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Journal of the Canadian Association for Conservation (J. CAC), Volume 37

Journal de l'Association canadienne pour la conservation et la restauration (J. ACCR), Volume 37

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This article explores the evolution of scientific research and its impact on conservation at the National Gallery of Canada (NGC) as envisioned by Director Alan Jarvis and conservation scientist Nathan Stolow. Stolow's early interest in painting influenced him to pursue a career encompassing both painting and chemistry. This took him to the Courtauld Institute of Art at the University of London, England where he graduated in 1956 with a doctorate in art conservation. Before joining the Gallery in 1957, Stolow completed an international survey of gallery and museum laboratories, establishing contact with key players in conservation in Great Britain, Europe, the United States and Canada. The tour set the direction of conservation research at the Gallery. In 1957, Stolow established the Conservation and Scientific Research Division, which developed into the National Conservation Research Laboratory in 1964. Over the years at the NGC, Stolow contributed to and sponsored research in such diverse fields as the analysis of picture varnish and the effects of solvents on drying oil films, an early survey and analysis of contemporary artists' materials, art fraud, packing and transportation of works of art, the museum environment, and the scientific analysis of works of art. He advised on the conservation of modern and contemporary art, assisted in the design of the art display spaces for the Canadian Pavilion at Expo 67*, organized the cross-Canada exhibition* Progress in Conservation*, and published and lectured widely. With the federal government's announcement of a new Ottawa-based institute for conservation in 1972, Stolow left the Gallery and took up duties as founding Director of the Canadian Conservation Institute.*

Cet article examine l'évolution de la recherche scientifique et son impact sur la conservation à la Galerie nationale du Canada (GNC - maintenant le Musée des beaux-arts du Canada) tel que constaté par Alan Jarvis, directeur du Musée et Nathan Stolow, scientifique en conservation. L'intérêt précoce de Stolow envers la peinture l'a poussé à poursuivre une carrière englobant à la fois la peinture et la chimie. Cela l'a amené à la L'Institut Courtauld de l'Université de Londres, en Angleterre, où il a obtenu en 1956 un doctorat en conservation. Avant de rejoindre le GNC en 1957, Stolow a mené une enquête sur les laboratoires de musées de nombreux pays et a établi un réseau de contact avec les principaux intervenants de la conservation en Grande-Bretagne, en Europe, aux États-Unis et au Canada. Cette enquête a permis de définir la direction de la recherche en conservation au GNC. En 1957, Stolow a créé à la Galerie la Division de restauration et recherches scientifiques, renommé le Laboratoire national de recherches sur la conservation des œuvres d'art en 1964. Pendant sa carrière au GNC, Stolow a soutenu et a contribué à la recherche dans des domaines variés tels que l'analyse de vernis pour tableaux, les effets des solvants sur le séchage des films d'huile, l'analyse de matériaux utilisés par des artistes contemporains, la fraude en art, l'emballage et le transport des œuvres d'art, les conditions environnementales muséales ainsi que l'analyse scientifique des œuvres d'art. Il a fourni son expertise pour la conservation des œuvres d'art modernes et contemporaines et, lors de la conception des galeries d'exposition, pour le pavillon du Canada à Expo 67. *Il a organisé l'exposition itinérante au Canada* Progrès en conservation et en restauration*, a rédigé plusieurs publications et donné de nombreuses conférences. Lors de l'annonce du gouvernement fédéral d'un nouvel institut basé à Ottawa pour la conservation en 1972, Stolow a quitté le GNC pour devenir directeur fondateur de l'Institut canadien de conservation.*

Manuscript received April 2011; revised manuscript received April 2012

The National Gallery of Canada

The National Gallery of Canada (NGC) opened early in 1911 in the newly built Victoria Memorial Museum in Ottawa, and was officially inaugurated in 1913 with the passing of the National Gallery of Canada Act by Parliament. Under Eric Brown ($_{b.}$1877-$_{d.}$1939), its first director, the Gallery established a restoration Workshop for frames and paintings in 1912, supervised by George Harbour ($_{b.}$1871-$_{d.}$1964).[1,2] When Harbour was nearing retirement, he recommended that a museum assistant with a university science degree be appointed. This became a reality in 1938 when C. Mervyn Ruggles ($_{b.}$1921-$_{d.}$2001) was hired to train under Harbour. In 1939, Brown was replaced by H.O. McCurry ($_{b.}$1889-$_{d.}$1964) who retired in 1955. He was followed by Alan Jarvis ($_{b.}$1915-$_{d.}$1972), a charismatic Canadian who had lived in England for many years, a practising sculptor and the first Director at the Gallery to have studied the history of art, graduating from the Institute of Fine Art of New York University, New York.[3] It was Jarvis who hired Nathan Stolow in 1956 to be a scientific advisor and to complete a survey of British, European and American museum conservation laboratories.

In 1955, W.G. Constable had been asked by the Trustees to complete a sequel to his 1931 report on the Gallery's organization and functions. Formerly Assistant Director of the National Gallery, London, Constable was by then Curator of Paintings at the Museum of Fine Arts in Boston, Massachusetts and he was in a unique position to complete this second report,[4] having in-depth knowledge as a previous consultant to the Gallery. One of Constable's recommendations was

> that the National Gallery should establish as an integral part of its organization a scientific laboratory, primarily concerned with research into the physical character and structure of works of art and into investigation of the validity and value of methods of conservation and treatment. ... [S]uch a laboratory ... is an essential means of detecting fakes ... invaluable both to the curator and art historian. Such a laboratory does not exist in Canada.[5]

Nathan Stolow

Nathan Stolow's parents, Moses and Anna Stolow,[6] emigrated from Russia to Canada in 1926 to live in Montreal, Quebec. Stolow ($_{b.}$1928) began to paint in his childhood and followed an education in chemistry. The two fields were, at that time, largely distinct from each other, especially in North America. Undeterred, Stolow followed a profession that encompassed both. On graduating in 1949 with a B.Sc. from McGill University in Montreal, Stolow went on to study at the University of Toronto, graduating in 1952 with an M.A., his thesis *Theoretical Chemistry: Rare Earth Oxides Magneto Chemistry*. Stolow explored several career options whereby he could combine chemistry and art. One avenue led him to Rutherford J. Gettens ($_{b.}$1900-$_{d.}$1974), a chemist who had come from the Fogg Museum's Center for Conservation and Technical Studies at Harvard University, Cambridge, Massachusetts to the Freer Gallery of Art in Washington, D.C. Gettens suggested Stolow contact museum colleagues in Europe, where conservation activity was reasonably well established.[7] Gettens' advice led Stolow to Professor Stephen Rees-Jones ($_{b.}$1909-$_{d.}$1996) at the Courtauld Institute of Art, University of London, and to art historian Anthony Blunt ($_{b.}$1907-$_{d.}$1983) who – familiar with the Gallery as a consultant to its Board of Trustees – recommended that Stolow study at the Courtauld. Stolow graduated in 1956 with a Ph.D. related to "the picture cleaning problem,"[8] his dissertation entitled *Some investigations of the action of solvents on drying oil films*. He was offered the position of scientific advisor at the Gallery by Director Alan Jarvis, who was keen to establish

> a systematic documentation of the collection ... [through] his appointment of Nathan Stolow as Chief of Conservation and Scientific Research ... a Canadian with a Ph.D. in conservation from the University of London, [who] was encouraged to do research on the nature of artists' materials as well as to supervise the documentation of the physical state of the collections.[9]

International Survey Tour

Some years earlier, Directors Eric Brown and Harry McCurry had used monies provided by New York City's Carnegie Foundation to sponsor art-related projects, and to train Canadian museum professionals and a few individual scholars. Following this practice, Jarvis requested that residual funds from various Carnegie grants to the Gallery be amalgamated for the purpose of a six- to nine-month travel grant for Stolow to do "further practical study in continental galleries and museums ... and ... spend some months in the leading American fine arts museums which also have scientific departments," and then to set one up at the National Gallery. Florence Anderson, then secretary of the Carnegie Collections, New York, "enthusiastically" approved the plan outlined by Jarvis.[10]

Before he started in Ottawa, therefore, it was agreed that Stolow (**Figure 1**) complete a study of museum restoration laboratories at British, European, American and Canadian institutions. This he did between October 1956 and April 1957. Prior to the trip, Stolow met with Jarvis in his exclusive London club over a glass of sherry and was impressed with the civilized surroundings in which to discuss his upcoming museum tour and its significance for the Gallery.[11]

As the survey formed the foundation for much of Stolow's subsequent career and for his particular relationship with the international conservation community, it is presented here in some detail. Stolow's 1957 unpublished forty-five page report to Jarvis tabulating the results of his tour – "Summarized Information on the Conservation, Restoration and Technical Research Organizations of European and American Museums and Art Galleries: National Gallery Report" – has not surfaced at this time; however, Stolow's letters to Jarvis[12] provide considerable detail on his tour. The first part, from October to December 1956, included visits to museum restoration laboratories in Great Britain, France, Italy, Belgium, Germany and the Netherlands (**Table I**).

