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that is sometimes imputed to them. The book concludes with an interesting illustrated timeline of key events and exhibition checklists.

I mentioned above that this book and exhibition had inspired me to take greater interest in the archive of object photography accumulated over 120 years by my own institution. No doubt, there is much of research interest within such an archive, including the tracing of historical shifts in the way objects have been understood and interpreted as artifacts before and after their arrival in the museum. But, reader, I have to report that there was no Man Ray at work here on the collections in Oxford, and neither was surrealism, evidently, a formative influence on our staff photographer. Nonetheless, this book's blend of patient research, historiographical confidence, and thought-provoking analysis, as well as visual richness and ability to engage with popular culture, should be enough to inspire future exhibitions.

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1 See Wendy Grossman and Steven Manford, "Unmasking Man Ray's *Noire et blanche*," *American Art* (Summer 2006): 134–47.

## Photography and Science

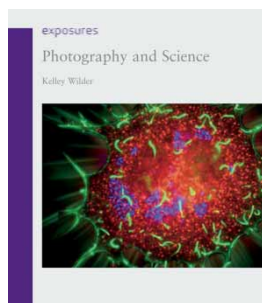
by Kelley Wilder

London, Reaktion Books Ltd., 2009

144 pp., 20 color plates, 60 halftones, \$29.95 (paper). ISBN 978-1-86189-399-4

Reviewed by Terrence R. Nathan

Born of science and nurtured by art, photography has exposed the invisible. From X-ray diffraction photographs of DNA to the faint light at the far reaches of the universe, photography has enabled science to record and document for later analysis a wide range of natural phenomena. The seeds of this photography–science relationship were sown centuries ago, beginning with developments in light and optics during antiquity and continuing with experiments using light-sensitive compounds during the Enlightenment. But it would only be in the early nineteenth century when Louis Daguerre (1787–1851) in France and William Fox Talbot (1800–1877) in England independently conducted experiments that were successful in permanently fixing an image with light-sensitive materials. Daguerre's process produced an image on a highly polished, light-sensitized, silver-coated copper plate, which produced a



one-of-a-kind image that he called a daguerreotype. Talbot's process, which he called photogenic drawing, fixed an image on light-sensitized paper to produce a stable negative from which multiple prints could be made. Daguerre's invention was announced on January 7, 1839 at a meeting of the Académie des Sciences in Paris. Talbot's invention was announced several months later in England. Thus 1839 marks the birth of photography, a singular year in the history of modernity.<sup>7</sup> From this beginning, photography and science have formed an immutable bond, where photography has relied on science for its technological developments, and science has utilized photography as an essential tool for probing and documenting the natural world.

Kelley Wilder's book, *Photography and Science*, provides a fresh and incisive introduction to the complex and evolving relationship between photography and science. Beginning with a concise and informative introduction, the book is organized around four chapters: "Photography and Observation"; "Photography and Experiment"; "Photography and the Archive"; and "Art and the Scientific Photograph." Each chapter contains quality color and duotone images that reinforce and expand on the text. The images span the history of the medium and are a welcome addition to those commonly found in books addressing the connection between photography and science. A brief glossary provides additional explanation of some of the key technical terms, though a more expansive glossary would likely benefit those less versed in the terminology associated with photographic emulsions and scientific techniques discussed throughout the text.

As Wilder states in the introduction, the chapters are bound together by three recurring themes: the representation of scientific objects or phenomena in pictures; the use of photography to detect and measure phenomena; and the development of photography as a science. Wilder poses several questions that motivate discussion in the subsequent chapters: What is a scientific photograph, or photographic science? What is the relationship between photography and science—and why should it interest us? Is "scientific" a genre of photography? Does "photographic" describe a type of scientific method? (p. 8). Wilder indirectly addresses these questions within the context of each chapter, drawing on examples from a variety of scientific fields, including astronomy, biology, medicine, photogrammetry, and physics. Notably absent from the book, however, is discussion of evolutionary biology, particularly Charles Darwin's (1809–1882) pioneering use of photography to illustrate scientific theory in *The Expression of the Emotions in Man and Animals*.<sup>8</sup>

In the introduction, Wilder not only lays out the main themes and central questions that frame the four chapters, but also she briefly discusses two issues that emerged at the beginning of photography and that remain to varying degrees today. Wilder identifies one issue as "trust" and the other as "illustrating science." The trust issue centers partly on the camera-as-eye analogy, which Wilder notes was highlighted by Jean-Baptiste Biot (1774–1862), Professor of Physics at the Collège de France, at the January 7, 1839 meeting of the Académie des Sciences in Paris (p. 9). From the camera-as-eye analogy springs the oft-quoted phrase "seeing is believing," a notion that underscores the perceived veracity of photographic images. Despite the camera-as-eye analogy and the trust it implies, early photography faced challenges regarding standardization in printing and reproduction: emulsions were inconsistent,

development processes were imprecise, and mechanical workings of the camera were variable. Overcoming these challenges was central to producing images that were considered reliable for scientific purposes (p. 14).

