly of the Ranunculaceae. Coats reproduces *Anemone pavonina* in her book and Blunt reproduces

*Helleborus niger* (Christmas rose) in *The art of botanical illustration*.

- (3) The Broughton Collection at Fitzwilliam Museum at University of Cambridge possesses an album of original paintings for von Humboldt and Bonpland's *Monographie des Melastomacées*, 1816-1823.

- (4) Some years ago we learned that two additional melastome paintings, reported to be the originals for plates 39 and 49 of the monograph cited above, were included in a private collection in North America.

- (5) A reprint of Blunt's *The art of botanical illustration* (1955) under "Third Edition: Additional Notes" revealed that "the original drawings for F. P. Chaumeton's *Flore médicale*, by P. J. F. Turpin and Mme. E. Panckoucke, are in the possession of Nada Kramar, Booksellers, of Washington, D.C." This bookstore closed long ago.

- (6) In 1983 Eyre & Hobhouse (London) reproduced Turpin's *Nelumbo nucifera* (lotus or lily of the Nile) in its sale catalogue titled *The discovery of nature*.

- (7) Item 92 in The Grolier Club's *Plant illustration before 1850* (1941) is an original William Bartram drawing for Benjamin Smith Barton's *Elements of botany...* (1803). The entry contains the following note: "accompanied by other drawings for the work by Bartram and Turpin, and a copperplate by Turpin with drawing and proof." The anonymous owner undoubtedly was a member of either The Garden Club of America or The Grolier Club.

- (8) The Barton-Delafield Collection in the The American Philosophical Society, Philadelphia, contains about 50 sketches, watercolors and plates by Turpin. A pen, black ink and color wash of "*Dracontium fatidum*"



Pencil drawing of *Dorycnium hirsutum* (L.) Sér. by Pierre Jean François Turpin.

and a watercolor of "*Magnolia acuminata*" are reproduced on pages 42 and 111, respectively, of Madeleine Pinault's *The painter as naturalist from Dürer to Redouté* (Paris, 1991).

Turpin was joined by Pierre-Antoine Poiteau (1766-1854), also a well-known French botanist and botanical artist, to collaborate "in some of the most important botanical publications of the early years of the nineteenth century, notably those of von Humboldt, Bonpland and Kunth," according to Wilfrid Blunt. Blunt referred to Turpin as "possibly the greatest natural genius of all the French botanical painters of his day."

The Institute is maintaining a database of information on original botanical art and welcomes additional information about either the location of Turpin artworks or, in fact, any botanical artworks.

In addition to the references listed for Turpin in Stafleu and Cowan's *Taxonomic literature* (second edition), we add the following:

American Philosophical Society. J. S. Catlett, ed. 1987. *A new guide to the collections in the Library of the American Philosophical Society*. Philadelphia [See #71 Barton-Delafield Col-



lection], pp. 20-21.

Cardew, F. 1953. A note on Poirer and [Pierre J. F.] Turpin's "Leçons de Flore." *J. Roy. Hort. Soc.* 78: 293-294 [On a copy of the book with original paintings by Turpin].

Champigneulle, B. 1957. *P. J. F. Turpin: Blüten und Früchte*. Eingeleitet von B. Champigneulle. Baden Baden. 12 pp. & 13 pl. (col.). [Reproductions of Turpin's plates. Another ed., *P.-J.-F. Turpin: Fleurs et fruits*. Introduction by de B. Champigneulle. Paris, Arts et Métiers Graphiques. 12 pp. & 12 [sic] pl. (col.).]

Elliott, B. 1991. Artist with an eye for detail: [Pierre J. F.] Turpin and Poirer's "Leçons de Flore." Brent Elliott's treasures of the Lindley Library. *Garden* (London 1975+) 116(5): 232-235.

Plantefol, L. 1970. Critique expérimentale d'une gravure de P. J. F. Turpin (1830). Quelques faits relatifs à la pomme de terre, développée à partir de la graine. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Paris 271D: 1481-1486.

Plantefol, L. 1970. Sur une belle et énigmatique gravure consacrée à la germination de la pomme de terre à partir de la graine et signée Turpin 1818. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Paris 270D: 2145-2150.

Plantefol, L. 1970. Sur l'utilisation ultérieure d'une gravure critiquable donnée par P. J. F. Turpin en 1830. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Paris 270D: 2735-2740.

My appreciation to Alicia Lourteig and G. Aymonin of the Muséum National d'Histoire Naturelle, Paris; Roger Polhill (Royal Botanic Gardens, Kew) for identification of the plant subject; Timothy T. Wilson, manuscripts processor, and Beth Carroll-Horrocks, manuscript librarian, at the American Philosophical Society in Philadelphia; Velva E. Rudd (Reseda, California), William F. Grant (McGill University) and C. Clara Heyn (The Hebrew University of Jerusalem) for helpful comments; and Peter Goldblatt (Missouri Botanical Garden) and Dieter Wasshausen (Smithsonian Institution) for their assistance.

