

**Making bodies, making kin:
Storytelling and the professionalization of
medical illustrators in North America**

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Abstract

Contemporary concerns about diversity and inclusion in medical practice demand a more nuanced understanding of medical illustrations as part of a larger system of medical knowledge informed by historical and economic conditions in which they are produced. This dissertation explores the professionalization, pedagogy, and practices of medical illustrators in North America since the First World War. I analyse medical illustrators' professional formation and epistemic culture through a combination of archival research, interviews, and participant observation in graduate programs and professional gatherings, paying close attention to the role of gender in disciplinary formation. Graduate education transforms students from epistemic misfits into "storytellers" capable of bridging cultural binaries of art and science by reasserting colonial hierarchies of knowledge. In contrast to the patriarchal "founding father" narrative of professional emergence, the structural work of professionalization such as standardizing training and organizing professional bodies was carried out largely by female illustrators. Emphasis on metaphors of "family" and "storytelling" has enabled a feminized group of scientific workers to navigate an uncertain social and economic position by situating their knowledge practices within established institutions and forms of authority. However, positioning medical illustrators as subservient and limiting their knowledge claims ensures their continued invisibility as expert knowledge workers and limits their ability to challenge colonial conventions of representation. Exploring the making of medical illustrators presents an opportunity to reimagine their role in making medical knowledge.

Keywords: diversity, equity, and inclusion; kinship; medical illustration; medical illustrator; professionalization; representation; specialization; visualization

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Chapter One: Introduction

Technologies of recognition

On a chilly afternoon in late September, I stand in a windowless and acrid cadaver lab in the basement of a brutish 1970s-era university medical building. A group of first-year biomedical communications students are sketching their most recent dissection from the morning's session. As they draw, the anatomy tutor asks about the drawings in relation to those in their textbook: "So you scan the drawings and then the computer fills in the colours? How does it know where to put them?"

The students laugh and patiently explain, "It doesn't just do it automatically, we do it. A person colours it." The anatomy tutor's expression conveys confused amazement, but for the students it is neither the first nor the last time they will need to explain that biomedical visualizations – from textbook drawings to three-dimensional (3D) animations – are made by people.

One of the central paradoxes of biomedical illustration is that a well-crafted image is one that seems not to have been crafted at all. The teaching assistant's seemingly absurd comments reflect the long-standing invisibility of professional biomedical illustrators as part of the apparatus of biomedical research and learning. In 1947, medical illustrator Eleanor Swezey opened an article on medical illustration with a medical intern's remark, "Why is a medical artist necessary? Can't they just use the pictures in the textbooks?" Swezey's concern was particularly that "Medical students accept the drawings in their text books [sic] without realizing that someone must have drawn them" (1947, p. 51). Seventy years later, the head of a graduate program in medical illustration, Adam, expressed the same concern:

The profession is kind of invisible and yet it contributes so significantly to the training of people across a range of health professions and also in science generally. [...] It's kind of everywhere in the kind of learning that people do, and everyone just assumes it's a machine who does it or something, I don't know, or these are just resources that exist somewhere and just get used. That's just surprising when people are, 'Oh, I didn't know that people did that.'

The invisibility of medical illustrators, even amongst those whose knowledge depends upon their products, reflects more than a simple lack of awareness. The elision of human agency and expertise involved in the production of biomedical visualizations is a central strategy through which their credibility as repositories of scientific knowledge is maintained.

Biomedical illustrations, animations, and visualizations are the product of complex assemblages of humans and non-humans. The anatomical images that anchor the concept of “medical illustration” in the public imagination are composed from the bodies of the dead (and the various modes through which such bodies are procured), methods of preservation, tools of dissection in the hands of dissectors and anatomists, lighting choices, technologies of registration from grids to photographic equipment (which itself entails a complex assemblage of lenses, emulsions, chemicals and papers), myriad manual drawing tools from pens and pencils to paint and carbon dust, computer-based tools from Photoshop and vector graphics to 3D rendering and four-dimensional (4D) animation software, reproduction and dissemination technologies from industrial printing presses to websites to video games, and the people trained to use all of these tools in tandem with scientific and medical knowledge. Yet once an image exists in its final form, the constellation of persons, objects, and relations that brought it into the world disappears.

The apparent self-evidence of medical illustrations obscures not only the labour and expertise required to make them but also the social and material contingencies embedded in them. Biomedical images play a key role in how medical personnel and laypeople alike learn to see bodies. The erasure of the material labour involved in the creation of such images leads to an

understanding of medical images as unfiltered representations of the scientific truth of bodies. When certain kinds of bodies become naturalized as normal, others are construed as inherently pathological, which can result in serious health disparities (Bauer et al., 2009; Massie et al., 2019; Parker, 2016). Thus, the creation of biomedical images has material consequences in the lives of the many people who fall outside those narrow (and often unattainable) norms. However, the persistence of narrow conventions of biomedical representation is tied not only to tradition or political ambivalence, but also to the social and historical forms upon which their producers' credibility rests. For decades, feminist scholars have critiqued the presumption of a white, male body as "standard" in medical illustrations (Cartwright, 1998; L. J. Moore & Clarke, 1995, 2001; Parker, 2016; Treichler et al., 1998; Tuana, 2004). Yet many of these anatomical and biomedical illustrations were created by women. Indeed, women have comprised the majority of professional medical illustrators in North America throughout the last century. In light of these demographic realities, the persistence of substantial gender and racial disparities in medical visuals and in medical practice demands a more nuanced explanation.

At a time when both medical and academic institutions are grappling with questions of identity and diversity in relation to pedagogy and knowledge, this project seeks to develop a more concrete understanding of the social and material mechanisms through which these norms are created and maintained. To better understand the social and material conditions in which biomedical images come to stand in for organic bodies and processes, this dissertation explores the material and social processes through which medical illustrations – and the people who make them – are produced. Through the lens of feminist science studies, I explore the professionalization, pedagogy, and practices of medical illustrators in North America since the First World War. Through a combination of archival research, interviews, and participant

observation in graduate programs and professional gatherings, I analyse medical illustrators' professional formation and epistemic culture in order to make sense of the labour required to make images appear credible, natural and self-explanatory. Drawing on Karin Knorr-Cetina's canonical analysis of "epistemic cultures," I approach medical illustration as part of the "arrangements and mechanisms" that "make up how we know what we know" about bodies in a medicalised western context (2022, p. 1). I evaluate historical and contemporary materials for what Michelle Murphy has called "regularities" – defined as "the pattern of arrangement that is repeated, congealed, and constitutive of a scientific discipline or epistemological tradition" – in order to develop an understanding of how the profession of medical illustration is materialised in tandem with its biomedical objects and material practices (2006, p. 13). Grounded in a feminist materialist approach to knowledge, I attend to how race, gender, and class have shaped medical illustrators' professionalization projects, which disciplinary stories are told, and the role of both their labour and their artifacts in the construction of medical knowledge.

In this chapter, I provide a general background and review some of the key concepts at stake in this study. First, I explore the epistemic anxieties that animate the history of representational practices in science and the material practices of medical illustrators. In the next section, I situate the current study in relation to studies of professionalization and ongoing concerns about diversity and inclusion in medical illustration. I suggest that questions of technology, expertise, and gender inform the kinds of professional boundary work deployed to manage these epistemic anxieties in the twentieth century. In the last section, I describe my research methodologies in greater detail and provide a brief overview of the dissertation, highlighting the empirical and theoretical focus of each chapter as well as major threads that unite the chapters.

Image 1

Aesculapius instructs Hygeia in the art of medical illustration



From Willis, T (1682). *Amstelaedami: Henricum Wetstenium*. Image retrieved from <http://resource.nlm.nih.gov/101435274> (in the public domain).