The second half of Stolow's survey (**Table II**) began in January of 1957 with a very brief visit to restorer John Muhl at the Montreal Museum of Fine Arts, Quebec. Stolow and his wife Sari then left for Boston, Massachusetts in early February. There he met W.G. Constable, who, as described in a letter to Jarvis,

> put [Stolow] in the way of meeting all the people here concerned with conservation and helped him map out a tour ... My favourable impression of him formed in London was very much confirmed ... I believe that you have got a first rate man for your purpose. ... Like all young men and especially young scientists, he perhaps does not give quite enough weight to experience and the empirical elements in

Figure 1. Nathan Stolow, at right, in front of *Abraham and the Three Angels*, 1674, oil on canvas, by Bartolomé Esteban Murillo, National Gallery of Canada, Acc. No. 4900, during the move of the collections in 1959. Credit: Rosemary Gilliat Eaton/Cole Harbour Rural Heritage Society, Cole Harbour, Nova Scotia/NGC 1959 Move; negative 252. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa.

Table I. Survey of British and European Art Galleries and Museums.
(Note: When known, the full name, honorific, job position and tombstone dates of the specialists noted below have been provided.)

Date	Institution	Contacts	Topics
October 1956	British Museum (BM), London, U.K.	**Dr. Harold Plenderleith** ($_{b.}$1898-$_{d.}$1997), Keeper of the Research Laboratory, 1924-1959 **Dr. A.E.A Werner** ($_{b.}$1911-$_{d.}$2006), Principal Scientific Officer, then Keeper of the Research Laboratory on retirement of Plenderleith in 1959	Discussions were held on conservation issues as applied to prints and drawings. Stolow noted various analytical processes, organic research and specialised apparatus. Werner discussed research on synthetic materials being considered for use in the conservation of paintings. The BM had close contact with the Paint Research Station at Teddington, London and certain industrial research organizations, a lead Stolow was to follow at the NGC when he submitted his research results to the British Standards Committee on Artists' Materials.
October 1956	The Tate Gallery, Millbank, London, U.K.	**Stefan Slabczynski**, Chief Restorer, established the Restoration Department in 1955	Discussion included documentation methods for reports on the examination, condition and treatment of works of art.
October 1956	The National Gallery (NGL), London, U.K.	**F. Ian G. Rawlins** ($_{b.}$1895-$_{d.}$1969), Deputy Keeper of the Scientific Department **Helmut Ruhemann** ($_{b.}$1891-$_{d.}$1973) **Arthur Lucas** ($_{b.}$1916-$_{d.}$1996), Chief Restorer **Garry Thomson** ($_{b.}$1925-$_{d.}$2007), Scientific Advisor **Joyce Plesters** ($_{b.}$1927-$_{d.}$1996), Microscopist **Norman Brommelle** ($_{b.}$1915-$_{d.}$1989) **Mr. Baxter**, Representative of Solus-Schall	Stolow visited the Scientific and Conservation Departments, studying the technical side of a large public picture gallery. He was shown various radiological equipment including easel and table x-ray units with a low voltage "Machlett" tube especially useful for thin paintings and watercolours (the construction of the15-20 kV x-ray unit was described to Stolow by Mr. Baxter of Solus-Schall); ultraviolet and infrared examination techniques were studied; layout of laboratories was noted. Reports were studied for collaboration between conservation and scientific departments. Lucas discussed cleaning, relining and treatment of supports. Material formulas of adhesives and of solvent mixtures and the layout of work areas were noted. Thomson discussed research into formulating varnishes, the action of solvents on old paint, the development of retouching media, and described inherent dangers of polymethacrylate type varnishes used in the U.S.A. Plesters discussed pigment analysis for authentication. Lighting and air conditioning in the NGL were observed, as much research had been done in this field. Like the British Museum, the NGL had close contact with the Paint and Research Station at Teddington, London and various industrial research organizations.
November 1956	Musées de France, Paris, France	**Georges Salles** ($_{b.}$1889-$_{d.}$1966), Director	They discussed various conservation equipment, processes and issues similar to those discussed in London.
October-November 1956	The Rijksmuseum, Amsterdam, the Netherlands	**Dr. A. van Schendel** ($_{b.}$1910-$_{d.}$1979), Director, Paintings Department **H. H. Mertens,** Chief Restorer **Messrs. Boon, Van Oort J. Leeuwenberg**, Curator of Sculpture	Methods of cleaning were discussed, and the use of moisture barriers for panel paintings. Mertens discussed treatment problems of Rembrandt's *Night Watch*. The paintings department used a relining adhesive compounded from wax and resin in a process named the "Dutch Method." Van Schendel did not agree with the Italian approach to cleaning and regarded old varnish as a necessary patina that should not be tampered with. Leeuwenberg discussed the treatment of wood.
November 1956	Institut Royal du Patrimoine Artistique, Brussels, Belgium	**Dr. Paul Coremans** ($_{b.}$1908-$_{d.}$1965), Director **Mr. Sneyers,** Head of the Laboratory **Messrs. Lefèv, Thissen, Devreux, Loose, Philippot** and **Charlier**	Stolow was given every opportunity over three weeks to observe and discuss features in the laboratories and studios. He studied the theory and practice of the workings of the different departments that made up the laboratories. Loose advised on x-ray, infrared, and ultraviolet equipment.

Date	Institution	Contacts	Topics
November 1956	Museum voor Schone Kunsten, Ghent, Belgium	**Mr. Eeckhout**, Restorer **Mr. Bazin**	Stolow observed the treatment of Hieronymus Bosch's oil on panel *Christ Carrying the Cross*, and attended the conference where the painting was discussed.
November 1956	Musée du Louvre, Paris, France	**Mr. Goulinat**, Director, Restoration Department **Mr. Chatelet** **Mme. Bouchot Saupique**	Stolow was shown x-ray, infrared, and sodium IR photography and ultraviolet examination techniques.
November 1956	Centre de Recherche et de Restauration des Musées de France	**Madeleine Hours**, Chief Curator and Master of Research	No specific topics noted.
November 1956	Bibliothèque Nationale, Paris, France	**Mlle. Kleindienst**, Conservation and Restoration Department	The treatment of works of art on paper and vellum was discussed.
December 1956	Museo Brera, Milano, Italia	**Signora F. Wittgens**, Director **Mr. Russoli**, Assistant Conservator **Mr. Gioia**, Head of the Laboratory	Stolow observed recently installed chemical and physical laboratories based on the latest laboratory design.
November 1956	Sovrintendenza alla Gallerie della Lombardia, Milan, Italy	**Mr. Mazzini** **Miss Bazzi**, private restorer	They discussed conservation methods used in northern Italy.
November 1956	Bayerische Staatsgemälde-sammlungen, Munich, Germany	**Dr. Christian Wolters**, Head of Conservation for the Bavarian State Collections	Discussions included x-ray analysis, picture cleaning and restoration of supports for works of art.
November 1956	Doerner Institute, Munich, Germany	**Dr. Rossman**	The topics included restoration training methods, analysis of materials, and techniques and research being undertaken at the Institute.
December 1956	Institut für Technologie der Malerei, Staatliche Akademie der Bildenden Künste, Stuttgart, Germany	**Professor Kurt Wehlte** ($_{b.}$1897-$_{d.}$1973)	They discussed approaches to the teaching of advanced students in restoration, the conservation of wall and easel paintings, and research on certain varnishes such as Ketone Resin AW2 (polycyclohexanone resin).
December 1956	Istituto Centrale del Restauro, Rome, Italy	**Dr. Giuliano Urbani** **Dr. Mora** **Professor Brandi** and his assistant **Dr. Carità** **Drs. Liberti, Torraca, Santini and Motzo**, scientists	The restoration department employed about 20 restorers and students; chemistry laboratory staff of 3; physics department; research and examination photography department staff of 6. An x-ray apparatus designed by Prof. Vermehren enabled the x-ray tube to move about and take stereoscopic and stratigraphic photographs. Stolow noted great activity on treatment of wood panel paintings, which he studied closely, and he spent time in the well appointed library.
December 1956	Uffizi Gallery, Florence, Italy	**Professor LoVullo**, Technical Director **Professor Vermehren**	Topics discussed included the x-ray equipment Vermehren had developed for the Istituto Centrale del Restauro in Rome as Technical Advisor.

Table II. Survey of American and Canadian Museums and Art Galleries.
(Note: When known, the full names, honorific, job position and tombstone dates of the specialists noted below have been provided.)