—James J. White

## Ex Libris Carnegie Mellon

Fine reproductions of historic images on hand-laid paper



*Ex Libris Carnegie Mellon* is a limited-edition portfolio of 12 frameable reproductions of decorative images selected from distinguished illustrated works of history, science and technology in the collections of the Hunt Institute for Botanical Documentation and the University Libraries at Carnegie Mellon University.

The *Ex Libris* edition is restricted to 350 numbered sets. The images are printed in black with crimson ruled borders. Four of the plates measure

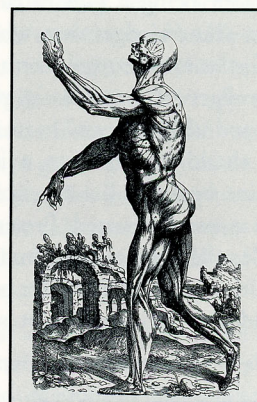
21" in height by 15"; the eight others are 15" by 10". Each interleaved set of plates is protected by a handsome portfolio, and an elegant title page provides citations for each of the images.

The 100% rag paper was hand-laid in the late 1950s by J. Barcham Greene & Son at the Hayle Mill in Maidenstone, Kent, England. It was commissioned by Rachel McMasters Miller Hunt, founder of the Hunt Institute, and bears a custom watermark. The paper is acid-free and will not become brittle or darken with age.

The *Ex Libris* portfolio is priced at \$700, plus \$12 shipping and handling. (Pennsylvania residents must add 7% sales tax.) To receive a packet of further information, including sample images and details on available arrangements for interest-free deferred monthly payments

by credit card, please write or call the Hunt Institute, Carnegie Mellon University, Pittsburgh, PA 15213; (412) 268-2434.

Checks and Visa, MasterCard, and American Express are accepted for payment. To place an order by mail, send your name, complete shipping address, phone number, and either a check payable to Carnegie Mellon University or your credit card information (name on card, account number, expiration date, and signature) to: *Ex Libris*, Hunt Library, Carnegie Mellon University, Pittsburgh, PA 15213. To place a credit card order by telephone, contact the Hunt Institute at (412) 268-2434. Please allow three weeks for delivery.





## Notes from the field:

### THOUGHTS ON PRESERVATION AND ACCESS

In the course of my work at the Institute, I have become increasingly interested in the preservation of collections as both a form of asset management and a way to provide ongoing access to collection materials. Although it is a vital aspect of collection management for all types of collections, the importance of preservation is still not universally recognized, and as a term it is often confused with "conservation" and relegated to the rarefied world of rare books and art objects. In recent years librarians and archivists have tended to use preservation as an umbrella term to refer to all of the activities aimed at preventing deterioration of collection materials, with conservation used as a more specific term to refer to treatments aimed at correcting specific effects of deterioration.

One of my primary aims as librarian of the Hunt Institute has been to work to preserve our library collection in good condition and yet continue to make it accessible to researchers. There is a motto in the library-science field these days that reflects this paradoxical ideal: "Preservation is access." Far from being a glib catch phrase, this motto acknowledges that, while "preservation" in its most extreme form would maintain collection materials in perfect condition, and while "access" in its most extreme form would destroy them, a librarian walks the line between these concepts and sees them as interconnected. Preservation efforts enable collections to be maintained in usable condition, and the desire for ongoing access provides the rationale for preservation.

While it is extremely important to maintain collections such as those at the Hunt Institute in good condition according to accepted preservation principles, there is no point in locking the books away in an ivory tower and swallowing the key, and this has been recognized from the earliest days of Hunt Botanical Library and its founding by Rachel McMasters Miller Hunt. In a "Memorandum of Objectives" signed by Mr. and Mrs. Hunt and quoted on the first page of the decennial report of the Hunt Botanical Library there is this statement: "Through the work of its staff, and of persons attracted to its facilities, there should be ample opportunity for this Library to become an institution

recognized not only for the excellence of its collections, but equally so for the center it surely will become in the field of bibliographic research and service." The ongoing effort to fulfill this purpose is reflected in the Library's mission statement: "To identify, acquire, conserve, catalogue, and otherwise provide access to published materials relating to botany and its history, with an emphasis on systematics."

Mrs. Hunt's core collection included many books which have what is referred to in the preservation field as "artifactual value," that is, they are important as objects in their own right and not just for the information they



These copies of Linnaeus' *Systema naturae*, Miller's *Gardener's dictionary* and Parkinson's *Theatrum botanicum* all exhibit "artifactual value," not only because of specific characteristics of text, paper or bindings but also because they are first editions of significant publications in the history of botany.

contain. The library also contains many newer acquisitions that do not have artifactual value, and such value is one factor considered when we provide material for research use. Naturally we want to preserve artifactual books in as good condition as possible, and so we limit the amount of handling such items receive. We do try to provide access to the contents of our collections whenever possible, whether through direct use, mediated use, provision of reprints or other reproductions, or reference service. When we are unable to provide what is requested, we typically refer the researcher to another library or information source.