The author, the image, and the medical illustrator

In this section, I provide a brief overview of literatures and concepts concerned with representation and expertise in science and medicine. Despite the clear importance of visualization in contemporary medical education and practice, the bulk of historical research has

focused on developments prior to the turn of the twentieth century. Although some have shown interest in areas such as medical photography, few historians have explored the shift in medical illustration from individual patronage to a recognizable and independent profession during the twentieth century. As I will show, attending to what changed – or did not – in the process of professionalizing can provide important insights into how these practices function in the present.

The historical development of anatomy and anatomical atlases provides a useful background to contemporary concerns (Carlino, 1999; Daston & Galison, 2010; Hopwood, 2005; Kusukawa, 2012; Park, 2006). I begin this section with a very brief overview emphasizing the co-evolution of materials and techniques alongside the changing role of both images and their makers in European science and medicine, particularly since the eighteenth century. As I explore in Chapter Three, this long history remains an important reference point for contemporary practitioners. Indeed, as I argue throughout, invoking particular versions of history is a key strategy for navigating questions of technological change, human agency, and the epistemic role of images in the professional self-fashioning of medical illustrators today.

The long history of medical illustration is typically traced via influential early European anatomists, beginning with Claudius Galen (130-200 A.D.). Andreas Vesalius's 1543 *De Humani Corporis Fabrica* is generally considered to be the first work to substantively challenge Galenic tradition. As the practice of cadaver dissection and increasingly formalized medical education proliferated over the subsequent centuries alongside developments in printing and image reproduction, an expanding array of increasingly sophisticated visual forms developed to accompany medical treatises and anatomical atlases.¹ As I explore in Chapter Six, the

¹ Thornton and Reeves (1983) provide a helpful overview of the use of various printing and engraving techniques in historical medical illustrations.

conventions and styles of medical illustration developed in conversation with the affordances of materials, contemporaneous representational canons, and the rhetorical and epistemic roles that these images played in the works they accompanied.

Although a detailed analysis is well beyond the scope of this argument, it is important to acknowledge the distinctiveness and materiality of different printing methods. Each employs distinct mechanical means of transferring ink to paper, which in turn creates unique physical and embodied relationships between materials, makers, and the finished product. For example, in addition to being more portable and durable than the woodcuts used throughout the early modern period, the introduction of etching and engraving on metal (usually copper) plates around the turn of the seventeenth century enabled even greater detail and shading of bodily tissues and spaces. By the eighteenth century, lithography and chromolithography allowed artists to draw directly onto the surface to be printed, as well as enabling far more nuanced use of colour. These material qualities inform strategies and styles of rendering, from use of line and shading to the images' size and their relationship to textual elements. Furthermore, each printing process also involves multiple translations. In addition to sometimes complex mechanisms for creating the original image, its apotheosis as a reproducible illustration requires transferring the drawing to wood, metal, or stone, rendering that image printable (via carving, incising, and/or treatments with resin, acid, or other chemicals), and finally, careful application of ink to the prepared surface for transfer to the final paper. Some of these steps entail exquisitely subtle bodily gestures, such as the careful whisking of excess ink from a copper plate, while others require large and physically exhausting movements, such as the cranking of layers of paper and plate through a press. At each step of production and reproduction, details might be added or lost. As scholars like Caren Berkowitz (2015) have argued, the character and quality of the resulting

images are as much the product of the skillful judgement of artists, engravers, and printers as the authorial vision of anatomists.

Because the creation of reproducible images entails multiple technologies, skills, and human actors, early authors were deeply concerned with emphasizing their own control over the outcome. The production of scientific and medical atlases generally necessitated a close working relationship between authors and artists, but this close relationship was also a stringently hierarchical one. While some authors described fraught relationships with artists and engravers, the ideal artist for eighteenth century atlas maker was a “clever but docile servant,” whose eyes and hands acted as an extension of the anatomist, but were not independent of him (Daston & Galison, 2010, p. 138). Both discursive and visual rhetorics stressed the primacy of the author as the source of illustrated knowledge. By the eighteenth century, a description of the production of images emphasizing the author’s vigilance and authority over the entire process – including choice and preparation of specimens, exacting oversight of artists, and vigorous exchanges with printers and engravers – was practically compulsory in prefaces to illustrated medical and scientific texts (Berkowitz, 2015; Daston & Galison, 1992). Furthermore, as Berkowitz argues, “Enlightenment anatomists across Northern Europe... used visual style to render artists and engravers invisible, and to ensure that their folios were distributed as objects identified with a single anatomist–author” (2015, p. 175). Authors established themselves as the ultimate authority over the knowledge presented by affirming their procedural, rhetorical, and aesthetic control over both artists and illustrations (Berkowitz, 2015; Kusakawa, 2012; Stelmackowich, 2008). However, both the form and purpose of this authorial oversight continued to evolve.

Over the course of the eighteenth and nineteenth centuries, production and circulation of increasingly detailed and colourful medical images worked in tandem with changing structures

of publishing, medical education, and medical practice to construct and orient medical knowledge practices (Berkowitz, 2015; Meli, 2015; Stelmackowich, 2016). Illustrated texts such as scientific and anatomical atlases serve not only to orient readers to unfamiliar objects and phenomena but to rework their particularities and idiosyncrasies into standardized, generalizable “working objects” for science (Daston & Galison, 1992, p. 85). However, as historians of science Lorraine Daston and Peter Galison have argued, this standardizing impulse might take many different forms, including the “selection of ‘typical,’ ‘characteristic,’ ‘ideal,’ or ‘average’ images,” each with its own relationship to referents in the natural world (1992, p. 87). Furthermore, the forms these standard images took created their own standards of representation. Strategic use of changing technologies and aesthetic conventions allowed authors (and skilled artists) to construct persuasive ontological relationships between cadavers, specimens, and living tissues by concretizing those relationships in recognizable visual forms (Berkowitz, 2013; Hopwood, 1999; Kusukawa, 2012; Meli, 2015; Valverde, 2009). The range of possible forms was constrained by the material realities of printing, publishing, and producing medical knowledge as well as existing representational repertoires. However, where those forms were unconventional, their instantiation in a successful atlas could also create a new norm (Hopwood, 2005; Stelmackowich, 2016). Decisions about how and when to use particular materials and methods of illustration were more than incidental, they enabled specific arguments and conceptualizations of bodies, disease, and medicine.

Martin Kemp asserts that around the late nineteenth century there emerged a “style-less style” in medical illustration, epitomized by the austere visual style of works such as *Gray’s Anatomy* (2010, p. 205). Kemp argues that although it might seem “style-less” in comparison to the self-consciously rhetorical visual style of Renaissance and Baroque illustrations, the pared-

down functionalism often associated with scientific and medical illustration was an equally rhetorical response to more regimented and institutionalized forms of medical education. Berkowitz (2011) attributes this shift to structural changes including the professionalization and regularization of medical training and careers, which reduced concerns with securing patronage. However, Daston and Galison (2010) suggest deeper epistemic motivations for stylistic changes. They argue that “the public personas of artist and scientist polarized” in the nineteenth century, resulting in the conceptual divergence of scientific “objectivity” and artistic “subjectivity” (2010, p. 37). The value previously placed upon human discernment and expertise as a scientific virtue shifted to become a source of potential illegitimacy as the moral framework for scientific authority coalesced around “an insistent drive to suppress the willful intervention of the artist-author” (Daston & Galison, 2010, p. 121). This “mechanical” conception of objectivity suggested that if the human was prone to subjective and unreliable observations, seeing what he wanted to see, the machine was not. Where human intervention was necessary, it should avoid emotion or analysis, seeking instead to record as impassively and automatically as possible, without flourish, interpretation, or artistry. The anxiously austere “style-lessness” in illustrated medical and anatomical texts reflects this emerging epistemic ideal of virtuous restraint.