Date	Institution	Contacts	Topics
January 1957	Montreal Museum of Fine Arts, Montreal, Quebec	**Mr. John Muhl**	No specific topics noted.
February 1957	Museum of Fine Arts, Boston, Massachusetts	**Mr. William Young** ($_{b.}$1906-$_{d.}$2000), Director, Research Laboratory **Mr. Rossiter**, Curator of Prints and Drawings **Messrs. Francis** and **W. Dollof**. **John Finlayson**, Restorer	Stolow concentrated on the research facility and the paintings and drawings restoration studios, studying a range of activities, equipment and laboratory layouts. Of specific interest was their x-ray fluorescence and x-ray diffraction equipment. He was shown Finlayson's re-lining, transfer, inpainting and varnishing rooms.
February 1957	Isabella Stewart Gardner Museum, Boston, Massachusetts	**George L. Stout** ($_{b.}$1898-$_{d.}$1978), Chemist **Mr. Jakstas**, Restorer	Scientific methods as applied to the restoration of works of art were discussed. Stolow visited Jakstas' private studio.
February 1957	Fogg Art Museum, Technical Department, Cambridge, Massachusetts	**Elizabeth H. Jones,** Head, Conservation Department **John Washiba** **Morton C. Bradley** ($_{b.}$1912-$_{d.}$2004), Technical Advisor	Of particular interest was the reforming of varnishes and the method developed by R.J. Gettens for bleaching prints and drawings using chlorine dioxide. Stolow met with Bradley in his studio in Arlington and discussed varnishes, and lectured on his recent research on the action of solvents on picture paint.
February 1957	Brooklyn Museum, New York, New York	**Sheldon Keck** ($_{b.}$1910-$_{d.}$1993), Conservator and consultant for the S.R. Guggenheim Museum and the Museum of Modern Art **Caroline K. Keck** ($_{b.}$1909-$_{d.}$2008), Conservator	S. Keck discussed problems associated with contemporary art.
February 1957	The Frick Collection, New York, New York	**Mr. Suhr**	No specific topics noted.
February 1957	New York Historical Society, New York, New York	**Mrs. Held**	No specific topics noted.
February 1957	Private restoration studio, New York, New York	**Mr. Korany**, Restorer	No specific topics noted.
February 1957	Metropolitan Museum of Art, New York, New York	**Murray Pease**, Conservator	He studied the layout of the laboratory and the equipment, and discussed air conditioning in museums with regard to the care of panel paintings.
February 1957	Yale University, New Haven, Connecticut	**Professor Seymour** **Mr. Petryn**, Conservator	He attended a conference on the restoration of Antonio Pollaiuolo's *Hercules and Deianira*, oil on canvas (Jarves Collection).
February 1957	Philadelphia Museum of Art, Philadelphia, Pennsylvania	**Mr. Marceau** **Mr. Theodor Siegl**, Restorer	Conservation treatment processes were discussed.
February 1957	Mellon Institute, Pittsburgh, Pennsylvania	**Robert L. Feller**, Director, Research Center on the Materials of the Artist and Conservator	Feller's research into varnishes and solvents for the National Gallery of Art in Washington D.C. was discussed.
February 1957	Walters Art Gallery, Baltimore, Maryland	**Elisabeth Packard** **Mr. Kirby** Studio and Workshops	No specific topics noted.
March 1957	National Gallery of Art, Washington, D.C.	**Mr. Cott**, Chief Curator **Mr. Sullivan**, Restorer	The gallery was fully air-conditioned 24 hours a day and it was noted that the condition of the panel paintings was very good.

Date	Institution	Contacts	Topics
March 1957	Freer Gallery of Art, Washington, D.C.	**Mr. Wenley**, Director **Rutherford J. Gettens** ($_{b.}$1900-$_{d.}$1974), Chemist and later Head Curator of the Freer Gallery Laboratory	Stolow was encouraged by Gettens to contribute to *Art and Archaeology Technical Abstracts* for the International Institute for Conservation of Historic and Artistic Works (IIC). Stolow studied Gettens' microscopic/chemical equipment.
March 1957	Corcoran Gallery, Washington, D.C.	**Mr. Dorra**, Assistant Director **Russell Quandt**, Conservator	Quandt was helpful with his experience in the field of plastic resinous coatings.
March 1957	National Archives, Washington, D.C.	**Mr. Gear**, Director of the Technical Department	This laboratory was where the "lamination technique" was first developed for documentary material.
March 1957	National Park Service, Museums Branch, Washington, D.C.	**Mr. Lewis**, Director **Messrs. Nitkiewicz and Wandrus**, Restorers	They discussed the preservation of historic homes and sites.
March 1957	Dumbarton Oaks Research Centre, Washington, D.C.	**Messrs. Thacher and Dale**	Their research was discussed.
March 1957	Isabella Stewart Gardner Museum, Boston, Massachusetts	**George L. Stout**, Director	On his second visit, Stolow observed techniques for testing and measurement of properties of paint and protective coating materials.
March 1957	Art Institute of Chicago, Chicago, Illinois	**Mr. Rich**, Research Curator **Messrs. Huth, Schniewind Louis Pomerantz** ($_{b.}$1920-$_{d.}$1988), Chief Conservator	Pomerantz discussed plans for the Art Institute's new technical department and the conservation of contemporary art. Schniewind worked on technical approaches to prints and drawings using soft-ray x-ray equipment which allowed watermarks, repairs and quality of ink to be examined easily.
March 1957	William Nelson Museum, Kansas City, Missouri	**Mr. Sickman**, Director **James Roth**, Conservator **Clements L. Robertson,** Assistant Conservator	Topics discussed included the appearance of different varnishes on the surface of paintings.
April 2-5 1957	Intermuseum Conservation Association, Allen Art Building, Oberlin, Ohio	**Richard D. Buck**	They discussed the restoration of panel paintings. Stolow lectured on "Solvent Action" at the seminar "Resinous Surface Coatings" organized by Buck.[13]
April 1957	Cleveland Museum of Art, Cleveland, Ohio	**Dr. Sherman Lee** ($_{b.}$1918-$_{d.}$2008), Assistant Director	Restoration work was contracted out, usually to New York.
April 1957	Art Museum of Toronto (re-named the Art Gallery of Ontario), Toronto, Ontario	**Martin Baldwin**, Director **Edward Zukowski**, Chief Conservator	Treatment materials and techniques were discussed.
April 1957	Art and Archaeology Department, University of Toronto, Toronto, Ontario	**Professor Brieger** **Professor C. Comfort**	Brieger was of the opinion that more should be done in the field of education in picture conservation.
April 1957	Royal Ontario Museum, Toronto, Ontario	**Dr. Heinrich** **Bill Todd**, Conservator	No specific topics noted.

> conservation. I therefore emphasized with him the importance of these and enabled him to see the work of one or two men whose craftsmanship and knowledge founded on tradition are impressive ... This I think may help you when you come to build up the whole conservation complex in the National Gallery.[14]

The comprehensive survey of the British, European, American and Canadian galleries and museums gave Stolow a sound understanding of laboratory design: how each of the laboratories managed their workload and hiring of staff, which equipment was necessary, and importantly, the funding required. The tour helped focus the areas of research to be included in the conservation and scientific research department at the National Gallery. These were still early days in conservation science, with much room for original research in nearly every aspect of conservation. Starting in 1957, Stolow would over the years conduct or sponsor others in conservation science research at the Gallery in such areas as the cleaning of paintings and the study of the action of solvents (leaching, swelling) on drying oil films such as linseed oil used in artists' paints; the materials used by contemporary artists and conservation concerns relating to modern works of art; art fraud; standards of care for works of art in transit; the action of the environment (relative humidity, temperature, atmospheric pollution, light, ultraviolet radiation) in galleries and museums; and the scientific examination of works of art.

Conservation and Scientific Research Division, 1957-1964

Arriving at the Victoria Memorial Museum on April 1, 1957, Stolow immersed himself in launching the Conservation and Scientific Research Division after submitting a detailed report on June 4, with cost estimates for the proposed facilities in both the Victoria Memorial Museum and the new location at the Lorne Building, on Elgin Street in Ottawa, outlining new equipment, design of studios, and personnel.[15] This included a comparison of funding at major international museums and art galleries. He proposed the new laboratories be implemented in two stages: the first phase to focus on the Victoria Memorial Museum by moving the conservation studio from the basement to the fourth floor; the second phase to be realized when the Gallery moved and the laboratory could be set up on the seventh floor of the Lorne Building.

There was immediate national media interest in the establishment of a department of conservation and scientific research at the Gallery,[16] which contributed to the gradual increase in public awareness of and appreciation for conservation in Canada.

The design of the new laboratory for the Lorne Building was discussed in 1958 by Stolow in an illustrated talk in Boston, where he noted in his introduction that "the utility of scientific laboratories in American museums and art galleries is still questioned on this continent, despite the fact that such laboratories have existed in Europe for quite some decades and have proved their value time and time again."[17] Stolow went on to describe the new conservation and scientific quarters in the Lorne building:

> The space allocated for this department is on the seventh floor of the new National Gallery building and occupies one wing, approximately 125 by 50 feet ... Both north and south light is available ... The entire area is designed to co-ordinate two activities, that of scientific research and that of conservation of works of art ... The acquisition of staff is ... a problem. There are very few training centres for conservators or museum scientists. The general tendency is to develop skilled people by means of the 'apprenticeship' system. A central laboratory can play a dominant role in the country initiating official training programs and in maintaining suitable standards.

Stolow was promoted to the position of Chief of the newly formed Conservation and Scientific Research Division in 1958. Two major pieces of equipment were installed in the following year: a walk-in environmental chamber to study the fundamental effects of changing temperature and humidity on works of art (**Figure 2**), and a combination x-ray diffraction and radiographic unit to be used in the detailed examination of minute samples taken from works of art, conducted initially by summer student Carol Darabaner from McGill University, Montreal.[18,19]

While planning the new laboratories, Stolow helped with the transfer of the Gallery's collection to its new location in the Lorne Building in December of 1959 (**Figure 3**). During this move, he and his staff gained valuable practical experience in the monitoring and control of temperature and humidity during transportation of works of art (**Figure 4**). The move was initially organized under the aegis of Alan Jarvis, and when Jarvis was forced to resign in 1959 due to administrative disagreements with the federal Progressive Conservative party of the day,[20] the plans

Figure 2. Mervyn Ruggles, at left, and Nathan Stolow standing in front of the walk-in environmental chamber on the 7th floor of the National Gallery of Canada, Lorne Building, April 17, 1960. Credit: City of Ottawa Archives/MG393/NP-6625-30/Andrews-Newton. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa.