Knowing that materials must be well cared

for in order to remain accessible, I returned to library school in 1989 when the University of Pittsburgh offered its first full course in preservation of library and archival materials, taught by Sally Buchanan, a nationally and internationally known expert in the preservation field. It is only fairly recently that such courses are appearing as regular features of library-school curricula. In part this may be due to the fact that aging and accelerating deterioration of collections, and particularly of the books and papers in libraries and archives, have become a widely recognized reality worldwide. In reaction to these growing problems, preservation experts are working to communicate knowledge of basic preservation issues widely in an effort to build up and distribute the expertise necessary to address the problem. Dr. Buchanan's basic preservation course (now expanded to several courses as part of an integrated Book Arts program focusing on rare books, special collections and archival studies) was an example of this effort.

These courses have radically changed my perspective on librarianship. My basic knowledge of preservation issues expanded as I learned about the many things that can be done to prevent, retard or stop the effects of deterioration, so that those of us who care for collections do not have to just sit by and watch it happen, powerless to intervene. Beyond that, there are exciting developments in the preservation field, such as mass deacidification and digitizing, which offer new possibilities for preserving and making accessible the materials in our collections.

Of course, Hunt Institute has a tradition of preservation awareness and good collection care. We work to maintain and develop our collections and look for new ways to make them accessible to researchers and others with an interest in plants and plant science. This is a major part of what we do, and much of it involves preservation in one way or another, because the only way to keep the collections accessible is to do whatever we can to preserve them.

The library collection is a good example of this. Environment and storage conditions are carefully controlled. To maintain an environment conducive to the preservation of the collection, we monitor and control temperature, humidity, air circulation and light. The temperature in the library is



maintained as consistently as possible under 70° Fahrenheit, with a relative humidity between 40% and 50% fluctuating no more than  $\pm 2\%$ . Particulate filters over the central air vents filter out particulate pollution without affecting air circulation, and ultraviolet (UV) filters have been installed on the lights in the main stack area of the library to reduce damage from overexposure to light. Books are shelved properly and the stacks are cleaned regularly by our housekeeping staff. Currently items requiring conservation attention are either "phase-boxed" (i.e., each book is placed in a special, wraparound enclosure to reduce stress from shelving and handling) or relocated to a holding area pending repair or other conservation treatment. Notes on their condition are entered into a machine-readable file maintained for the purpose of keeping track of conservation problems, which allows us to identify items listed as having specific types of problems or needing specific types of treatment.

In addition to controlling how the books are stored and maintained, we pay close attention to how they are used. Visitors who come to use the library are instructed in careful handling and supervised throughout their visit. Some examples of our rules for use of the collection are: only pencils may be used for notetaking (although laptop computers are now permitted — a rule update is in order!);

no large bags or cases are allowed in the reference area; and photocopying, when permitted, is done by the librarians. A sheet listing these and other rules for use of the library is read and signed by first-time users of the library as an agreement to these

---

*Preservation efforts enable collections to be maintained in usable condition, and the desire for ongoing access provides the rationale for preservation*

---

conditions. We have a closed-stack arrangement for access, which means that library users do not have free access to the shelves but instead the materials they require are retrieved by the librarians. This reduces wear and tear, prevents misshelving, and minimizes security risks. In the case of rare books, we also minimize wear and tear and maximize security by acquiring reprints (sometimes facsimile reprints) of historically significant botanical works when possible, which in many cases can be consulted by library users in place of the original publications with no loss of information or compromise of scholarly value.

In addition to on-site reference and research, some collection use involves library users only indirectly. One example of such indirect use is the reference queries we receive by mail, telephone, fax and electronic mail. Another example is the reproduction of images from books in the library. In both of these cases requests are received from people who have no opportunity to visit the library and so request these services from a distance. Interest in images from our collections has increased in recent years, and the librarians and the Institute's photographer work closely together to ensure that, when images are provided, books are photographed in a non-damaging manner.

Photocopying has become a fact of life in libraries, but it is also a prime cause of book damage. In recognition of this, we provide photocopies when we can, but only if we can do so without damaging or endangering the item in question. We receive many interlibrary loan requests for photocopies, and when we decline to copy we check to see if the requester has access to copies in other institutions. If the Institute appears to be the only known possibility for a particular request, we qualify our refusal with an offer to try to assist the person to get the requested information in another way. Occasionally we will provide transcripts of brief passages from folios, or we might try to find another library which has a microfilm copy of the book in question from which the requester might be able to get a hard copy made. If he or she is unable to visit the library to consult the book in person, Assistant Librarian Sarah Leroy and I also offer the possibility of doing whatever research is needed.

These are just a few examples of the many preservation-related concerns which are a daily part of our work here. As time goes on and as proliferating collection materials all over the world continue to deteriorate, preservation will become even more critical for collection-holding institutions. Those of us who have become active in the effort to prevent or retard deterioration of collection materials recognize that nothing lasts forever, and that the best we can do is to take appropriate care of our collections and continue to look for ways to make our materials accessible into the future.