Shifts in style and ethical orientation toward scientific images in the nineteenth century are accompanied by a shift in the gendering of medical illustration. Although some medical books were illustrated by the authors themselves (e.g., John and Charles Bell), the majority were not.² Through the eighteenth century, artists and engravers were rarely credited by name, but where artistic authorship has been established, most were male. However, the number of

² For a general overview, see Thornton (1983); Roberts & Tominson (1992); Anderson et al (2011). For some specific examples, see Berkowitz (2015); Neher (2009); Meli (2015).

illustrations produced by women – often the wives, daughters, and female relatives of male scientists – increased over the course of the eighteenth and nineteenth century (Lykknes et al., 2012; Richmond, 2001; Roos, 2012; Rossiter, 1987; Sheffield, 2006). Daston and Galison suggest that eighteenth century “naturalists encouraged women artists because the double inferiority of their status as artisans and as women” rendered them doubly submissive to the author’s vision (2010, p. 89). However, even as the author-artist relationship shifted away from the eighteenth century ideal of a “compliant draftsman” to an “uneducated blank slate” in the nineteenth century, this gendered dynamic did not (Daston & Galison, 2010, p. 95). The shift simply replaced one type of idealized passivity with another.

The confluence of epistemic, aesthetic, and gendered shifts at the end of the nineteenth century was not coincidental. Mechanical objectivity, “style-less style,” and the feminization of medical illustration were interlocking strategies for managing anxieties about the epistemic position of images in science. As Daston and Galison acknowledge, women scientific workers were, like other “unskilled” workers, “identified with the machines, and, like the machines, in their ‘emptiness’ they offered a transparency through which nature could speak” (1992, p. 341). Moreover, naturalized as a gendered quality, women’s “emptiness” meant they could be relied upon to abstain from theorizing or intervening in the interpretation of data, making them ideal extensions of a mechanically objective apparatus of representation. At the same time, as Bernard Lightman argues, women were “considered to be ‘naturally’ religious, emotional, and subjective,” precluding their participation in professional scientific societies (2006, p. 228). Although use of illustrations contributed to women’s authority in the context of their own popular texts, that authority did not translate to illustrations in texts authored by men, popular or otherwise. Faced with continued exclusion from professionalized science, women’s

incorporation into the scientific enterprise as popularizers and invisible technicians adapted normative female social roles to a changing political climate (Shteir & Lightman, 2006; Twohig, 2005). The feminization of medical illustration reinforced the longstanding construction of illustrators as both passive and subservient technicians by re-entrenching that understanding in gendered social relations.

In addition to broader social developments, which I will address shortly, the evolution of material representational practices alongside the transformation of “objectivity” into a scientific virtue and the feminization of medical and scientific illustration in the late nineteenth century provide a context for the developments of the twentieth century which are the focus of this dissertation. Despite changes in both representational technologies and the epistemic values that motivated their production, the responsibility, agency, and authority over images in medical texts remained with authors, not illustrators. Although the labour of artists was increasingly acknowledged and even praised, the scientific authority of authors depended on establishing the the illustrator’s subservience. As a form of epistemological reassurance, atlas prefaces continued the long tradition of painstakingly describing the artist’s role in an increasingly mechanized process of image production well into the twentieth century (Sawchuk, 2012). Although epistemic virtues have shifted to acknowledge and valorize the interpretive work of image-making (including a growing number of works whose illustrators are credited as co-authors), the historical and cultural tendency to elide this work and to treat the scientist-author as locus of authority and ultimate defender of those virtues remains constant. Indeed, even as they assert the significance of this turn towards valuing the epistemic role of the artist’s “trained judgement,” the names of illustrators in Daston and Galison’s account appear only in parentheses and footnotes.

Making history matter

As I will explore in Chapter Three, the history of medical illustration is typically incorporated in the education and professionalization of medical illustrators. In the context of contemporary medical illustration programs, the standard narrative tends to begin with Galen, pass quickly over the contributions of non-Europeans, and to mark Vesalius' *De Humani Corporis Fabrica* as a turning point for both modern anatomy and modern representational practices. Anchored in this long history, the disciplinary history of medical illustration as a distinct profession in North America takes Max Brödel – a German émigré to Baltimore and founding director of the Johns Hopkins Department of Art as Applied to Medicine – as its point of departure. However, this periodization is as much a rhetorical frame for medical illustrators' own self-fashioning as it is a historical one. As I will show, although many medical illustrators cite Brödel's death in 1941 as a catalyst for the expansion of training programs and professional organizing, mid-century professionalization projects emerged in the context of shifts in technology, education, and medical practice during and after the two World Wars. They also reflected anxieties and opportunities arising from the changing status of women during this period.

The mid-twentieth century was also characterized by rapid expansion of new medical technologies and – not coincidentally – visualization technologies for both diagnostic and record-keeping purposes. The rationalization of medical education in North America, begun in the wake of the Flexner report in 1911, gained urgency and speed in response to the two World Wars. The expansion of mass media and rapid rationalization of both medical education and medical practice created an unprecedented demand for medical illustrations and related media. However,

as this dissertation seeks to make clear, even in this context, the apotheosis of medical illustration as a viable and distinct profession was far from inevitable.

Up until the 1940s, the majority of medical and scientific illustrators were typically trained artists, recruited to scientific labour via personal connections. In the early decades of the twentieth century, Brödel and Tom Jones, staff medical illustrators at Johns Hopkins in Baltimore and the University of Illinois in Chicago, respectively, began taking on students in what would eventually become the first two formal training programs for medical illustrators in North America. The majority of students were upper- and middle-class white women with a background in art, referred via family and personal connections. For the first few decades, training remained more akin to apprenticeship, with Brödel and Jones overseeing only a few students at a time while continuing to provide medical art services for the university. Over time, Brödel developed a loose curriculum covering key techniques and concepts, but implementation remained largely discretionary and unregulated, intentionally adapted to the character of students and the work available (M. Brödel, 1941).

As the quality of illustrations available in North America improved during the first half of the twentieth century, so did the overall status of medical illustrators. Increasingly sophisticated techniques for rendering and reproduction, coupled with the growing influence of their institutions and their medical patrons, enabled certain illustrators like Brödel to develop an individual reputation. Indeed, Brödel in particular was often praised not only for the quality and beauty of his images but also for his material contributions to medical research (Patel et al., 2011; Schultheiss et al., 2000; Schultheiss & Jonas, 1999). These contributions were possible in large part as a result of Brödel's association with prominent physician-employers who granted both access and time for original research. However, only a few male illustrators working for

prominent researchers in well-funded institutions enjoyed this enhanced status and freedom. Most illustrators, especially those who were women, did not have the luxury of performing their own original research and when they did, it was rarely acknowledged as such.³ As I argue in Chapters Four and Five, the status of the medical illustrator in North America did not shift substantially until after the Second World War as a result of concerted efforts to professionalize.