Figure 3. Truck used by W. Sparks & Son Ltd. outside the Victoria Memorial Museum prior to moving the collections to the Lorne Building in November 1959. Credit: Rosemary Gilliat Eaton/National Gallery of Canada Library and Archives/ Record Number: 090254. Photograph courtesy of the National Gallery of Canada Library and Archives Ottawa.

were moved forward by Associate Director Donald Buchanan. Stolow wrote his first two papers on works of art in transit in 1960 and 1961, based mainly on the recent move.[21,22]

Mervyn Ruggles headed the restoration Workshop when Nathan Stolow joined him in 1957. Ruggles noted in 1976 that they worked closely together – Stolow focusing on scientific research and Ruggles on the conservation of the collections (**Figure 5**).[23] Expansion of the division began in earnest with the employment of new staff and procurement of analytical equipment. Bernard Hamelin was hired as assistant restorer and J. MacGregor Grant as documentation scientist in 1960 and 1962 respectively. Grant engaged in microscopic studies, in the preparation and photomicrography of cross-sections of works of art, and in experiments with the environmental chamber. L. Larkin, a summer student from Acadia University, Wolfville, Nova Scotia, studied the effect of humidity on relining compositions. Part-time assistance was provided by professionals such as Mary-Lou Florian, who studied the techniques for the microscopic identification of the wood in panel paintings and the biological deterioration of oil films and works on paper. Employment of part-time professional staff became a constant over the years, as was the utilization of university interns. Occasionally, Stolow would invite experts such as Sheldon Keck[24] and Louis Pomerantz to Ottawa to treat works of art.

In an early National Gallery *Bulletin*, Stolow reported on the work in the new division up to 1963,[25] citing case histories and a few examples of laboratory investigations into mould and wood identification. Research was conducted in an increasingly well-equipped laboratory. Additions to research equipment over the years were an x-ray diffractometer with analytical accessories, a high pressure laboratory press, and the components for an electrically heated vacuum hot table,[26-28] which was built in house. An infrared spectrophotometer was also acquired for qualitative analysis of complex paint and film materials, and a comparison microscope for comparing minute samples of painting materials from old paintings with samples from the library of reference microscope slides.

Research into Drying Oil Films and their Solvents

Stolow collaborated with Robert Feller and Elizabeth Jones on the book *On Picture Varnishes and Their Solvents*,[29] first published in 1959, with his contribution based on his research at the Courtauld Institute of Art and his lecture given at the Intermuseum Conservation Association in Oberlin, Ohio, on April 4, 1957. The 1959 publication was later updated by Stolow for the revised 1971 edition.

A study in 1961 by Stolow into twenty-five-year-old pigmented oil films provided by Elizabeth Jones of the Fogg Art Museum in Cambridge, Massachusetts indicated that the swelling behaviour of the pigmented films followed a consistent pattern and was predictable within certain limits. He concluded that "an important aspect of the study is that linseed oil films appeared to be somewhat more soluble in solvents as they grow older, although their capacity to swell may diminish. This indicates that the film experiences breakdown of polymer chains, probably enhanced by oxidation and exposure to light."[30]

Figure 4. Mervyn Ruggles monitoring the temperature and relative humidity inside the truck used by W. Sparks & Son Ltd, to move the collections, in November 1959. Credit: Rosemary Gilliat Eaton/National Gallery of Canada Library and Archives/ Record Number: 090253. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa.

Figure 5. Mervyn Ruggles, at left, working on *A Berber Slave in a Harbour*, 1699, oil on canvas, artist unknown (Dutch?-17th century) National Gallery of Canada, Acc. No. 823, with Bernard Hamelin, at right, assistant conservator, 7th floor of the Lorne Building in December, 1962. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa / Record Number: 090080.5.

In the 1963 *Bulletin* article, Stolow described his continuing studies into solvent action:

> By attempting to identify the nature of the leached materials from paint films it is possible to determine more precisely the reactivity of linseed oil films to solvents. The methods of micro-chemistry, infra-red spectroscopy, and gas chromatography are proving most useful in this regard. Essentially interest is being focused on the fatty acids, esters, and breakdown products which are extractable from aged paint, and which lend themselves to positive identification.[31]

During his first years at the NGC, Stolow pursued this research on the effects of picture cleaning solvents on drying oil films by a variety of means, including the employment of summer interns. Lucille Thompson, a chemistry student at the University of Ottawa, studied the action of solvents by leaching, swelling and erosion on paint films; Timothy Bond, a chemistry student from Carleton University, Ottawa, carried out research in the chromatography of linseed oil materials; and Valerie Zahradnitzy from the University of Ottawa researched pigments with the use of x-ray diffraction.[32] Stolow continued to employ summer students from universities such as Ottawa and Carleton over the course of his tenure at the Gallery (and in the process met his second wife, Johanne Robert).

Artists' Materials and the Conservation of Contemporary Art

Artists' materials were manufactured in Canada by companies such as The Canadian Art Laboratory in Toronto, which was in production from 1932 until 1954.[33] The Gallery pursued an early interest in such materials, as demonstrated at the session "Painter's Workshop," jointly organized by the National Gallery, the Carnegie Foundation and Queen's University, Kingston, and presented at the so-called Kingston Conference (Conference of Canadian Artists) in 1941. Papers were presented by Frank W. Sterner, Rutherford J. Gettens and George Holt of Boston, Massachusetts, and published in the Technical Proceedings[34] funded by the Carnegie Foundation.[35] Many Canadian artists had to contend with the problem of isolation from major art centres, leading in part to retreats such as "The Artist's Workshop" series beginning in 1955, which was held at Emma Lake, Saskatchewan, and was organized by the University of Saskatchewan. At the invitation of Alan Jarvis, the Mexican artist José Gutierrez gave a series of lectures and workshops across Canada ("From Frescos to Plastics") which was very successful and had an impact on the materials used in certain Canadian paintings after 1955.[36]

In the late 1950s, Stolow was somewhat dismayed by the methods employed by many contemporary artists. In addition, there were few Canadian conservators with expertise in the field. Stolow wasted no time in asking specialists to visit, including Sheldon Keck, an expert on the treatment of contemporary paintings. Keck gave a lecture on "Painting and the Laboratory" in 1960 in which he discussed a number of his experiences with the treatment of contemporary art works.[37] In 1962, Louis Pomerantz,[38] previously head of conservation at the Art Institute of Chicago, visited at Stolow's invitation and addressed guests from the National Research Council, artists, politicians and museum professionals. During this period, in the 1950s and 1960s, Stolow was consulted by contemporary artists such as Ghitta Caiserman, regarding materials she was using, and Tony Urquhart, who requested information about the proprietary artists' paint "Liquitex."[39] About this time, Stolow began to forward technical information on his research into artists' materials to members of the British Standards Committee on Artists' Materials.[40]

Ahead of most in the field, Stolow surveyed living artists in 1963 by mailing a one-page questionnaire for Canadian artists to complete so that he could compare painters' materials and techniques before and after 1958.[41] The Gallery then began to send out a standard one-page form at the time of purchase of an art work, requesting the artist to note the type of support, ground, medium, technique and surface coating used. As artists were starting to experiment with retail trade paints, Stolow analysed some of them, as is referenced in "A Typical Generalized Formula for Pigmented Latex Aqueous Emulsion Paint."[42] Actual analysis was important, as the voluntary information could be misunderstood or inadvertently misrepresented by individual artists, particularly regarding their use of commercial retail trade paints.

Stolow set down many of his thoughts on the conservation and restoration of contemporary art in his 1969 publication "Conservation of the Contemporary,"[43] based on his lectures "Problems in Contemporary Art Techniques," first presented at the Regina Art School, University of Saskatchewan, February 18-20, 1965, at the invitation of artist and instructor Ted Godwin. In the early 1960s, Stolow began his lecture series at the Ontario College of Art in Toronto on "The Structure and Permanence of Artists' Materials and Works of Art" for students in the department of drawing and painting. The lectures were organized at the invitation of artist and instructor Carl Schaefer[44]

($_{b.}$1903-$_{d.}$1995) between 1963 and 1969, and were attended by the author in the 1960s. They stressed the need for artists to use quality materials and sound technique. Stolow lectured at the Department of Fine Art, University of Toronto in 1969 on the preservation of watercolours,[45] and at the Faculty of Fine Arts, York University in Toronto early in 1970 on "Techniques of the Artist."[46] His message to artists was that

> the contemporary artist-cum-technologist should be more concerned about the permanent properties of his materials and methods. [The artist] has a certain responsibility to society in making his works last for a reasonable period of time. If the artist deliberately sets out to create disposable works then this is another matter. But his intention should be made clear. ... The information gap on the technical properties of the new materials becomes apparent again. It would seem necessary now for artists in the new idioms to pause and contemplate and try to understand the real properties of their materials.[47]

Charles F. Comfort ($_{b.}$1900-$_{d.}$1994), Gallery Director from 1959 to 1965, succeeded Alan Jarvis (Director 1955-1959), and was eventually replaced by Jean Sutherland Boggs (Director 1966-1976). Boggs observed that, in the late 1960s, "the most radical change in acquisition policy has been the decision to buy American art. The Trustees revoked its former policy and the Public Service Commission appointed as Curator of Contemporary Art ... Mr. Brydon Smith,"[48] who was hired in February, 1967 (**Figure 6**).