— Charlotte A. Tancin



The Institute's library can provide access to Basil Besler's *Hortus Eystettensis*, the catalogue of plants growing in the garden of the Bishop of Eichstätt in the 17th century, in three different forms: the original publication, a reprinted edition, and a recent study of the work which includes a survey of extant colored copies.



## MONUMENTAL *FLORA OF NORTH AMERICA* PROJECT ACHIEVES GOAL OF CONTINENTAL FLORA

One of botany's long-cherished but so-far elusive objectives has been a comprehensive account of the native and naturalized plants of the North American continent. European botanists, drawing on the floristic discoveries of the explorers, were the first to chronicle the plant life of North America. Throughout the nineteenth and twentieth centuries, American and Canadian botanists were successful in producing regional floras, treatises, and monographs, but many species and geographical areas remained poorly known.

North American botanists' efforts to produce a comprehensive flora of their own continent foundered; John Torrey and Asa Gray were the first to attempt this ambitious feat, but they published only one volume, in 1838. Other botanists' subsequent efforts were less productive for various reasons, lack of funding being a common hindrance. Because of North America's geological history, diverse topography, and range of climates, its flora is remarkably rich and interesting: 38% of the genera native to the area are found only in North America, and an additional 18% are confined to the Western Hemisphere. The lack of a continental flora has been an impediment not only to studies of North American plants themselves but also to understanding the worldwide patterns of botanical diversity.

The need for a North American flora has persisted, and even intensified, in the modern era, because of increased floristic research and widespread concern about the impact that human activities are having on the environment. Meanwhile, although plants are sources of food, animal habitats, medicine, fibers, and industrial materials, many species of flowering plants have never been evaluated for potential use. Because living species are being obliterated from our planet at a rate that far exceeds that of dinosaur extinction, there is a growing realization that we must conserve our rapidly dwindling resources and use them more wisely, and likewise there is a need to guide development activities and direct conservation efforts according to sound information about plant resources.

With the publication of the first two volumes of *Flora of North America* in the fall of 1993, the long-awaited synthesis of defini-

tive scientific information on the vascular plants and bryophytes of North America is now becoming a reality. Until now, no single work has systematically surveyed the more than 20,000 plant species, or about 7% of the world's total, that are known to grow in North America. The Hunt Institute is very pleased to have been instrumental in organizing this major effort by the North American botanical community. At a meeting in 1982 at the Missouri Botanical Garden, the Institute and the Carnegie Museum

---

*Until now, no single work has systematically surveyed the more than 20,000 plant species, or about 7% of the world's total, that are known to grow in North America*

---

in Pittsburgh proposed to botanists from institutions throughout the U.S. and Canada a plan to form a consortium that would provide the apparatus necessary to coordinate preparation of a continental flora. The ensuing *Flora of North America* project is a collaborative, bi-national effort of over 30 U.S. and Canadian institutions and hundreds of botanists. The *Flora* draws on the expertise of U.S. and Canadian botanists and of other specialists from the systematic botanical community worldwide. The project's Organizational Center is at the Missouri Botanical Garden in St. Louis, and the Hunt Institute serves as its Bibliographic Center.

Volume 1 of the *Flora* contains introductory essays on climate, the history of vegetation, geology, expeditions and research, and classification systems. Volume 2 contains taxonomic treatments of the pteridophytes (ferns and fern-allies) and the gymnosperms (conifers and allies). When complete, the *Flora* will total 14 volumes, each with its own index and bibliography. Ten of the future volumes will be devoted to the angiosperms (flowering plants), one to the bryophytes

(mosses and liverworts), and a cumulative index and bibliography will appear as the final volume. The *Flora* is being published by Oxford University Press, and completion is expected in 2003. Supplementary funding for the project has been contributed by a number of foundations and agencies, including the National Science Foundation, the Pew Charitable Trusts, The Caleb C. and Julia W. Dula Foundation, The Surdna Foundation, The Robert and Lucile Packard Foundation, the National Fish and Wildlife Foundation, the ARCO Foundation, The William and Flora Hewlett Foundation, and the Andrew W. Mellon Foundation.

In preparing a flora, botanists survey and synthesize all that is known about the plant species of a region, to produce a concise summary of current knowledge. Unlike popular field guides, floras attempt to cover all plants found in their areas of coverage, not just the most common or conspicuous ones. *Flora of North America* covers North America north of Mexico, including the United States, Canada, Greenland, the St. Pierre and Miquelon islands, the Florida Keys, and the Aleutian islands. The *Flora* contains a full spectrum of critical botanical data, including identification keys, scientific and common names, synonyms, morphological descriptions, chromosome numbers, illustrations, distribution maps, summaries of habitat, phenology and geographical range, and literature references (see sample page illustration on next page).

The *Flora* distills the results of herbarium, laboratory, and field work, and integrates original research with critical literature studies. Where necessary, erroneous information is corrected, variant names are qualified, hybridizations are noted, and long-standing discrepancies and limitations in how plant scientists have described, named, and mapped North American plant species are resolved. Thus the *Flora* reconciles, revises and synthesizes information from thousands of monographs and regional and local floras that have been published over the last three centuries.