The second issue that Wilder touches on is “illustrating science.” The use of photography in illustrating science began soon after its invention, and by the twentieth century, it was firmly entrenched in scientific communication. Photography commonly appeared in popular science magazines, books, and professional journals and provided an efficient means for promulgating scientific thought and findings to the public and scientific community. Using the journal *Nature* as an example, which was first published in 1859 and continues in circulation today, Wilder gives a brief overview of the evolution and intimate connection between photography and scientific illustration. But, as she states, her focus is not on the history and developments in scientific illustration per se; rather, she is most concerned with issues typified by “the possible connections between Paul and Prosper Henry’s astronomical images of the nineteenth century and an anonymous sheet of film from the late twentieth century, showing DNA” (p. 15).

In chapter 1, “Photography and Observation,” Wilder addresses some of the complex issues that emerged in the nineteenth century as science slowly embraced photography as a reliable tool for recording and observing natural phenomena. Owing to its mechanical nature, photography was perceived as efficient and objective, thus lifting from the observer the often tedious burden of measuring, tabulating, and describing; skills often prone to human error. Moreover, by exploiting short- or long-time exposures or by using emulsions sensitive to radiation outside the visible part of the electromagnetic spectrum, photography could display for later analysis phenomena that were beyond the ability of ordinary human vision to resolve.<sup>9</sup> Oft-quoted examples of such phenomena include: Eadweard Muybridge’s (1830–1904) pioneering high speed photography (ca. 1877), which settled an ongoing debate about whether a galloping horse had all four hooves off the ground (it did); Wilhelm Röntgen’s (1845–1923) startling X-ray photographs of his wife’s hand (ca. 1895); and Paul (1848–1905) and Prosper Henry’s (1849–1903) striking photograph of the Lyra nebula (ca. 1885). Yet, despite these remarkable and informative images, the application of photography to scientific observation in the nineteenth century was fraught with problems. As Wilder lucidly describes, these problems centered largely on nonstandardization of emulsions and the absence of interpretive procedures for photographs (p. 20). Emulsions differed in light sensitivity, tonal range, and clarity of detail, and were subject to the vagaries of the weather. Moreover, different photographers used different emulsions, further exacerbating the task of extracting reliable data from the photographs. Once the photographs were made, then issues of interpretation arose. Quite simply, what was the photograph about? Analysts might provide various interpretations of the same photograph, thus diminishing the photograph as scientific evidence. And how is the information depicted in a photograph quantified for further analysis and documentation? To illuminate the issues surrounding standardization and interpretation, Wilder discusses several examples, most notably the transits of Venus in 1874 and 1882 (p. 21), C. V. Raman’s (1888–1970) photometric images of diffraction (p. 35), the application of photogrammetry in archaeology surveying, and engineering

(p. 41), and the use of high speed photography in parceling motion into sequences of discrete images (p. 44).

In chapter 2, Wilder delves into the relationship between photography and experiment. The chapter opens with Wilder briefly addressing several related concepts: photographic reliability in experimental situations; photographic experiment versus experimental photography; multiple uses of photographic images; hybrid nature of photography; photography as experimental evidence; and photographic control. Wilder ties these concepts together by highlighting specific experiments conducted by such scientific luminaries as Sir John Herschel (1792–1871), Antoine Henri Becquerel (1852–1908), and Cecil F. Powell (1903–1969).

Photographic reliability in experimental science, particularly in the nineteenth century, was often compromised by lack of understanding of the photochemical properties of the emulsions that were being used. Consequently, as Wilder makes clear, scientists such as Herschel and Becquerel would often have the dual task of using and developing photographic processes when conducting experiments. In Herschel's case, he conducted pioneering experiments in 1839 showing the practicality of photography in experimental science while also developing new photographic processes (p. 56). Becquerel's experiments on radioactivity in 1896 were designed to investigate both the radioactivity and the emulsions that were used to record it (p. 58). As scientific experiments became more specialized in the twentieth century, emulsions followed suit. So-called designer emulsions were developed that were highly specialized, adding greater control and reliability in experimental applications. Wilder provides an excellent discussion of designer emulsions on pages 74–78, noting, for example, the nuclear emulsions developed and used by Powell, for which he received the 1950 Nobel Prize in physics, and highlighting the Photographic Emulsion Panel, which was established in England in 1945 to create nuclear emulsions.