Smith went onto to acquire works that were ideologically and materially controversial, such as Gary Lee-Nova's *The Ballad of a Wise and Curious Wizard*, 1966. As did many contemporary works, this one posed a new and different conservation challenge. This colourful painting incorporated an oversized plastic half ice-cream cone with an electrical light component. It is likely that Stolow recommended that four identical half ice-cream cones be acquired at the time of purchase[50] (it was a singular object that would not be easily replicated). How did the Gallery view the storage, display, transportation and preservation of these new acquisitions? The different parameters used by modern and contemporary artists forced many museum professionals to rethink these issues. And Stolow did.

The Canadian Art Fraud Case of 1962-1964

In 1962, the National Gallery became immersed in what came to be known as the Canadian Art Fraud Case. In Stolow's words, it had "few if any North American counterparts. To understand its scope, one must compare it to the Otto Wacker trial (concerning fake Van Goghs, Berlin, 1932) and the Van Meegeren case (concerning fake Vermeers and De Hoochs, The Hague, 1947-48)."[51]

The investigation was headed by Inspector J.L. Erskine of the Anti-Rackets Branch of the Ontario Provincial Police, who first examined the paintings at Toronto police headquarters. The Attorney General of Ontario considered it necessary in addition to have supporting scientific evidence, so the National Gallery was approached and the framed paintings were escorted by police to Ottawa.

The focus of the physical examination was directed toward the supports, the signatures, signs of artificial aging, and comparison of brush strokes with those in authenticated works. Frames and stretchers were scrutinized. The paintings were first fully documented using different photographic light sources to reveal any internal or surface changes to the paintings. The results of the examinations were compared with several "control" sketches and paintings in reputable collections, such as the National Gallery. The artist A.Y. Jackson was consulted; as Stolow noted in his article in *Canadian Art*, "A living artist is best qualified, in the legal sense, to say whether a painting is his work or not."[52]

Several months into the project, Stolow was visited by Crown Prosecutor E. Patrick Hartt, Q.C. and Inspector Erskine, and the scientific results were compared with Erskine's findings. Stolow had found that several paintings had been copied from book illustrations and also noted that "of great interest … were two panel paintings promoted as by Morrice and Cullen which … were cut from the same slab of pinewood and bore matching grain patterns, paint and brush qualities, as well as signature styles. This was borne out by raking light, by x-ray and infrared."[53]

It was also discovered that one of the Crown witnesses, W.F. MacGregor, had been commissioned by Neil Sharkey to copy twenty-seven illustrations of paintings by MacDonald, Jackson, Morrice and others. Neil Sharkey and Leslie W. Lewis, an art dealer who sold the spurious paintings, were sentenced to prison in 1964; Sharkey for one year and Lewis for two years less a day. Stolow lectured across Canada on the "Art Fraud Case" and the project was covered extensively in the media.[54]

Figure 6. Nathan Stolow and Brydon Smith, who was attending the first course of its kind offered by NCRL, *The Principles of Conservation of Works of Art and Historic Materials*, February 1-12, 1965.[49] Smith became Curator of Contemporary Art at the National Gallery of Canada in 1967. Credit: John Evans, Ottawa © Doris Evans. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa.

National Conservation Research Laboratory, 1964-1972

Formerly a division of the Curatorial Branch, the National Conservation Research Laboratory (NCRL) became a branch in its own right on April 1, 1964. Director Charles Comfort shared with Stolow an interest in the scientific analysis of works of art and supported Stolow in establishing the laboratory.[55] With its formation, Canada had its first conservation science and research laboratory in which conservators and scientists worked side by side – with the collaboration of the photography division at the Gallery. Scientific examination was conducted on works of art from the Gallery's own collection as well as from outside collections[56] and all paintings valued at $5,000 or over which were contemplated for purchase were to be examined in the laboratory.[57] NCRL was an early example of a complete conservation institution with treatment, research, analysis, scientific imaging, and library coordinated under one roof.

The NCRL years marked a major step in the development of conservation science research in Canada, with the hiring of staff and the purchase of capital equipment.[58-60] New staff included Raymond Boyer, who undertook cross-section analysis, x-radiography and electron emission radiography. J. MacGregor Grant, as the documentation scientist already on staff, pursued the refinement of the microscopic examination of cross-sections and studied the effect of changing humidity and temperature on the dimensions of early wood sculptures. In 1963 and 1964, two summer students worked on the identification of pigments in old paint by chemical and x-ray methods and on the classification of media of old masters by means of gas chromatography. In 1965, Stolow purchased x-ray diffraction equipment and a gas chromatograph; George de Witt Rogers became the chromatography specialist and later moved on to environmental studies. The chemist Herbert Wheeler was hired in 1965, leaving a year later to pursue his studies at university. Kenneth Tanino, who came from the Department of Mines and Technical Surveys, was hired as a research assistant in 1965. Dr. James F. Hanlan, a senior research chemist, joined the staff in 1967, as did D. McNicoll; research chemist John M. Taylor joined in 1971. Professor D.K. Sebera, on sabbatical from Wesleyan University, Middletown, Connecticut, joined the staff in 1967 for an academic year to carry out research into the influence of pigment on the aging processes of paint films.

The acquisition of additional laboratory space not only permitted a more efficient arrangement for research and documentation activities but added more space for the examination and preventive and remedial care for works of art in the Gallery's collections. Senior conservator Mervyn Ruggles, already on staff, worked on conservation projects and helped develop Harumi mat board.[61] Other staff[62] included Ursus Dix, hired in 1965, and Peter Vogel, in 1967 (both paintings conservators working on special projects); Joseph Halmy joined as a conservator technician. The author, on the advice of Carl Schaefer, met with Stolow in the spring of 1971, and subsequently worked as a summer student, completing diagrams of artists' materials and tools for the didactic panels in the travelling exhibition *Progress in Conservation*. The author joined NCRL in an apprenticeship position as a conservator technician in October 1971.

NCRL comprised a Radiographic Laboratory, Photographic Documentation (an annex facility on the sixth floor), a Microscopy Laboratory, an X-ray Spectrography Laboratory, an Analytical Research Laboratory, Conservation Studios, solvent storage, a library and conference room, and offices of the Administrative Assistant and of the Director of NCRL on the seventh floor of the Lorne Building. The laboratories were well equipped, with 150 keV and 300 keV x-ray tubes for x-radiography and electron emission radiography, and instruments for x-ray diffraction, x-ray fluorescence spectrometry (including the "Macroprobe," as well as one of the first energy-dispersive x-ray spectrometers to be used for non-destructive analysis of works of art), light microscopy and cross-section preparation facilities, and pyrolysis gas chromatography. Typical research and conservation projects, educational and training activities, external consultations, and a selection of staff publications are described in a report catalogued in the library of the NGC.[63]

Research into Environmental Issues

Early in his tenure at the Gallery, Stolow became concerned with issues of storage and transit of works of art.[64] This developed into an interest in the museum environment in general, with the observation that progress had been made in the design of air conditioning in museums since the early 1900s – but not to the degree required for ideal stabilization of works of art. Stolow also began to focus on works in transit, as he observed that an upsurge in the loan of works of art to national and international exhibitions had left many museums unprepared. Increasing travel meant greater exposure to changes in relative humidity and temperature, vibration, mishandling and atmospheric pollution. Stolow, with J. MacGregor Grant, conducted experiments in the environmental chamber into the behaviour of wood, canvas and paint in changing external temperature and relative humidity, and designed controlled-environment display cases for specific works of art, as no one solution would be suitable for all works.[65] Further research into various designs of shipping crates was done to determine their effectiveness in providing a suitable internal environment for works of art. These trials concluded that control of the environment for works of art during display or travel could be realized in practice by applying the principles of hygrometry and the moisture diffusion properties of materials, as well as their thermal properties. Stolow acknowledged R.D. Buck's 1960 success in the transportation methods used for an exhibition of Flemish panel paintings jointly organized by the Detroit Institute of Arts in Detroit, Michigan and the City of Bruges in Belgium. Of particular note was Buck's use of the hygroscopic properties of silica gel, confirming studies conducted at the Gallery in 1963, in which it was found that materials such as silica gel and fibre board were stabilizers of humidity and temperature and could help protect works of art when in transit. The environmental trials conducted by Stolow and Grant resulted in fifteen recommendations for the ideal crate.[66]