Although the basic form of floras has changed little over the centuries, modern ones like *Flora of North America* differ from their predecessors in that such contemporary works



increasingly are complemented by computer databases. The core data in the published *Flora* as well as large amounts of supplementary data are stored electronically in databases that are being developed as the printed volumes are prepared. These databases will be updated throughout and after the completion of the printed *Flora*. The project's main database is being compiled and maintained at the Missouri Botanical Garden. The Institute serves as the project's Bibliographic Center and is developing and maintaining

the *Flora's* bibliographic database. As bibliographic editor of the *Flora*, Institute Director Dr. Kiger builds and utilizes this database as he edits all manuscripts for bibliographic accuracy and consistency, and prepares the individual volume and cumulative bibliographies. As one of the project's taxon editors, he is also responsible for recruiting specialist contributors and peer reviewers for the families, genera and species in various portions of the taxonomic spectrum, and for editing the scientific content of those treat-

ments. In addition, the Institute supplied some of the botanical illustrations and portraits of botanists that were published in the introductory volume.

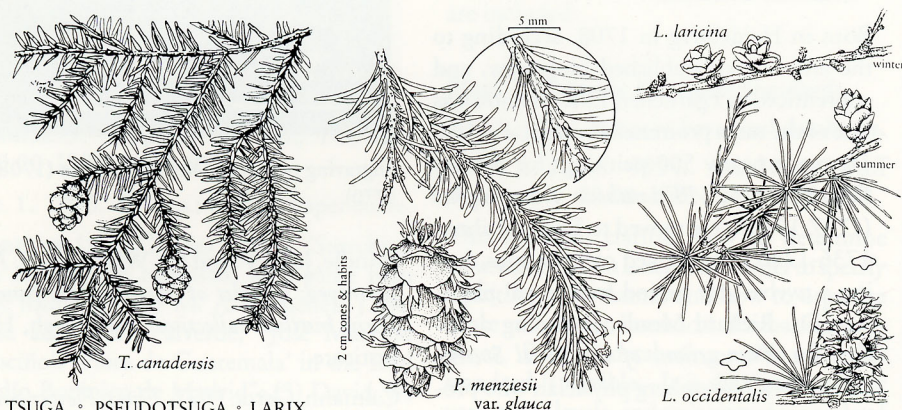
The *Flora of North America* will be an authoritative reference work for botanists and other plant-science professionals in horticulture, conservation, agriculture, and forestry. It will also be an invaluable resource for non-botanists, especially for individuals and agencies involved with environmental assessment, wildlife and natural-resource management,

and environmental law, as well as for zoologists, entomologists, medical researchers, and poison-control center personnel. The *Flora* also will provide essential data for identifying and protecting the 15% of the flora of the United States that is threatened with extinction. In order to determine whether a species is threatened or endangered, the federal and state governments as well as groups like the Center for Plant Conservation and the Nature Conservancy require reliable and thorough information about that species. Besides answering that need, the *Flora* also will constitute a single dependable source of information for developing effective plant-breeding programs, conducting biological weed control, and launching and administering other plant-management projects in the public and private sector alike. In sum, the *Flora* will be used by many different people and institutions for countless purposes as a tool for identifying, understanding and conserving North America's floristic heritage.

A page from volume 2 of *Flora of North America*, showing the entry for *Tsuga canadensis* (Eastern hemlock), the state tree of Pennsylvania. Reproduced with permission of the Flora of North America Organization.

364

PINACEAE · *Tsuga*



TSUGA · PSEUDOTSUGA · LARIX

Murray bis) Parlatore; *Tsuga crassifolia* Flous; *T. hookeriana* (A. Murray bis) Carrière; *T. pattoniana* (A. Murray bis) Engelm. var. *hookeriana* (A. Murray bis) Lemmon; × *Tsuga-Picea hookeriana* (A. Murray bis) M. Van Campo-Duplan & Gausson.

Trees to 40 m; trunk to 1.5 m diam.; crown conic. Bark charcoal gray to reddish brown, scaly and deeply fissured. Twigs yellow-brown, glabrous to densely pubescent. Buds oblong, 3–4 mm. Leaves 10–25(–30) mm, mostly spreading in all directions from twigs, curved toward twig apex, thickened centrally along midline, somewhat rounded or 4-angled in cross section, both surfaces glaucous, with ± inconspicuous stomatal bands; margins entire. Seed cones oblong-cylindric, 3–6 × 1.5–3 cm; scales broadly fan-shaped, 8–15 × 8–15 mm, apex rounded to pointed.  $2n = 24$ .

Coastal and montane forests to alpine slopes (where it occurs in krummholz form); 0–2400 m; B.C.; Alaska, Calif., Idaho, Mont., Nev., Oreg., Wash.