Making images matter

Although expanding visual technologies certainly informed changes in everyday practice in the twentieth century, they did not necessarily resolve long-standing epistemic tensions around representation in science and medicine. Despite grandiose claims to the “objective, indexical truth-value of the photograph” most nineteenth century uses of photography in the medical context had more in common with practices and conventions of photographic portraiture than with medical illustration (Amirault, 1993, p. 57). Whereas medical illustration had emerged as a means of documenting bodily interiors revealed through cadaveric dissection, most early medical photography was employed to document externally visible conditions such as physical trauma and deformity, skin conditions, and the external manifestations of psychiatric distress (Amirault, 1993; Kubicki, 2009; Linker, 2011a; O’Connor, 1995, 1999). As historian Erin O’Connor argues, this focus on external symptoms was instrumental in constructing certain disease entities, such as anorexia nervosa, in that “the photograph enabled an ideologically charged assessment of the

³ The most well-known example of a female medical illustrator who did original research is Dorcas Hager Padget (1906–1973). Having begun her career as an illustrator working for neurosurgeon Dr. Walter Dandy, she did extensive research in embryology, including authoring several chapters and monographs. Although she was encouraged by some collaborators and even hired as a “research assistant” at the University of Maryland Medical School, the extent of her contributions as a researcher was not widely recognized until much later. Furthermore, despite her position, she was often dismissed or excluded during her lifetime because she did not possess an MD or other research credentials. For more on Hager Padget’s research contributions, see Sugar (1992); see also Gailloud (2014), Gregg and Gailloud (2017), and Ojumah et al (2020).

anorexic body to seem scientifically neutral” while at the same time “the appeal to the visual effectively obscured questions of etiology” (1995, p. 541). While O’Connor suggests that this Foucauldian conflation of “surface and substance” enabled the reconfiguring of disease “as an external phenomenon,” it did not replace the instrumental uses of medical illustrations in representing bodily interiors and processes, nor did it resolve the epistemic anxieties of medical knowledge production (1999, p. 234). Despite techno-utopian enthusiasm throughout the late nineteenth century and the first half of the twentieth, the material and epistemological realities of photography’s use in medicine did not necessarily match up to these ontological fantasies.

Well into the twentieth century, the role of photography in medicine was far from clear-cut. Correspondence in major medical journals such as the *British Medical Journal (BMJ)* and *The Lancet*, especially between 1945 and 1948, document heated debates over the proper role of photography in medicine, including who should practice it, how, and to what end.⁴ Because radiology and medical photography shared many material practices, most radiologists also practiced some medical photography. However, medical illustrators, professional photographers, and doctors (particularly dermatologists) also made use of the medium. In a textbook demonstration of jurisdictional disputes, each framed arguments over how to define and institutionalize photography in a manner congruent to their own professional interests. Despite its rhetorical power “as a means of record and a source of ‘evidence,’” photography failed to establish itself as a diagnostic tool on par with radiology, with the relative security and prestige accorded technical subspecialties (Tagg, 1999, p. 247). While some forms of recording the appearance of bodily interiors and microscopic subjects did move into the diagnostic realm, the

⁴ Much of this analysis is based on my own unpublished research regarding this material. See also Stanford (1946), Hansell and Ollerenshaw (1947), Hansell (1948), and McFall (2000).

linguistic shift from *photography* to *imaging* is pertinent. The bulk of historical work on “medical photography” pertains to the use of photographs in a documentary capacity, such as patient records and public relations (Fox & Lawrence, 1988; Fox & Terry, 1978; J. L. Golden & Rosenberg, 1991; Kubicki, 2009; Linker, 2011a; Warner, 2014).⁵ Much like medical illustration, the eventual construal of medical photography as a form of representing (but not generating) knowledge relegated it to more feminized areas of practice related to clerical and educational work.

While changes in medical imaging technologies and representational tools are clearly tied to changes in research practices, representational practices, and the epistemic role of images in medicine, these changes do not directly coincide with substantive changes to the place of the medical illustrator in the ecology of purveyors of medical knowledge. Rather than replacing medical illustration, photography was (and is) deployed as part of an array of tools and technologies circulating in the ever-changing economy of medical image-making. While certain forms of specialized photography eventually freed medical illustrators from extremely detailed work such as microscopic and ophthalmic illustration, in areas such as surgery or anatomy photographs were more likely to be used as a reference than as a final product (Sawchuk, 2012). Although it had once been framed as an antidote to the “excess” of the artist, by the twentieth century it was the camera whose excess needed to be managed (Amirault, 1993, p. 55). However, photography retained the aura of objectivity and scientific authority “through an indexical relationship to reality that could claim an authentic connection to ‘real’ specimens” (Sawchuk, 2012, p. 123). Furthermore, although women (including some medical illustrators) also practiced medical photography, it retained a more masculine cultural coding and demographic makeup

⁵ Some notable exceptions include de Rijcke (2008), Sawchuck (2012), Sappol (2017), and Alberti (2018).

(Gibson, 1981; McFall, 2000). Despite their overlapping and often complimentary jurisdictions, these divergent histories and material conditions continue to inform the professionalization projects and self-fashioning of both groups.

The matter of medical Illustration

Alongside technological changes, the markets and social economies of medical illustration have also shifted, particularly since the Second World War. At the beginning of the twentieth century, the bulk of medical illustration work was the result of close, ongoing patronage-like relationships between the illustrator and particular surgeons or researchers (R. D. Johnson & Sainsbury, 2012; M. R. Moore et al., 1991). The work consisted primarily in illustrating the patron's publications, including both articles and large long-term projects, such as book-length surgical and anatomical atlases. Post-war employment was less tied to personal relationships with physicians and researchers and the work became more dispersed, covering an ever-broader range of subjects and output formats as medical education and hospital medicine expanded. As more hospitals and universities began to directly employ medical illustrators full or part-time in service to their medical staff and faculty, medical illustrators found themselves managing higher volumes and a widening scope of work and working relationships.

As I explore in Chapter Four, after the Second World War, some of these institutionally-employed illustrators were able to develop professional structures including robust training programs and professional organizations. In 1940, a student seeking formal training as a medical illustrator could find it only at Johns Hopkins or with Tom Jones in Chicago. By the founding of the Association of Medical Illustrators (AMI) in 1945, three additional training programs had been established. By the end of the decade, there were nine training programs in North America,

of which four were headed by women, including the Johns Hopkins program. As I explore, this rapid expansion was met with both excitement for the future and anxiety around maintaining standards and an exclusive market, further motivating institutionalization and credentialing projects.

New financial and political uncertainty emerged in the mid-1960s, just as the AMI's accreditation structure for schools of medical illustration was coming to fruition. Budget cuts and administrative restructuring in the 1970s and 1980s led to the decline of more secure institutional positions and a rise in freelancing and commercial work, which dried up again in the 1990s (Brierley, 2013). As I explore in Chapter Five, although the profession had long been a solitary and piecemeal one for those without a stable institutional position, the latter part of the century presented greater precarity, as illustrators competed for contracts, as well as increasing autonomy, especially for those practitioners who were able to keep abreast (or ahead) of trends in graphic technologies. Since the turn of the millennium, there are more permanent positions in dedicated departments and independent agencies, which function somewhat like highly specialized ad agencies. Thus, contemporary medical illustrators are more likely than their predecessors to work as part of a larger team alongside practitioners with different areas of media and subject-matter expertise to develop visualizations in various media for a variety of clients. However, freelance work continues to comprise a large portion of the field and anxieties about employment stability, autonomy, and professional jurisdiction continue to animate graduate teaching and the work of the professional organization.

Contemporary medical illustrators produce images within a complex assemblage of material and social constraints. It is difficult to convey the breadth of practices that make up the field of biomedical communications and visualization today. Since the mid-century, the range of

subjects and products that members work on has expanded in almost every direction imaginable, encompassing a wide variety of techniques, media, and practices, enacted at the intersections of research, clinical practice, and education of practitioners and patients. In addition to medical education and research dissemination, they produce promotional and training materials for pharmaceutical and medical device manufacturers, patient education and public health campaigns. While illustrations for print and the occasional “moulage” (3D sculpting and casting used primarily for teaching) were the bread and butter of earlier generations, contemporary practitioners are likely to work across or even specialize in digital media including animations, simulations, and app development. Although traditional work such as anatomical illustration still occurs, it is mainly accomplished using computer-assisted rendering tools and is rarely the main focus of the project.