Throughout chapter 2, Wilder discusses and provides examples of scientifically motivated images that have transcended their original evidentiary purpose. In some cases, photographs that were made for the sole purpose of demonstrating scientific principles, such as Berenice Abbott's (1898–1991) photographs of the principles of mechanics, are now considered modernist art (p. 54). As Wilder points out, photographs born of scientific experiments often have multiple functions: they may serve as a body of scientific evidence; become part of an archive for later analysis; result in a single image that is representative of a broad concept or idea; or be displayed as art (p. 53).

Chapter 3, "Photography and the Archive," briefly reviews the history and challenges of archiving photographs. Wilder frames this chapter around two sections: the photographs that make up the core of the archives and the manner in which knowledge is gleaned from the archives. Before treating these two sections, Wilder sets the stage by noting some of the early challenges and efforts to archive photographs. Among the challenges is the fluid nature of photographs. Photographs often have multiple meanings and may take on new meanings when viewed from future and unexpected perspectives. Early efforts to archive photographs include the collecting and archiving of landscape photographs by the United States Geological Survey

(USGS), which began in 1879, and the recording of photographs of cultural and historical importance by the United Kingdom's National Photographic Record Association, which was formed in 1897 by Sir Benjamin Stone (1838–1914). Archiving photographs on a large scale continues today, most notably with the Landsat Program, initiated by NASA in 1972 and jointly administered by NASA and the USGS. Wilder uses the Landsat Program to pose two key questions that are addressed later in the chapter: How does photography in scientific archives work? What are its expected roles, its weaknesses and strengths, its limitations? (p.81). In answering these questions, Wilder travels from the nineteenth century to the present, discussing specific cases and showing several example photographs. Along the way she touches on a variety of topics, including specimen photographs, i.e., singular images from a photographic record that isolate an object; the development of scientific portraiture and the use of photogrammetric techniques in the study of ethnography and anthropology; the photographic inventory or catalog, commonly termed the “organic archive”; the twentieth- and twenty-first-century uses of microfilm and microfiche for archiving photographs; and photographic atlases. Wilder places these topics in historical perspective, identifying strengths and weaknesses as well as several unresolved issues surrounding the various approaches to archiving photographs.

Chapter 4, the final chapter, provides a very brief introduction to the history and current state of art and the scientific photograph. From photography's inception, its purpose and interpretations have naturally vacillated between art and science, often resting in the borderland occupied by both fields. As sometimes mediator and other times protagonist in the art–science dialogue, photography continues to confront issues surrounding the connections between art and science. Wilder embodies these issues in several questions that continue to inspire and challenge scientists, artists, philosophers, and historians: Are scientific creativity and artistic creativity similar? Do art and science images share iconographies (or an aesthetic)? and Can artistic and scientific modes of thought lead to problem solving in each field? (p. 102). Though largely posed as rhetorical questions, Wilder builds on the foundational principles developed in the previous chapters to touch on issues that are related to these questions and discussed in the three subsections of the chapter.

The three subsections of the chapter are “Beauties of Nature,” “Revelation and the Art of Photography,” and “The Science of Art Photography.” In the first subsection (pp. 105–17), what constitutes beauty is not formally defined, but Wilder makes note of form, pattern, and structure, which are at the heart of many of the scientific photographs that are deemed beautiful and discussed and shown in the chapter. These photographs include the photomicrographs of Frederick H. Evans (1853–1943; p. 120), the botanical images of Karl Blossfeldt (1865–1932; p. 108), and the photograms of László Moholy-Nagy (1895–1946; p. 109).

In the subsection, “Revelation and the Art of Photography” (pp. 117–21), Wilder returns to the recurring theme of emulsions, but now discusses them in the context of tonal scales, an important consideration for some photographers who were striving for beauty in their photographs. Wilder highlights the work of Frederick Evans, who she states believed that the “real truth of photography lay not only in the formal beauty

of the object (microscopical or architectural) but in the grayscale achieved by a combination of proper negative exposure and appropriate choice of printing material” (p. 119).