The wood of *Tsuga mertensiana* is somewhat inferior to that of western hemlock both for building purposes and as pulp. This is a very handsome tree with its branches densely clothed with pale, spreading leaves and is adaptable to a wide variety of climatic conditions.

M. Van Campo-Duplan and H. Gausson (1948) postulated that this taxon originated by hybridization between *Picea* and *Tsuga*. Although this is unlikely, some characteristics such as leaf arrangement and shape, phenolic chemistry, and pollen grain structure lend some support for this hypothesis.

### 3. *Tsuga canadensis* (Linnaeus) Carrière, Traité Gén.

Conif., 189. 1855 · Eastern hemlock, pruche du Canada *Pinus canadensis* Linnaeus, Sp. Pl. ed. 2, 2: 1471. 1763

Trees to 30 m; trunk to 1.5 m diam.; crown broadly conic. Bark brownish, scaly and fissured. Twigs yellow-brown, densely pubescent. Buds ovoid, 1.5–2.5 mm. Leaves (5–)15–20(–25) mm, mostly appearing 2-ranked, flattened; abaxial surface glaucous, with 2 broad, conspicuous stomatal bands, adaxial surface shiny green (yellow-green); margins minutely dentate, especially toward apex. Seed cones ovoid, 1.5–2.5 × 1–1.5 cm; scales ovate to cuneate, 8–12 × 7–10 mm, apex ± round, often projected outward.  $2n = 24$ .



Moist rocky ridges, ravines, and hillsides; 600–1800 m; N.B., N.S., Ont., P.E.I., Que.; Ala., Conn., Del., Ga., Ind., Ky., Maine, Md., Mass., Mich., Minn., N.H., N.J., N.Y., N.C., Ohio, Pa., R.I., S.C., Tenn., Vt., Va., W.Va., Wis.

Numerous cultivars of *Tsuga canadensis* have been developed, including compact shrubs, dwarfs, and graceful trees. Wood of the species tends to be brittle and inferior to that of the other North American hemlocks.

Eastern hemlock (*Tsuga canadensis*) is the state tree of Pennsylvania.



## DELECTUS HUNTIANA 17:

### PORTRAITS OF ARTISTS EHRET AND BESLER

Engraved portraits of two Germans, both well-known in the field of botanical art, have captured my interest. Working in different centuries, both impressively illustrated the plants in their patrons' gardens.

Basil Besler (1561-1629) was a Nürnberg pharmacist and the artist of the 374 engravings that depict more than 1,000 flowers in his *Hortus Eystettensis* (1613, 1640 and 1713). Besler's patron, the Prince Bishop of Eichstätt, funded production of the *Hortus* from 1595 to 1612. The original plates, made by at least six engravers, are in the university library at Erlangen.

The accompanying portrait is from an engraving in *Hortus Eystettensis*, courtesy of the Linnean Society, London. The inscription



Engraving of Basil Besler (1561-1629), courtesy of Linnean Society, London.

around the portrait, translated by Dan H. Nicolson (Smithsonian Institution), reads: "Basil Besler, Nurnberger, Lover of the pharmaceutic [and] chemical art. Matchless student of the plant kingdom. Age 51. 1612." The portrait also is reproduced in W. Junk (ed.), *Portraits of old botanists* (Berlin: W. Junk, 1926).

The appealing portrait of my favorite botanical artist, Georg Dionysius Ehret (1708-1770), is by A. Heckell, engraved by Johann Jacob Haid, and is from Christoph Jacob Trew's *Plantae selectae*. The portrait is a

mixed mezzotint, stipple and line engraving. Calmann notes that it must be a self-portrait because of the inscription on a similar ink and wash portrait in the print room of the Hamburg Kunsthalle. The inscription on the print is translated: "George Dionysius Ehret of Heidelberg in the Palatinate, member of the Imperial Academy of Naturalists and of the Royal Society of Science in London, botanist and painter of plants, born in January 1708." Ehret holds a magnolia (a rose, according to some) in his left hand; in the vase to his left is a specimen labeled "Gladiolus africanus."

Born in Heidelberg in 1708, according to the artist's own published biography, and apprenticed as a gardener, Ehret is known as one of the most prominent botanical artists. He made nearly 500 paintings for Johann Weinmann for *Phytanthoza Iconographia* (1737-1745). He moved to England about 1736-1740 and received commissions during a twelve-year period from royal physician Dr. Richard Meade, including drawings for *Transactions of the Royal Society*. Trew was a Nuremberg physician who produced two of the 18th century's most sumptuous botanical color-plate works, *Plantae selectae* (1750-1773) and *Hortus nitidissimus* (1768-1786), both containing reproductions of Ehret paintings. Carl Linnaeus' *Hortus Cliffortianus* (1737) with Ehret engravings was published by Clifford, a wealthy banker and a director of the Dutch East India Company, to provide an illustrated catalogue of the plants growing on his estate. Ehret was also associated with Bernard de Jussieu at the Jardin Royal des Plantes and with Sir Hans Sloane, founder of the British Museum and patron of the Chelsea Physic Garden. Countesses and duchesses were among his pupils. He was made a Fellow of the Royal Society (the only foreigner on the English list).