The increasing technical and technological promiscuity of contemporary medical illustrators is clear in the range of their outputs, but it is equally tied to shifts in scientific research and inputs from which to draw. Growing demand for work at the molecular level entails frequent recourse to Protein Data Bank models and sophisticated representations of biochemical processes for both practitioner and patient education, research publications, pharmaceutical advertising and science journalism. In addition to direct observation of objects and phenomena, medical illustrators can extract data from medical imaging technologies, such as computerized tomography (CT) and magnetic resonance imaging (MRI) scans, to aid in creation of 3D computer models. Echoing the moulage practices of the past, such models can, in turn, be used to develop applications for learning anatomy, animations explaining surgical procedures, 3D printed models for surgical planning, or even two-dimensional (2D) printed illustrations.

The image of expertise

Although they cannot be considered explanatory mechanisms for professionalization itself, shifting technologies and structures of medical education play a key role in the professionalization projects and self-fashioning of medical illustrators. Many cite technological developments as the greatest driver of change in their profession, but they rarely frame these technologies as a threat. Instead, medical illustrators tend to accept these changes as inevitable, even positive, and understand the ability to assimilate new tools as an essential quality of any good practitioner. They adapt to and exploit the affordances of graphical rendering tools rather than compete with them. However, the protean nature of their material practices continues to complicate the task of distinguishing their work as properly “scientific” while managing professional boundaries against incursions from scientists, data specialists and non-medically trained artists and designers. While mastery of the material practices of visualization are integral to the profession (and comprise a large part of graduate training, as I explore in Chapter Two), this technical promiscuity also makes it increasingly difficult to define just what (or who) a medical illustrator is. In this section, I explore how intersecting ideas of expertise, trust, gender, and technology have informed understandings of what professions are, what they do, and who can be included in them.

What makes a medical illustrator?

Since its founding in 1945, the AMI has become one of the primary structures through which North American medical illustrators recognize and regulate belonging in their profession. As I explore in Chapters Three and Four, this has always been a complex task. However, as both technologies and working conditions continue to shift, it has become increasingly difficult for

practitioners to articulate a cohesive professional identity. Around 2011, the members of the AMI began a process of re-evaluating and “re-branding” their organization, including its name. Conversations that took place during the re-branding exercise were deeply emotional and, at least by some accounts, not always wholly cordial. Some members felt the term “medical illustrator” is too dated and does not convey the breadth and scope of actual practice, while others felt it important to retain a recognizable name that evokes a historical trajectory. Although some understood these frictions as part of a generational divide, individual reasoning tended to be more complex. Echoing earlier debates around educational standards, membership requirements, and collaboration with other organizations in the twentieth century, the twenty-first century re-branding exercise raised fundamental questions about the nature of their work and the role of professional structures.

The simple question of what to call their organization forced contemporary practitioners of varied forms of biomedical visual communications and media creation to confront not only what technological and social changes mean for their profession, but also which parts of their history matter to the present.⁶ As I explore in Chapter Two, the term “medical illustrator” connects professional identity and belonging to a shared history and thereby to a shared set of professional values. However, alternatives entail their own set of histories, values, and practical concerns. Julie, a junior faculty member, described the stakes clearly,

For the association, I strongly feel that sticking with medical illustrator is very important because that is really what drew so many people to the profession to begin with and that

⁶ For the purposes of this dissertation, I use the term “medical illustrator” to cover the broadest possible range of activities undertaken by historical and contemporary practitioners who specialize in the creation of novel visual representations of biomedical knowledge. I also use various alternative nomenclature as appropriate, but without implying substantive ontological distinctions. Similarly, I employ a variety of terms to describe the products of this labour, including representations, images, illustrations, or visuals. Although each bears particular connotations and limitations, there is considerable interpretive flexibility in their everyday use. Thus, rather than artificially delimiting the meanings of various terms, I intend them to be interpreted in the broadest contextually appropriate manner, unless otherwise specified.

ties what we're doing today back to our profession. [...] So, I prefer medical illustrator and I want to uphold the history of the profession in how I refer to myself.

That being said, when I'm introducing myself to new clients and things like that, sometimes I'll pull out the biomedical visual communication specialist stuff because it just sounds more expensive. (laughs) [...] It's like, trying to make ourselves look more technologically relevant and worthwhile to pay for our services. Cause I have to say, it really hurts to just be constantly told like, "I don't see why I should pay that much for your services, but I really need it."

For Julie, the issue of terminology raises deeper questions of professional identity encompassing history, technology, expertise, and economics. Although few contemporary medical illustrators work on gross anatomy as for an atlas, the term "medical illustrator" situates contemporary forms within a recognizable cannon and provides a more familiar starting point for explaining what practitioners have to offer.

On the other hand, the term obscures the sophisticated technical skills and scope of contemporary practice. As another faculty practitioner, Eric, explained:

I try to tell people I'm a medical illustrator cause I often think that that will be simple, but I realize very quickly it isn't cause nobody really knows what that is. [And] to clarify I say have you ever seen a textbook that shows drawings of anatomical specimens? And they'll say, yeah, yeah, yeah. And I'll say okay, well, you know, I do that, but I actually don't do a lot of that. I do something similar to that, so I might build software applications that incorporate visual elements or 3D representations of scientific or anatomical structures.

Paradoxically, the use of a potentially outmoded term to make the work legible to outsiders also misconstrues the very nature of that work. At the same time, while terms like "biomedical visualization specialist," "biomedical multimedia developer," or "biomedical communicator" might more accurately evoke the specialized technical expertise of many contemporary practitioners, such terms remain clunky and opaque. Most practitioners conceded that they adapt terminology to fit the context: "It's just that it's so complex that it can be described differently to different people depending on, you know, what I'm connecting with them most on" (Teresa, junior faculty). Explaining the complex intellectual and dexterous labour of visual production,

while also claiming status as professionals and scientific experts, requires constant negotiation and adaptation to changing contexts.

By the time I began my research, the branding question seemed to have been put to rest, at least for the time being. The decision to retain the name Association of Medical Illustrators (AMI) could be seen as a victory of the more conservative branches of the professional membership at the expense of obscuring the variety of new technologies, practices, and practitioners that make up a growing portion of the field. However, the re-branding debate reflects more fundamental tensions around representation, expertise, and gender at the heart of the profession.

Modest witnesses

Discursive claims to expertise on the part of medical illustrators often hinge on the capacity to understand, interpret, and accurately convey complex biomedical information and concepts to a wide range of audiences. At the same time, the specificity of the medical illustrator's domain within the biomedical "system of professions" (Abbott, 1988) lies in the capacity to render that information *visually*. However, visual expertise is tricky to substantiate. As Eric's statement shows, attempts to contextualize their work by describing material practices and outputs fail to convey the perceptual and interpretive skills that are most peculiar to medical illustrators, making it difficult to articulate their expertise and to assert professional boundaries.

Material technologies and practices are more easily made visible and measurable than tacit knowledges. However, as the anatomy tutor's misunderstanding of the role of the computer at the start of this chapter shows, the persistence of epistemic ideals of "mechanical objectivity" and skepticism or erasure of human intervention remains an undercurrent of scientific knowledge

systems (Daston & Galison, 2010, p. 43). Early efforts to professionalize the field of medical image-making were often based on technological expertise (such as the use of photography or film). Despite often overlapping practices, epistemic roles, and economic concerns, reliance on technological definitions of expertise fragmented the field of medical image-making along technological lines. Eventually some of the early professional groups merged or folded, but tensions around material practices and technologies as markers of professional belonging and expertise remain. As Regula Valérie Burri (2008) argues with respect to radiology, when competing for power, prestige, physical space, and economic security within the ecosystem of medical and paramedical professions, practitioners often emphasize material practices and mastery of specific technologies as a proxy for expertise and competence. However, each new imaging process requires a renewed negotiation of material, spatial, and social relationships in order to secure control over (and privileged access to) the “symbolic capital” of the machine (Burri, 2008, p. 45). Although professional distinctions based in specific technologies and visible material practices are more immediately legible, they are also more fragile.