In the final subsection, “The Science of Art Photography” (pp. 122–28), Wilder begins with a discussion of how emulsions were used by artists not only as a tool for making observations, but also as medium that could be experimented with in the creation of art, often leaving the outcome to chance. Exemplars of this practice were surrealist photographers Man Ray (1890–1976) and Paul Uvac. Wilder concludes the section with a discussion of rephotography, a direct counter to the experimental and interventional approach in making scientifically motivated art photographs. Rephotography concerns itself with photographing sites or objects that have been previously photographed, thus providing a time sequence between images. Wilder highlights the Second View and Third View rephotographic projects of Rick Dingus (b. 1951), Mark Klett (b. 1952), and others who have rephotographed iconic scenes of the American West that were originally made in the nineteenth century by master landscape photographers such as Timothy O’Sullivan (ca. 1840–1912; pp. 124–28). These rephotographic projects require great precision, making sure the vantage point and camera settings match those used in making the original images. By doing so, comparison between past and present is made clear and the artistic style of the original images is preserved. As Wilder states, by closing with a discussion of the rephotographic projects, the central themes of the book are united: the historical assumption of passivity and objectivity; the creation of objective and measurable photographs; the control and experimentation in making photographs; and the state of the photographic record.

Photography and science have a rich and common history with many familiar stories and others yet to be told. In *Photography and Science*, Kelley Wilder has added a fresh story, one built on scholarship that adds new and meaningful insight into the ever-evolving relationship between photography and science.

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1 The scientific discoveries, timelines, and circumstances that culminated in the announcements of photography in 1839 have been covered in depth in several notable histories of photography, including: Beaumont Newhall, *The History of Photography* (New York: The Museum of Modern Art, 1982); Naomi Rosenblum, *A World History of Photography*, 4th ed. (New York: Abbeville Press, 2007).

- 2 Charles Darwin, *The Expression of the Emotions in Man and Animals* (London: John Murray, 1872). For a thorough analysis of the role of photography in Charles Darwin's theory of evolution and how it connected art and science in the nineteenth century, see Phillip Prodger, *Darwin's Camera: Art and Photography in the Theory of Evolution* (Oxford: Oxford University Press, 2009).
- 3 For a brief history and many photographs showing how nineteenth-century photography made visible what was previously invisible to ordinary human vision, see Corey Keller, ed., *Brought to Light: Photography and the Invisible, 1840–1900* (New Haven: Yale University Press, 2008).

### The Stillness of Hajj Ishmael: Maxime Du Camp's 1850 Photographic Encounters

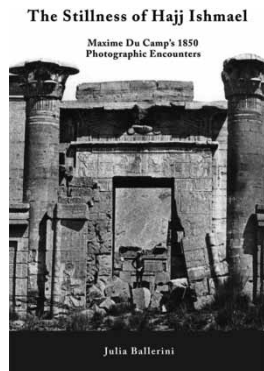
by Julia Ballerini

Bloomington, Indiana, iUniverse, 2010

216 pp., 19 black-and-white illus. \$18.95 (paper). ISBN 978-1-45020-307-4

Reviewed by Keri Yousif

Julia Ballerini, in *The Stillness of Hajj Ishmael: Maxime Du Camp's 1850 Photographic Encounters*, examines the recurring figure of Hajj Ishmael, a Nubian sailor, in Maxime Du Camp's photographs of Egypt. Du Camp (1822–1894) and Gustave Flaubert (1821–1880) traveled to Egypt in November 1849. They spent six months sailing



along the Nile, during which time Du Camp photographed monuments, ruins, temples, and the Egyptian landscape. Ishmael is present in many of Du Camp's photographs: "standing *kouros*-style in front of a monument," "posed within the crevices of a ruin," or "framed by the architecture, his figure a picture within a picture" (p. xiv). While such positioning follows the traditional use of the human form as a measure of scale, Ballerini posits that Du Camp's reliance on Ishmael exceeds conventional visual practices. Yes, the Nubian is a meter, but he is a meter for nineteenth-century notions of home, travel, and the foreign.

In order to flesh out the figure of Ishmael and his significance, Ballerini turns to Du Camp's entire Egyptian oeuvre: the photographic album, *Égypte, Nubie, Palestine et Syrie* (1852); the novel, *Le Livre posthume: Mémoires d'un suicidé* (1853); and the travel narrative, *Le Nil* (1854), all of which include and "reinvent" Ishmael "according to the demands of each genre" (p. xv). It is this combination of written and visual texts that sets Ballerini's work apart. By widening the scope of her analysis, she is able to track the many faces of Ishmael, as he is figured and then reconfigured in word and image. This cross-textual approach is a welcome addition to the small corpus of scholarship on Du Camp's writings and photography. Importantly, Ballerini's work falls in line with recent interdisciplinary research on nineteenth-century Orientalism. Her move between photography, fiction, and travel writing illustrates the shifting, and at times conflicting, ways in which the French portrayed the Orient and themselves.