In addition to the references listed for Ehret in Stafleu and Cowan's *Taxonomic literature* (second edition), we add the following:

Blunt, Wilfrid. 1953. *Georg Dionysius Ehret. Twelve coloured reproductions of flowers from the original paintings on vellum in the V. & A. Museum*. With an introduction by W. Blunt. Guildford, C. W. Traylen. [8] pp. & 12 pl.



Engraving of Georg Dionysius Ehret (1708-1770).

Brindle, John V. and J. J. White. 1985. *Flora portrayed: Classics of botanical art from the Hunt Institute collection*. Pittsburgh, Hunt Institute.

Calmann, Gerta. 1977. *Ehret: Flower painter extraordinary*. Oxford. 160 pp.

Ehret, Georg D. 1896. A memoir of Georg Dionysius Ehret ... written by himself. *Proceedings, Linnean Society of London* 1894/95: 41-58.

Hunt Botanical Library. 1967. *An exhibition of botanical art and illustration by Lee Adams and Georg D. Ehret. 1 May-1 July 1967*. Pittsburgh, Hunt Botanical Library. 15 pp.

1988. *Reproductions of 40 water-colour drawings from the Museum's collection of more than 90, mostly dating from the 1740s*. New York, H. N. Abrams.

Victoria & Albert Museum. 1987. *Ehret's flowering plants*, by Gill Saunders. Exeter, Webb & Bower. 63 pp. incl. 40 pl. (col.).

White, J. J. (with the assistance of Elizabeth R. Smith). 1987. *Catalogue of the botanical art collection at the Hunt Institute. Part 2. Plant portraits, artists E-G*. Pittsburgh, Hunt Institute.

— James J. White



## RECENT PUBLICATIONS

### Catalogue of the botanical art collection at the Hunt Institute.

#### Part 5. Plant Portraits, Artists P-S.

Compiled by James J. White with the assistance of Elizabeth R. Smith.

1994. 248 pp.; frontis. Paper cover, \$16.00 ISBN 0-913196-42-8

A computer-based catalogue of the Institute's art collection, which includes over 30,000 original works — paintings (mostly watercolors), drawings and original prints — dating from the Renaissance onward. The main portion is arranged by the artists' surnames and will be followed by a comprehensive taxonomic index.

### Huntia.

#### A journal of botanical history.

Volume 9. Approx. 200 pp.; 1-3 nos., \$60.00 ISSN 0073-4071

No. 1. 1993. 101 pp.; 12 figs. Paper cover.

Contents: (1) E. Charles Nelson, "Searching the archives for botanists, with some Irish case histories"; (2) M. A. Giménez, J. M. Losa and J. L. Valverde, "José Mariano Mocino's 'Flora de Guatemala' in the Real Jardín Botánico de Madrid"; (3) David W. Altman, Paul A. Fryxell and Rosemary D. Harvey, "Sydney Cross Harland and Joseph B. Hutchinson: Pioneer botanists and geneticists defining relationships in the cotton genus"; (4) Francisco Pelayo and Ricardo Garilleti, "Spanish botany during the Age of Enlightenment: A. J. Cavanilles"; (5) James J. White and Gavin D. R. Bridson, "John

Laporte's *Characters of trees* (1795-1801)"; (6) Som Prakash Verma, "The tulip (ca. 1621): A study by Mansur"; (7) Carolyn Dodson, "Botanists of the Mexican-United States Boundary Survey"; (8) Book reviews and announcements.

### Natural-history paintings from Rajasthan.

By James J. White and Autumn M. Farole.

1994. 44 pp.; 48 figs. (25 col.). Pictorial stiff paper cover, \$5.00 ISBN 0-913196-61-4

Illustrated catalogue of an exhibition of paintings of flowers, fruit, still lifes, bonsai, animals, birds and figures by six artists from the state of Rajasthan in northwestern India. Biographical data and portraits of the artist are included.

### Plant Taxonomic Database Standards.

#### No. 3. Plant names in botanical databases.

Frank A. Bisby. 1994. viii, 30 pp. Stiff paper cover, \$8.00 ISBN 0-913196-62-2

This standard clarifies how to determine what information is needed in order to specify scientific plant names and how to organize those names for botanical databasing purposes. Because databasing needs vary, this standard is flexible. It is divided into four variants or levels, and so it provides a scale of options for rendering plant names according to the degree of specificity needed. It identifies the elements that need to be considered — taxa, name elements (species, species aggregate, intergeneric hybrids and graft chimaeras, interspecific hybrids and graft chimaeras, intraspecific categories, subspecies,

variety, cultivar), author strings, classes of names, and reference citations — and provides recommendations. This standard is useful for taxonomic reference databasing but may also meet the databasing needs of natural-history societies, nature reserves and conservation centers. Includes references and appendices.

### Register of Pennsylvania curators.

Compiled and edited by James J. White and Sharon M. Tomasik.