Canada Pavilion, *Expo 67*, Montreal

The 1967 International and Universal Exposition, or *Expo 67*, was a general exhibition held in Montreal, Quebec from April 27

to October 29 and was Canada's main celebration during its centennial year. The Canada Pavilion, as part of its display, housed a fine arts gallery.[67] Most members of the Gallery conservation staff at the time were involved in the project, from the planning of the building's architecture to the completion of the last condition report in January of 1968. As Boggs observed, "with the guidance of the Gallery's Dr. Nathan Stolow, a building with the ideal system of temperature and humidity control was constructed on the fair site. As a result, works of art that came from all over the world – from twenty-one countries – could be given perfect care."[68]

***Progress in Conservation*, 1972-1974**

Toward the end of his tenure at the Gallery, Stolow initiated the didactic travelling exhibition *Progress in Conservation*,[69] opening in Ottawa on April 1, 1972. The exhibition travelled in reduced format from 1972 to 1974, to sixteen art galleries and museums across Canada.[70] The exhibition – with an accompanying catalogue in English and French – was brought together in collaboration with the staff of NCRL. The exhibition was opened by Dr. Gerhard Herzberg ($_{b.}$1904-$_{d.}$1999), 1971 winner of the Nobel Prize for Chemistry (**Figure 7**). As Stolow wrote in the exhibition catalogue:

> *Progress in Conservation* has as its main purpose the presentation of the broad programme of the National Conservation Research Laboratory. A variety of case histories, research projects and displays are presented to illustrate the interaction of conservation, the physical sciences and art history in solving problems of preservation of works of art. This interdisciplinary approach dates back to the founding of the Laboratory in 1964, when it was decided that the conservation of works of art and historic objects would be carried out in a setting where the conservator, chemist and art historian could find common cause.[71]

As Ruggles observed, "The appearance of *Progress in Conservation* at this time marked the beginnings of a new public awareness of the importance of conservation."[72] Even after the exhibition completed its tour, many of the didactic panels were utilized by the Gallery and the Canadian Conservation Institute to illustrate aspects of conservation treatment and research during such events as "Open House" tours.

Formation of the Canadian Conservation Institute, 1972

In the late 1960s, Stolow and many others felt that there should be a national institute for conservation in Canada, similar to those in other countries, to focus on a complete range of conservation, scientific research and training activities. With the National Museums of Canada newly created in 1968, it was considered a favourable moment to establish this type of cultural activity. Preliminary discussions were held with the office of the Secretary of State for External Affairs, Gérard Pelletier. Stolow was instructed to draw up a comprehensive plan for a centralized conservation institute to serve all of Canada that would not infringe on the Gallery's activities but rather complement their established program – with the exception of its research activities. In January of 1972, Stolow informed Director Boggs that he was leaving to establish a new conservation institution in Ottawa. The decision by Cabinet to recommend the establishment of the Canadian Conservation Institute (CCI), set up under the National Museums Policy, was announced by Pelletier, on March 28, 1972 and CCI was formed in October of 1972. As it was described in the Gallery's *Annual Review*, "Undoubtedly the greatest shock to the Gallery's system in the fiscal year 1972-73 was the dissolution of its National Conservation Research Laboratory, and the removal of its scientists to form a Canadian Conservation Institute, under Dr. Nathan Stolow."[73]

Initially the new Institute continued to have its headquarters in the Lorne Building although some of the work took place in temporary quarters elsewhere. Conservation treatment and documentation was done at the Bankal Building on Bank Street. A conservator training program, started in 1974 in the Daly Building Annex on Rideau Street, accepted ten students per year and comprised two years of course work and a one year internship (the program was ended in 1976). By 1974, the professional staff numbered thirty. Conservation staff was hired from all over Europe, Great Britain and North America, while most of the scientists were Canadian. Two satellite conservation

Figure 7. Gerhard Herzberg, winner of the 1971 Nobel Prize for Chemistry and Nathan Stolow, opening night at the NGC, January 13, 1972, for *Progress in Conservation* 1972-1974. Stolow demonstrates one of the two working microscopes included in the exhibition. Credit: Duncan Cameron/Library and Archives Canada/Acc. 1975-155, File 11650-1, negative no. 27. Photograph courtesy of the National Gallery of Canada Library and Archives, Ottawa.

studios were established in 1973 as part of a larger plan for five regional laboratories: a Pacific Conservation Centre in Vancouver, British Columbia, directed by Ursus Dix ($_{b.}$1927-$_{d.}$2002), and an Atlantic Conservation Centre in Moncton, New Brunswick, directed by Roger Roche (both centres were disbanded in 1978).[74] By 1975, Stolow had obtained space for the Institute in a new building in Ottawa's industrial east end at 1030 Innes Road, where it continues to operate.

After an external review of CCI and its management in 1975,[75] Stolow was replaced as Director-General. He served as a conservation advisor to the National Museums of Canada until 1979; as Senior Curator of Conservation at the Australian National Gallery in Canberra from 1982 to 1984; as Foundation Conservator, Colonial Williamsburg Foundation in Williamsburg, Virginia from 1984 to 1987; and subsequently has been a conservation consultant to international institutions.

Conclusion

The considerable contribution Nathan Stolow has made to the National Gallery of Canada and to the conservation profession is evidenced by his establishment, first, of the National Gallery of Canada's Conservation and Scientific Research Division in 1957, which expanded into the National Conservation Research Laboratory in 1964, followed by the founding of the Canadian Conservation Institute in 1972.

Stolow's timing was fortuitous in graduating from the Courtauld Institute of Art when the Gallery and its Director Alan Jarvis were looking to implement the recommendations of W.G. Constable's 1956 report. The international tour of established conservation laboratories in museums and art galleries at the beginning of his career greatly enhanced Stolow's ability to eventually design and implement one of the first "all-in-one" museum conservation and research laboratories housed under one roof. NCRL would have continued to do excellent scientific research, but on a much smaller scale than that which the Canadian Conservation Institute was able to pursue with state-of-the-art equipment and a full complement of scientific, conservation and support staff.

The Gallery, benefitting from the perspicacity of Jarvis, was fortunate to employ Stolow when it did, as he went on to have an enormous influence on conservation in Canada and his initiatives resulted in careers for a large number of people through the undertaking of countless treatments and conservation science projects. As Ian Wainwright notes, from his perspective as a scientist hired during CCI's formation, Stolow was a builder and not averse to taking on new projects and ideas.[76] For example, Stolow agreed that CCI should be conducting research into Canadian First Nations rock art after he was contacted in the 1970s by Selwyn Dewdney[77] and Wainwright continues to work on rock art forty years later. Peter Vogel describes his appreciation as a young conservator of Stolow's well designed illustrated lectures for conservators, which he found to be an excellent resource in learning about deterioration in works of art, and about physics and chemistry as applied to conservation treatment.[78] When lecturing at the Ontario College of Art, Stolow stressed the need for quality artists' materials and sound technique, which the author, among the drawing and paintings students there in the 1960s, took to heart. His numerous lectures and publications have influenced many conservators and artists, and media interest in activities at the NGC (such as the art fraud case) and the *Progress in Conservation* exhibition, all helped to raise the public's awareness of and appreciation for conservation in Canada. His early initiative to collect information from living artists was groundbreaking. In the conservation science field, Stolow's collaborations and publications on scientific research topics (see **Appendix II**) have formed a basis for further work which continues today.

When Stolow founded the Canadian Conservation Institute, he took most of the scientific staff and some conservators with him and left the Gallery's conservation department to concentrate on the care of its collection. In the intervening years, the renamed Restoration and Conservation Laboratory (RCL), reporting to the Chief Curator, focused on the preventive and remedial care of the Gallery's collection, first under the guidance of Mervyn Ruggles between 1972 and 1977, through a series of Chiefs[79] to Stephen Gritt, who came to the Gallery from the Conservation and Technology Department at the Courtauld Institute of Art in 2003. However, a change of direction to once again include research in the mandate was initiated in 2011 when Gallery Director Marc Mayer named Gritt the Director of the new Conservation and Technical Research (CTR) section, with John McElhone named Chief Conservator, Restoration and Conservation.[80] CTR is effectively its own directorate with Gritt reporting directly to Mayer, which will bring the conservation perspective straight to senior management and the steering committee of the Gallery. The new path is an acknowledgment that conservation is vital to the success of the Gallery. CTR will advise on treatments, research, and conservation-related issues, with new programming and partnerships. It is intended that the new section will also bring a more public face to the profession within and outside the Gallery, using videos, on-line content, exhibition labels, a series of exhibitions[81] and the NGC's quarterly magazine *Vernissage*. In a sense, the Gallery has looped back to Stolow's early initiatives, and reached far beyond those imagined by the Gallery's first Director Eric Brown and George Harbour, the first resident museum conservator in Canada.

Acknowledgments

For their invaluable assistance the author wishes to thank Nathan Stolow, Williamsburg, Virginia, U.S.A. and, at the National Gallery of Canada Library and Archives, Ottawa: Cyndie Campbell, Head, Archives, Documentation and Visual Resources; Philip Dombowsky, Assistant Archivist; and Michael Williams, Visual Resource Officer.

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41. Barclay, Marion H., "Materials Used in Certain Canadian Abstract Paintings of the 1950s," in: Denise Leclerc, *The Crisis of Abstraction in Canada: The 1950s* (Ottawa: National Gallery of Canada, 1992), p. 214. Exhibition catalogue.