Explanations and terminology based in specific technologies and artifacts not only obsolesce quickly, they tend to obscure the human labour of their making. Lucy Suchman argues that designers of autonomous technologies such as early forms of artificial intelligence (AI) and interactive robots “evidence a desire to naturalize them, to obscure their artifactuality” (2007, p. 214). Suchman’s argument builds on Steven Shapin and Simon Schaffer’s (1985) claim that “[t]he matter of fact can serve as the foundation of knowledge and secure assent insofar as it is not regarded as man-made,” (as cited in Suchman, 2007, p. 214). Similarly, the mythos of autonomous technology easily overtakes the messier material and social realities of agentive human medical illustrators. In order to “achieve the appearance of matters of fact as given items”

(Shapin, 1984, p. 508), medical illustrations must not appear “man-made.” Because the structures and processes conveyed appear self-evident, medical illustrations must be naturally occurring or machine-made reflections of scientific truths, not human-made. When the meaning of an image is understood as inherently indexical to the object or process it depicts, its legibility is easily construed as a straightforward result of the work of technologies, not humans. Conversely, when an image is assumed to represent legitimate knowledge, the human elements of its creation are elided.

Medical illustrators are caught in a double bind. Making biomedical knowledge legible as “fact” is understood to be the work of machines precisely because the expert labour of medical illustrators lies in naturalizing their own artifacts. The acceptance of biomedical images as objective representations of self-evident scientific truth depends upon the misconstrual of the human labour involved in their creation. However, continued emphasis on the material technologies of making medical knowledge visible and teachable obscures the human agency and power relations invested in those renderings. Furthermore, as historians of science have argued, the emergence of experimentalism in the seventeenth century entailed an emphasis on dispassionate rationality and “gentlemanliness,” casting suspicion on the embodied expertise of both artisans and women (Daston & Galison, 2010; Schiebinger, 1991; Shapin, 1989; Shapin & Schaffer, 2011; Smith, 2012). It is not an accident that a field dominated by women is also one where the agency of human practitioners is routinely effaced, their expertise overshadowed by visions of autonomous, value-neutral machines and artifacts which “speak for themselves.”

Making experts

The AMI re-branding was not intended to be a philosophical or epistemological exercise; it was a matter of instrumentalizing the group as a professional tool. While the twenty-first century has seen an increase in full-time positions in hospitals, universities, and independent agencies, most medical illustrators will still spend at least part of their career working freelance. The AMI serves not only as a mechanism for regulating the profession and maintaining individual certification, but also as a clearing house for connecting practitioners and potential clients. The association's website and a number of key activities, such as the production of an annual source book, copyright advocacy, business practices workshops, and networking events, are specifically aimed at promoting the profession and protecting the intellectual property (and income) of practitioners. Having a recognizable "brand" which conveys the type of specialized expertise they can offer is a key motivation for the association's very existence. Indeed, questions of expertise – What is it? Who has it? Can they be trusted? – lie at the core of professionalization.

Understood in the broadest terms, "professionalization" is part of an ongoing process in which certain social groups, their roles in society, their members, and their values are co-produced in and through their attempts to define and control their own labour. Although much of this work is grounded in instrumental efforts to acquire prestige and economic security by securing an exclusive domain of practice, these material goals are frequently articulated through ethical claims about trust and expertise. Professions establish particular institutional forms of governance as a means of substantiating these less tangible ideals and values in particular people: the institution vouches for the practitioner as *a kind of person* who is both possessed of

legitimate and specialized knowledge and can be trusted to exercise that knowledge in a way that is responsible to society (or at least to a certain segment of it).

Early studies of established professions such as medicine and law took their exceptional status as given but sought to make sense of this exceptional nature by exploring the properties common to them. Although the precise list varies, it generally includes an array of attributes relating to expertise, autonomy, ethical frameworks, and institutionalization which contribute to an “occupational value of professionalism based on trust, competence and cooperation” (Evetts, 2006, p. 517). However, a functionalist focus on tracing and enumerating these “visible characteristics of the professional phenomenon” fails to explain how and why they acquired this exceptional status (Larson, 1977, p. 208). Taking a historical and constructivist view of “the professional project,” Magali Sarfatti Larson’s canonical study *The rise of professionalism* (1977) suggested that occupational groups professionalize by embedding their knowledge claims within political, economic, and social institutions whose power and authority are in turn bolstered by that investment. Furthermore, these projects produce a particular type of elite person (the professional), whose expertise is rendered recognizable, trustworthy, and valuable through their involvement in professional structures. Thus, when the professionalization project is successful, these structures enable practitioners to “[define] their identities in such a way as to establish themselves as an obligatory passage point in the network” (Callon, 1984, p. 204). Moreover, by controlling external markers of expertise such as credentialization and access to professional networks, the structures themselves become obligatory passage points for practitioners who wish to participate in the protected market of the profession. In this sense, professionalization entails both a collective effort to define and assert expertise and individual efforts to cultivate the markings of that expertise – including belonging to the collective.

Practitioners deploy both individual and collective strategies to attain a more desirable position within social and economic hierarchies.

Like many fields, subsequent work in the sociology of professions has called into question the very concept of professions as epistemic things (Rheinberger, 1997). Some, like Andrew Abbott (1988) and George Weisz (2006), suggest that the boundaries between occupational groups emerge out of jurisdictional disputes between related fields of practice. These approaches suggest that new “professions” are formed and structured in and through struggles to articulate and expand domains of expertise and practice within a larger “system of professions” or specialties. Like Abbott, Thomas Gieryn (1999) argues that scientific controversies can be seen as territorial disputes between groups of “experts” over what does or does not count as “good science,” including which truth claims are legitimate and who can make them. However, while they may be formulated as ontological arguments, in practice such conflicts often arise from more instrumental disputes over access to social, political, and economic resources. These approaches help to consider professionalization as part of a larger framework in which disputes over expertise and epistemic legitimacy both arise and are settled through the entrenchment of bureaucratic and institutional structures, the parceling up of areas of practice (and thus of domains of expertise), and the reframing of ontological disputes over the nature of knowledge as epistemic disputes over the purview of specific knowledge practices. Viewed from this angle, the maintenance of professional institutions and identities is a kind of boundary work which not only articulates but also constitutes the normative epistemic values of the “profession” as part of a larger struggle for credibility and autonomy.

In many ways, the scope of both “professionalism” as an occupational value (or system of valuation) and “profession” as a kind of occupational status (or system) has crept so

substantially under contemporary bureaucratic and managerial regimes as to render them increasingly problematic as analytic frames (Evetts, 2006; Larson, 2018). However, questions of trust and expertise continue to underwrite empirical questions about what or who a professional is or should be. Indeed, in a recent re-evaluation of her early work, Larson suggests that while the strict delineation of “professions” from other “expert” occupations may be less salient than in the past, this “dilution of profession into expertise [raises] questions of trust and secondarily of identity” (2018, p. 36). Nevertheless, Larson’s formulation belies the co-constitution of these concepts; ironically, the dissolution of “profession” as a cohesive object of analysis brings into sharper focus what is at stake in professionalization as a “project.” Larson asks, “What are experts for, what are they expert in, who should the public trust and why, and most emphatically, to whom are experts accountable?” (2018, p. 39). These remain potent questions, not only in light of contemporary crises of both trust and expertise, but also in light of the very real exclusions and omissions that institutionalized expertise enables.