Published jointly by the Greater Pittsburgh Museum Council and the Hunt Institute.

1994. 74 pp. Pictorial stiff paper cover, \$2.50 ISBN 0-913196-59-2

Directory which contains information about 285 curators and their specialties and also includes indices by institution, city, county, and specialty. A useful reference source, the register is based on data from questionnaires received from curators working in museums, institutions of higher learning (public and private), historical societies, archives, historic gardens and arboreta, historic houses, and state government agencies.



**Hunt Institute publications** are available directly from the Institute. Hunt Institute Associates receive a 20% discount from regular list prices. Please direct queries to: Hunt Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213-3890; (412) 268-2434.

## LAWRENCE MEMORIAL AWARD:

### 1994 WINNER AND INVITATION FOR 1996 NOMINATIONS

Kathleen M. Pryer, at the Department of Botany, Duke University, received the 1994 Lawrence Memorial Award. A student of Dr. Brent D. Mishler, Ms. Pryer has undertaken a worldwide phylogenetic, systematic, biogeographic and developmental study of an evolutionarily crucial group of ferns, the Mersileaceae (water ferns). She will use the proceeds of the Award for travel in southern Africa for herbarium research.

Commemorating Dr. George H. M. Lawrence, founding director of the Hunt Institute, the biennial Award of \$1,000 is made to an outstanding doctoral candidate for travel in support of dissertation research

in systematic botany or horticulture, or the history of the plant sciences, including literature and exploration.

The Award Committee of the Lawrence Memorial Fund invites nominations for the 1996 Lawrence Memorial Award. Major professors are urged to nominate outstanding doctoral students who have achieved official candidacy for their degrees and will be conducting pertinent dissertation research that would benefit significantly from travel enabled by the Award. The Committee will not entertain direct applications. A student who wishes to be considered should arrange for nomination by his/her major professor;

this may take the form of a letter which covers supporting materials prepared by the nominee.

Supporting materials should describe briefly but clearly the candidate's program of research and how it would be significantly enhanced by travel that the Award would support. Letters of nomination and supporting materials, including seconding letters, should be received by the Committee no later than 1 May 1996 and should be directed to: Dr. R. W. Kiger, Hunt Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213-3890 USA. Tel. (412) 268-2434.



**HUNT INSTITUTE STAFF (1995)****Director's Office** (412) 268-2434

Dr. Robert W. Kiger  
*Director & Principal Research Scientist*

Dr. T. D. Jacobsen  
*Assistant Director & Principal Research Scientist*

Mrs. Donna M. Connelly  
*Administrative Assistant*

Ms. Stephanie L. Dickey  
*Office Assistant*

**Art** 268-2440

Mr. James J. White  
*Curator of Art & Principal Research Scholar*

Ms. Autumn M. Farole  
*Assistant Curator of Art*

Sr. Jaime Torner Pannochia (Barcelona)  
*Honorary Curator*

Sr. Luis Torner Pannochia (Barcelona)  
*Honorary Curator*

**Library** 268-2436

Ms. Charlotte A. Tancin  
*Librarian & Senior Research Scholar*

Ms. Sarah Y. Leroy  
*Assistant Librarian & Research Scholar*

**Bibliography** 268-2438

Mr. Gavin D. R. Bridson  
*Bibliographer & Principal Research Scholar*

**Archives** 268-2437

Mrs. Anita L. Karg  
*Archivist & Senior Research Scholar*

**Business Office** 268-2439

Mrs. Karen F. Hornak  
*Business Manager*

**Operations and General Program**

Ms. Bernice Poellnitz  
*Housekeeper*

Mr. Frank A. Reynolds  
*Operations Manager*

Mrs. Elizabeth R. Smith  
*Assistant Editor*

Ms. Sharon M. Tomasic  
*Editor*

Mr. Joseph A. Calcutta  
*Operations Consultant*

Ms. Bernadette G. Callery  
*Adjunct Research Scholar*

Dr. Gilbert S. Daniels  
*Adjunct Research Scientist*

Ms. Jean Gunner  
*Conservation Consultant*

Mr. Rob Roy Kelly  
*Design Consultant*

Dr. Frances B. King  
*Adjunct Research Scientist*

Dr. James E. King  
*Adjunct Research Scientist*

Dr. Edward P. Krenzelok  
*Adjunct Research Scientist*

Dr. Rogers McVaugh  
*Adjunct Research Scientist*

Dr. W. Ann Robinson  
*Adjunct Research Scientist*

Dr. Paul L. Schiff, Jr.  
*Adjunct Research Scientist*

Dr. Michael T. Stieber  
*Adjunct Research Scientist*

Dr. Sue A. Thompson  
*Adjunct Research Scientist*

Dr. Frederick H. Utech  
*Adjunct Research Scientist*

**HUNT INSTITUTE**

*Carnegie Mellon University*

*5000 Forbes Avenue*

*Pittsburgh, Pennsylvania 15213-3890*

Non- Profit Org.  
U.S. Postage  
PAID  
Pittsburgh, PA  
Permit No. 251