42. Barclay, M.H., "Materials Used in Certain Canadian Abstract Paintings of the 1950s," p. 228.

43. Stolow, N., "Conservation of the Contemporary," *artscanada*, vol. 26, no. 1 (128/129), February 1969, pp. 14-18.

44. Letters between Stolow and Carl Schaefer, November 23, 1965, January 10, 1966 and September 29, 1966, in: *Stolow, Nathan – Documentation File*, National Gallery of Canada Library and Archives, Ottawa.

45. Stolow, N., "The Preservation of Watercolours," text of an illustrated lecture at the *Seminar on Watercolours*, Department of Fine Art, University of Toronto, October 17, 1969 (Toronto: Canadian Society of Watercolour Painters and the Youth Recreation Branch, Ontario Department of Education, January 1970), 20 pp.

46. Stolow, N., "Occasional Lectures at York University," memorandum to Gallery staff, October 23, 1970, in: *Stolow, Nathan – Documentation File*, National Gallery of Canada Library and Archives, Ottawa.

47. Stolow, N., "Conservation of the Contemporary," p. 18.

48. Boggs, J.S., *The National Gallery of Canada*, p. 61.

49. *Archival File: National Gallery of Canada Conservation Course (1965).* Brydon Smith fonds *(Box 4, File 2)*. National Gallery of Canada Library and Archives, Ottawa.

50. Thomas, M.E. (Manager, Dairy Products Advertising), Letter of June 14, 1966, "As requested by Mr. Silver, we have sent you, at no extra charge, the four replacement half cones for Mr. Nova's Painting ... The original Ice Cream Cone was moulded by Maye C. Storer for Dairy Products Advertising, and was copyrighted." In: Restoration and Conservation Laboratory, Canadian painting dossier: *Lee-Nova, Gary, The Ballad of a Wise and Curious Wizard, 1966: Acc. No. 14916*, National Gallery of Canada, Ottawa.

51. Stolow, N. "This Art Was a Crime," *Canadian Art*, no. 94, November/December, 1964, pp. 354-357.

52. Stolow, N. "This Art Was a Crime," p. 355.

53. *Archival File: Canadian Art Fraud Case*, Nathan Stolow fonds, National Gallery of Canada Library and Archives, Ottawa.

54. "The Lab Detectives," *Time*, Arts Section, January 31, 1972, pp. 4-5, in: *Stolow, Nathan – Documentation File*, National Gallery of Canada Library and Archives, Ottawa.

55. Stolow, N., "Brief Relating to the Establishment of a National Conservation Research Laboratory" (Ottawa: National Gallery of Canada, April 18, 1962). Unpublished typewritten report, 21 pp. NGC: N910 O7 A71 1962.

56. Stolow, N., "The National Conservation Research Laboratory" (Ottawa: National Gallery of Canada, May 1971). Typewritten report/handout, 15 pp. NGC: N910 O7 N35 1971. This booklet provides a comprehensive overview of NCRL from its inception in 1964 to 1971. Stolow describes the functions and responsibilities, facilities and operations, gives a list of the various laboratories for radiology, photographic documentation, microscopy, environmental research, physical and chemical analytical research and the library. The booklet outlines the typical research and conservation projects undertaken, educational and training activities, a selection of staff publications, a list of the staff at the time, and a detailed floor plan of the seventh floor of the Lorne Building, Elgin Street, Ottawa.

57. Minutes of the 102nd Meeting of the Trustees of Canada, October 21-22, 1964, in: *Archival File: Board of Trustees – Minutes (9.21B)*, National Gallery of Canada fonds, National Gallery of Canada Library and Archives, Ottawa.

58. National Gallery of Canada, *Annual Report 1965-1966* (Ottawa: National Gallery of Canada, 1966), p. 9.

59. National Gallery of Canada, *Annual Report 1966-1967* (Ottawa: National Gallery of Canada, 1967), p. 22.

60. National Gallery of Canada, *Annual Report 1967-1968* (Ottawa: National Gallery of Canada, 1968), p. 46.

61. Harumi mat board is a 100% rag, acid free board used for mounting prints and drawings, developed between 1970 and 1973 at the National Gallery of Canada, Ottawa, by (and named after) Dr. James **Ha**nlan, senior research chemist, NCRL; Mervyn **Ru**ggles, senior conservator, NCRL; and **Mi**mi Cazort, curator of Prints and Drawings, National Gallery of Canada, Ottawa.

62. Ruggles, Mervyn, "The History of Conservation in Canada: Developments to the Early 1970s," *Journal of the International Institute for Conservation – Canadian Group*, vol. 5, nos. 1 / 2, 1980, p. 10.

63. Stolow, N., "The National Conservation Research Laboratory."

64. "Environmental Control of Works of Art and Museum Material," text of a lecture presented in Cooperstown on July 15, 1964, in: *Archival File: Restoration and Conservation Laboratory: Stolow, Nathan 1964 (Box 37, File 40-3-1-(64)-D)*. Unpublished typewritten report, 16 pp.

65. Stolow, N., "Fundamental Case Design for Humidity Sensitive Museum Collections," *Museum News: Technical Supplement*, no. 11, February, 1966, pp. 45-52.

66. Stolow, N., *Report on Controlled Environment for Works of Art in Transit*, International Council of Museums (ICOM): Committee for Museum Laboratories, Paris, September, 1965 (London: Butterworths, 1966), 46 pp.

67. Press Release, April 17, 1967, in: *Stolow, Nathan – Documentation File*, National Gallery of Canada Library and Archives, Ottawa.

68. Boggs, J. S., *The National Gallery of Canada*, p. 64.

69. *Progress in Conservation*, edited by N. Stolow (Ottawa: National Gallery of Canada, 1972), 60 pp. Exhibition catalogue.

70. *Progress in Conservation*, p. 59.

71. *Progress in Conservation*, p. 5.

72. Ruggles, Mervyn, "The History of Conservation in Canada: Developments to the Early 1970s," p. 10.

73. National Gallery of Canada, *Fifth Annual Review, 1972-1973* (Ottawa: National Gallery of Canada, 1973), pp. 123-127.

74. Wainwright, Ian N.M. (former Senior Conservation Scientist and Manager, Analytical Research Laboratory, Canadian Conservation Institute, Department of Canadian Heritage, Ottawa), personal communications, September 28, 2010 and January 6, 2012.

75. Costain, Charles G. (Director, Research, Conservation and Scientific Services, Canadian Conservation Institute), personal communication, July 19, 2010.

76. Wainwright, Ian N.M., personal communication, February 16, 2011.

77. Dewdney, Selwyn ($_{b.}$1909-$_{d.}$1979). Author, illustrator, artist, activist and pioneer in pictography, in: *Wikipedia*, <http://en.wikipedia.org>. Accessed February 2011.

78. Vogel, Peter (Former Conservator of Fine Art, Canadian Conservation Institute, Department of Canadian Heritage, Ottawa), personal communication, March 8, 2011.

79. *Restoration and Conservation Laboratory – Documentation File*, National Gallery of Canada Library and Archives, Ottawa. During the period after 1972, the Chiefs were: Mervyn Ruggles from 1972-1977; Ian S. Hodkinson, 1977-1979 (Director, Master of Art Conservation Program, Queen's University, Kingston on a professional exchange with Mervyn Ruggles); Ursus Dix, 1979-1984 (retired to administer the estate of his father, artist Otto Dix, in Switzerland); Stephen Hackney, 1984-1985 (Senior Conservation Scientist, Tate Britain, London, U.K., on a one-year professional exchange with Marion H. Barclay, N.G.C.); J. MacGregor Grant, 1985-1994; Marion H. Barclay, 1994-2002; followed by Stephen Gritt in 2003; in

2011 Mr. Gritt became Director, Conservation and Technical Research and John McElhone was promoted to Chief Conservator, Restoration and Conservation. The Restoration and Conservation Laboratory, which is now responsible for all aspects of framing, in addition to its stewardship of the art collections, currently has a staff of fifteen of whom ten are professional conservators.

80. McElhone, John (Chief Conservator, Restoration and Conservation, National Gallery of Canada, Ottawa), personal communication, March 29, 2012.

81. Gritt, Stephen (Director, Conservation and Technical Research, National Gallery of Canada, Ottawa), personal communication, March 9, 2011.