Feminist analysis suggests that professional boundaries are also articulated and managed through the gendering of certain forms of labour and knowledge work. Canonical arguments assert that male-dominated professions achieve professional closure through parallel processes of inclusion and exclusion: professions exclude women by constructing them – and professionalism itself – as inherently “masculine” while also including them in roles construed as auxiliary or support work (Acker, 1990; Adams, 2003; C. Davies, 1996; Witz, 1990). On the one hand, re-gendering work previously performed by women (from midwifery to computer programming) as expert labour best performed by men enables men to take over expanding areas of practice (Hicks, 2018; Leavitt, 1983; Light, 1999; Richmond, 2006; Witz, 1992). On the other hand, male-dominated professions maintain and reinforce hierarchies by shifting and subordinating

work onto women (for example, nursing, dental hygiene, and librarianship) while simultaneously construing that work as unskilled or undesirable (Adams, 2003; Game & Pringle, 2020; Rossiter, 1987). Davies argues that the appearance of autonomy and executive function that characterizes male-dominated professions depends upon the subordination of this invisible feminized labour. In other words, professions naturalize their own autonomy and independent agency “only by ignoring or misrepresenting the work of others” (C. Davies, 1996, p. 670).

In the sciences, this type of stratification is also accomplished both by “funnel[ing women] into the gender-appropriate (and less prestigious) fields” and by construing the fields and kinds of scientific work done by women as necessarily less prestigious or less objective (Rutherford, 2020, p. 24). Thus, while women have historically performed many tasks that undeniably meet the cultural definitions of scientific objectivity – such as precise quantification, data collection, and use of complex instrumentation – their work has tended to remain invisible (Oreskes, 1996). Evelyn Fox Keller refers to this “interacting network of associations and disjunctions” through which ideas about gender and science inform one another as the “science-gender system” (1985, p. 8). In other words, like professional autonomy, the illusion of the detached, autonomous, and heroic scientist is also dependent on the invisibility and subordination of women’s labour.

Importantly, many female-dominated occupational groups (such as teaching, nursing, and physiotherapy) have also drawn on gendered assumptions to assert professional identity – albeit with mixed results (Adams & Bourgeault, 2004; Cavanagh, 2003; Linker, 2011b; Ottosson, 2016). In addition to redefining “feminine” traits as desirable (or desirable traits as “feminine”), these attempts at reframing often appeal to other forms of social stratification such as race and class status to differentiate professional practitioners from their unprofessional others (Ashcraft

et al., 2012; Cavanagh, 2003; Linker, 2011b; Neuendorf, 2019). Furthermore, those women who do enter male-dominated professions must still manage conflicting expectations and restricted access to the privileges of professional belonging (Ainsworth & Flanagan, 2020; Barker, 1998; Hinze, 1999). As sociologist Susan W. Hinze (1999) argues, the gendering of certain roles and kinds of labour as “masculine” or “feminine” often has less to do with the nature of the work itself, and more to do with the amount of prestige (and pay) it secures.

While it unfolds in a variety of sometimes contradictory ways, the process of professionalization often entails strategies that yoke employment security, prestige, and hierarchy to social ideas about gender, race, class, and disability. Recently, communications researchers Karen Lee Ashcraft and colleagues (2012) have suggested “occupational branding” as an alternative analytic framework for understanding ongoing tensions around what has come to be known as “diversity, equity, and inclusion” (DEI). The authors advocate focusing not on presence or absence of particular kinds of people (such as women, racialized groups, or disabled people), but rather attending to the ways in which occupational groups strategically manage those tensions through “collective identity work” (Ashcraft et al., 2012, p. 468). Importantly, they argue,

Occupational branding is not merely a matter of establishing a line of work as knowledge-intensive and indispensable; the province of an exclusive few: it is also a matter of claiming that knowledge practitioners, the work they perform, the organizations for which they do it, the clients they serve and the outcomes they yield deserve high valuation. (Ashcraft et al., 2012, p. 479)

This rhetorical work of branding constructs a particular view of the profession “aimed at abridging or standing in for the complexity of occupational identity” in ways that affirm both its exclusivity and its value (Ashcraft et al., 2012, p. 476). Tracing the rhetorical work of occupational branding allows the authors to track the ways shifts in professional identity are used to manage contemporary tensions around gender and racial inclusion within the profession

without sacrificing access to this privileged (exclusive) status. Like Hinze, this approach also suggests that while certain forms of knowledge and labour have been construed as belonging to certain kinds of people, those categories and characterizations are malleable. However, it also makes clear that the management of professional identities is always partial and subject to existing dynamics of social and economic valuation, including the lasting material effects of sexism, racism, and ablism on the historical distribution of labour and prestige.

The diversity problem

For medical illustrators, professionalization has been a strategy to position and market themselves both structurally and discursively as trustworthy experts and to ensure continued access to economic and social capital. The lens of occupational branding takes on additional salience in light of a second recent professional controversy: medical illustration's "diversity problem." In 2016, just before I began my dissertation fieldwork, a trio of young medical illustrators gave a panel presentation on "Normativity & Diversity in Healthcare Imagery, Graduate Programs, and the Profession" at the annual meeting of the AMI. The presentation was well-attended, but contentious. The panel's presentations addressed not only social inequalities arising from the prevalence of the "able-bodied, attractive/thin, young, cisgender" white male body as "standard" in medical images, but also the demographics of the profession itself (Tetzlaff et al., 2016). The vast majority of members are white and, although the profession and the organization are at least 70% women, men often dominate awards and positions of power and (Tetzlaff et al., 2016). In a moment of informal conversation, one student explained to me that at least one presenter expected the critical tone of the "diversity" presentation to result in their exclusion from the organization and possibly from the profession. My interlocutor gestured

dramatically, coupled with a sound effect, as though dropping a bomb. When I spoke to the presenters later, their relationship with the organization remained uneasy. Although they continued to engage in various ways, including through involvement with the diversity committee, they also expressed feelings of ambivalence about the organization and skepticism that substantive long-term change was imminent.

The results were slightly less catastrophic than the presenter feared, but much like re-branding conversations, the subject of diversity in medical illustration was indeed contentious. Increasing acknowledgment of the problem of diversity challenges medical illustrators to re-evaluate their own knowledge practices, representational idioms, and professional projects. The 2016 presentation did lead to the formation of a “diversity task force,” which was enshrined as a more permanent committee in 2018. The task force and committee produced a “Diversity and Inclusion” statement, which expresses a commitment to “reflect the richness of our whole society both in our members and in the images we create” (Association of Medical Illustrators, n.d.-a). Although the statement enumerates “color, race, age, sex, gender expression and identity, sexual orientation, appearance, religion, ethnicity, nationality, and disability,” most discussion at the annual meeting focused on the recruitment of new illustrators from more varied ethnic and socioeconomic backgrounds. The approach hypothesizes that expanding the pool of qualified illustrators will, over time, result in a diversification of perspectives and representations more generally. However, given the recurrent charges of sexism in medical illustration over the past 40 years, despite the gender demographics of the field, the task is likely to be more complicated (Alexanderson et al., 1998; Giacomini et al., 1986; L. J. Moore & Clarke, 1995, 2001; Parker, 2016; Wall, 2009). The diversity committee also sponsors an annual plenary and various other

initiatives, but it is too early to tell whether these measures will be successful in shifting the balance.