Appendix I. Nathan Stolow: Key Dates

1928 May 4	Born in Montreal, Quebec.
1949	B.Sc., McGill University, Montreal, Quebec.
1950	M.A., University of Toronto, Ontario.
1950 Sept 10	Married Sari Mandel Stolow ($_{b.}$1928 in Warsaw, Poland). Divorced July 1978. Sons Albert Stolow ($_{b.}$1959) and Jeremy Stolow ($_{b.}$1965).
1956	Ph.D., Courtauld Institute of Art, University of London, England.
1956 Oct. to 1957 April	Tour of museum and art gallery conservation facilities in U.K., Europe, U.S.A., and Canada.
1957 April	Hired by Director Alan Jarvis, National Gallery of Canada (NGC), Ottawa.
1957	Established the Conservation and Scientific Research Division, NGC.
1959-1960	NGC moved its collections from the Victoria Memorial Museum Building to the Lorne Building.
1963-1964	Canadian Art Fraud Case.
1964	Established the National Conservation Research Laboratory, NGC.
1967	Canadian Pavilion, *Expo 67* in Montreal, Quebec.
1958-1982	Rapporteur-Coordinator, Committee for Conservation: International Council of Museums (ICOM).
1971-1972	Coordinator, Committees for Conservation and International Exhibitions: International Council of Museums (ICOM).
1971-1972	Chairman, Canadian National Committee for International Council of Museums (ICOM).
1972-1974	Initiated and supervised *Progress in Conservation*, cross-Canada travelling exhibition.
1972	Established Canadian Conservation Institute, National Museums of Canada, Ottawa.
1975	Appointed Special Conservation Advisor, National Museums of Canada Corporation, Ottawa.
1979 April 6	Married Johanne Robert Stolow ($_{b.}$1950-$_{d.}$1989); divorced March 1984. Johanne died by drowning in the Ottawa River, on October 13, 1989.
~1982-2008	Served on editorial board of *Journal of Museum Management*.
1982-1984	Senior Curator, Conservation Department, Australian National Gallery, Canberra, Australia.
1984-1987	Foundation Conservator, Department of Conservation, Colonial Williamsburg Foundation, Williamsburg, Virginia, U.S.A.
1985 to present	International Conservation Consultant.
1995 March	Married Mary Grove Moore Stolow.

Appendix II. Nathan Stolow's Publications

1954

"A Modified Apparatus for Measuring the Swelling of Polymer Films in Solvents," *Journal of Physics. E: Scientific Instruments*, vol. 31, November, 1954, pp. 416-420.

1956

"The Measurement of Film Thickness with a Pneumatic Hypodermic Needle Mechanism," *Journal of Physics. E: Scientific Instruments*, vol. 33, no. 9, 1956, pp. 333-337.

1957

"The Measurement of Film Thickness and of Solvent Action on Supported Films," *Studies in Conservation*, vol. 3, no. 1, 1957, pp. 40-44.

"Action of Solvents on Dried Linseed Oil Films," *Nature*, vol. 179, no. 4559, 1957, pp. 579-580.

"The Action of Solvents on Drying-Oil Films, Parts I and II," *Journal of the Oil and Colour Chemists Association*, vol. 40, no. 5, May, 1957, pp. 377-402 and vol. 40, no. 6, June, 1957, pp. 488-499.

1959

"Problems in Setting up a Museum Laboratory," in: *Application of Science in Examination of Works of Art*, Proceedings of the Seminar, September 15-18, 1958, edited by William J. Young (Boston: Museum of Fine Arts, 1959), pp. 1-16.

"Peering Through the Varnish," *Canadian Art*, no. 65, Summer, 1959, pp. 1-8.

"Part II: Solvent Action," in: Feller, R.L., E.H. Jones and N. Stolow, *On Picture Varnishes and their Solvents* (Oberlin, Ohio: Intermuseum Conservation Association, 1959), pp. 60-91.

1960

"On the Moving of Works of Art," *Canadian Art*, no. 70, September, 1960, pp. 289-290.

1963

"Conservation and Scientific Research at the National Gallery of Canada," *Professional Public Service*, vol. 42, no. 2, February, 1963, pp. 4-7.

"From the Laboratory of the National Gallery," *Bulletin of the National Gallery of Canada*, vol. 1, no. 2, 1963, pp. 1-14.

"Some Studies on the Protection of Works of Art During Travel," in: *Recent Advances in Conservation: Contributions to the IIC Rome Conference*, Proceedings of the Conference, 1961, edited by Garry Thomson (London: Butterworth & Co. (Publishers) Ltd., 1963), pp. 9-12.

"Application of Science to Cleaning Methods: Solvent Action Studies on Pigmented and Unpigmented Linseed Oil Films," in: *Recent Advances in Conservation: Contributions to the IIC Rome Conference*, Proceedings of the Conference, 1961, edited by Garry Thomson (London: Butterworth & Co. (Publishers) Ltd., 1963), pp. 84-88.

1964

"This Art Was a Crime," *Canadian Art*, no. 94, November/December, 1964, pp. 354-357.

1965

"Report on Controlled Environment for Works of Art in Transit," *ICOM Report 65/21* (Washington, D.C. and New York: International Council of Museums, Committee for Museum Laboratories, 1965), 39 pp.

1966

"Fundamental Case Design for Humidity Sensitive Museum Collections," *Museum News*, vol. 44, no. 6, 1966, pp. 45-52.

Controlled Environment for Works of Art in Transit (London: Butterworths & Co. (Publishers) Ltd., 1966), 46 pp.

"The Action of Environment on Museum Objects: Parts I and II," in: *A Primer on Museum Security*, Transcripts from the Seminar, July 13-18, 1964, edited by C.K. Keck, H.T. Block, J. Chapman, J.B. Lawton and N. Stolow (Cooperstown, N.Y.: New York State Historical Association, 1966), 85 pp.

"The Action of Environment on Museum Objects: Part I, Humidity, Temperature, Atmospheric Pollution," *Curator*, vol. 9, no. 3, 1966, pp. 175-185.

"The Action of Environment on Museum Objects: Part II, Light," *Curator*, vol. 9, no. 4, 1966, pp. 298-306.

1967

"Application of Gas Chromatography in the Investigation of Works of Art," in: *Application of Science in Examination of Works of Art*, Proceedings of the Seminar, 7-16 September 1965, edited by William J. Young (Boston: Museum of Fine Arts, 1967), pp. 172-183.

1968

"The Ideal Container and the Travel of Works of Art," in: *Museum Registration Methods* (Washington, D.C.: American Association of Museums and the Smithsonian Institute, 1968), pp. 254-260.

"Man and his World, Expo 67 Montreal: The Technical Organization of an International Art Exhibition," *Museum*, vol. 21, no. 3, 1968, pp. 181-210; French translation, pp. 211-228; Spanish and Russian summaries, pp. XXXIII-XXXVI, XXXVII-XL.

"Standards for the Care of Works of Art in Transit," in: *Contributions to the London Conference on Museum Climatology, 18-23 September 1967*, edited by Garry Thomson (London: International Institute for Conservation of Historic and Artistic Works, 1968), pp. 271-284.

1969

"Conservation of the Contemporary," *artscanada*, vol. 26, no. 1 (128/129), February 1969, pp. 14-18.

"The Importance of Traditional Art Museum Practice," *Curator*, vol. 12, no. 1, 1969, pp. 23-24.

Boyer, R., J.F. Hanlan and N. Stolow, "Element Distribution in Cross-Sections of Paintings Studied by X-ray Macroprobe," *Studies in Conservation*, vol. 14, no. 4, 1969, pp. 139-151.

"Examination of Pictures by Rembrandt and Lievens in Ottawa," in: *Symposium on Technical Aspects of Rembrandt Paintings: Proceedings*, September, 1969 (Amsterdam: Amsterdam Kunshistorisch Institute, 1969), p.14.

1970

"Newer Analytical Techniques for the Study of Paint Layers of Works of Art," in: *Abstracts of the Fourth Annual Conference of the American Group, International Institute for Conservation of Historic and Artistic Works*, New York, N.Y., June 12, 1970 (New York: International Institute for Conservation of Historic and Artistic Works, 1970), p. 59.

Hanlan, J.F., N. Stolow, J. MacG. Grant and R.W. Tomie, "Application of Non-Dispersive X-ray Fluorescence Analysis to the Study of Works of Art," *Bulletin of the American Group, International Institute for Conservation of Historic and Artistic Works*, vol. 10, no. 2, 1970, pp. 25-40.

"Trends in the Care of Traveling Art Exhibitions," in: *Abstracts of the College Art Association Annual Conference*,

Washington, D.C., January 28 to February 1, 1970 (New York: College Art Association, 1970).

1971

"The National Conservation Research Laboratory" (Ottawa: National Gallery of Canada, May 1971), 12 pp. Typewritten report/handout.

"Part II: Solvent Action", in: Feller, R.L., E.H. Jones and N. Stolow, *On Picture Varnishes and their Solvents*, (Cleveland, Ohio: Case Western Reserve University, 1971), pp. 45-111.

1972

Stolow, N., B. Wennberg, P. and Cannon-Brookes, "Report on the Working Group on the Care of Works of Art in Transit," *ICOM Report 69/38* (Paris: International Council of Museums, 1972), 30 pp.

"Solvent Action," in: *Conservation of Paintings and the Graphic Arts*, Proceedings of the Lisbon Congress, 1972 (London: International Institute for Conservation and Historic Works of Art, 1972), 14 pp.

Progress in Conservation, edited by N. Stolow (Ottawa: National Gallery of Canada, 1972), 60 pp. Exhibition catalogue.

"The Exhibition Progress in Conservation," *Bulletin of the International Institute for Conservation of Historic and Artistic Works, American Group*, vol. 12, no. 2, April 1972, pp. 9-12.

For References after 1972 consult the following:

Stolow, Nathan. Curriculum Vitae-Résumé 2008, in: *Stolow, Nathan - Documentation File*, National Gallery of Canada Library and Archives, Ottawa.

National Gallery of Canada Library and Archives, Ottawa, <http://www.gallery.ca/en/library/services.php>.

AATA Online (Conservation at the Getty), <http://aata.getty.edu/nps>.

Canadian Conservation Institute (CCI), <http://www.cci-icc.gc.ca>.