Taken together, professionalization, boundary work and occupational branding are useful ways to make sense of the structural and identity work required to maintain the precarious position of medical illustrators, without treating these processes as inevitable or natural. If a profession is understood as a special kind of occupational group, a professional can be understood as a special kind of person. In this sense, the professionalization of medical illustration is a way of “making up” a new kind of person – the professional medical illustrator (Hacking, 1999). However, overlapping questions of representation, technology, expertise, gender, and broader demographic diversity create a web of tensions about just what kind of person that is (or should be).

Making sense of medical illustrators

It matters what matters we use to think other matters with; it matters what stories we tell to tell other stories with; it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories. (Haraway, 2016, p. 12)

In this dissertation, storytelling functions on multiple levels at once as a promiscuous and protean conceptual, analytical, and methodological framework. In keeping with recent reflections on social research methods, I tend to view this messiness as positive and generative, allowing research questions, methods, and conclusions to develop in non-linear, responsive, and sometimes unpredictable ways (Childers et al., 2013; Law, 2004, 2007; Parvin et al., 2022). From an empirical perspective, understanding the world of medical illustrators required me to make sense of how they conceptualize concepts such as storytelling and how they use those concepts to organize, explain, and act in the world. However, as an interdisciplinary scholar, I

also approach storytelling – and related concepts such as narrative, discourse, and history – as both empirical objects of study and as analytical constructs to be explored and critiqued. I analyze medical illustrators’ use of “storytelling” as a concept not only to make sense of its normative and explanatory function in their training and practice but also to explore the cultural assumptions embedded in that usage. Moreover, in constructing my own stories about medical illustrators, I inevitably construct new ways of organizing, explaining, and acting. These varied approaches are bound together by an understanding of storytelling as an epistemological framework explicitly engaged with its own partiality.

The term “storytelling” first emerged in my research as part of medical illustrators’ vocabulary and training. As I discuss in Chapter Two, medical illustrators tend to invoke “the story” or “storytelling” as a shorthand for the management of an audience’s experience and understanding, almost (but not entirely) synonymous with the goal of “communication.” For the medical illustrators I spoke with, storytelling is at once a description of their skill set and part of a normative imperative. As one faculty practitioner stated, “you have to tell a really good story.” As an actors’ category, storytelling stands in for a wide range of methods of controlling meaning-making and the transmission of scientific and medical knowledge. It is a concept that organizes medical illustrators’ understanding of their work and has become a key element of professional branding in recent years.

Davies and Horst define science communication in terms of activities directed at sharing scientific knowledge with non-scientists: “organised actions aiming to communicate scientific knowledge, methodology, processes or practices in settings where non-scientists are a recognised part of the audience” (2016, p. 4). This focus on activities directed outward (from scientific communities to non-scientific ‘publics’) in much of the science communication literature poses

two problems for the present study. First, it circumscribes a large portion of the work that medical illustrators do, such as science education and communication within or across scientific sub-fields. Secondly, it suggests a clear delineation between these activities that was not present in the context of my research. The medical illustrators that I met saw themselves as engaged in science communication work aimed at both scientific and lay publics.

Although medical and scientific illustrators are typically left out of most discussions of science communication, this literature does provide some insight into how they conceptualize their role within that field. Various forms of science popularization have existed since the emergence of science itself as a particular epistemological framework (Bensaude-Vincent, 2009; Cooter & Pumfrey, 1994; Shteir & Lightman, 2006). Unlike more historical approaches to science popularization grounded in social sciences traditions, such as studies of science communication, “public science,” and “public understanding of science,” have tended mainly towards either descriptive exploration of interactions between science and its publics or normative work aimed at improving those interactions (Brossard & Lewenstein, 2009; Gregory & Lock, 2008). Since the 1980s, two dominant models developed to describe trends in science communication, broadly categorizable as “deficit” (one-way or top-down communication from experts to non-experts) or “dialogue” (two-way or three-way, interactive, and participatory activities ranging from public engagement and consultation to “citizen science”) (Brossard & Lewenstein, 2009; S. R. Davies & Horst, 2016; Trench, 2008). Trench argues that the common framing of these models in terms of evolution or progress – shifting from “deficit” models of science communication to “dialogue” models – is “more normative than descriptive” (2008, p. 123). In practice, these models coexist, overlap, and are enacted in a wide variety of ways. Building on Trench (2008), Davies and Horst argue that the “deficit to dialogue” narrative is

overly dichotomous, culturally narrow, and historically limited (2016, p. 218). In contrast, they advocate a more cultural approach to studying science communication that treats it as “integrated into the lives of many different people and into the construction of many different kinds of identities, rather than simply seeing it as the transfer of knowledge” (S. R. Davies & Horst, 2016, p. 10).

Placed in this wider context, medical illustrators’ storytelling – about both science and themselves – provides insight into professional identity construction as well as the norms and values of practitioners. Davies and Horst suggest that contemporary trends toward professionalization in science communication be studied “as a sociological phenomenon that will tell us something about the nature of both science and society in contemporary societies” (S. R. Davies & Horst, 2016, p. 95). Theories of science communication that have evolved out of research into public understandings of science and science popularization are “an important part of the story that science communication tells about itself (for instance in educating communicators)” (S. R. Davies & Horst, 2016, p. 94). As I explore more deeply in Chapters Two and Six, medical illustrators’ emphasis on “storytelling” usually recapitulates deficit models of science communication, in which the goal is to transmit ready-made expert knowledge to students, patients, or experts in other fields. This attitude tends to frame friction, uncertainty, and interpretive flexibility as communication problems to be solved, rather than as opportunities to reframe or question knowledge and knowledge-making practices.

Storytelling is also part of a broader process of “collective meaning making” not just about scientific facts but also about the social and cultural contexts in which those facts come to matter (S. R. Davies et al., 2019, p. 3). A cultural approach to science communication “encourages us to ask not whether facts are being successfully transmitted, but what is being

made or reinforced through particular instances of public storytelling about science: this might be, for instance, ideas about the nature of science, assumptions about wider society, or new collectives or identities” (S. R. Davies et al., 2019, p. 4). Storytelling encompasses multiple forms of cultural meaning-making that entail active (though not necessarily conscious) rhetorical processes of selection, articulation, and interpretation. This intentionally broad definition includes not only those stories that are made of words or explicitly narrative, but also those that are visual and performative, as well as those that are unfinished, incomplete, or cobbled together from partial perspectives. In this sense, the accretion of details and recognizable forms that emerge through multiple tellings and revisions is as much a form of “storytelling” as the thoughtful and intentional crafting of meanings that medical illustrators seek to achieve. As an early example of professionalization in science communication, I approach medical illustrators’ disciplinary histories, personal stories, allusions, and anecdotes as ways of making their experiences, identities, imaginaries, and feelings about science *meaningful* by editing and repackaging them into recognizable cultural forms. Furthermore, I consider how literary and rhetorical technologies such as research articles and promotional literature, pedagogies, and other discursive strategies contribute to the production and maintenance of cultural norms and practices.

Over the course of my research, storytelling also became a means of expressing my methodological commitments and materializing my own articulation work. Donna Haraway insists that “any sustained account of the world is dense with storytelling” (2018, p. 64). The power of Western scientific storytelling has been its insistence that it is not a story at all but “fact.” As Shapin and Schaffer (2011) have carefully argued, the construction of “matters of fact” as the basis for the scientific enterprise is grounded in partiality and situatedness: it depends

upon the carefully limited design of experimental systems, the modest claims of gentlemen witnesses, and their articulation through scientific texts. However, as Haraway asserts, this “specifically modern, European, masculine, scientific form of the virtue of modesty” enables these texts to “lose all trace of their history as stories” (2018, pp. 23–24). Nevertheless, stories are “an inherent and dominant feature of the production of knowledge” (Friesen & Dionne, 2022, p. 73). Rather than seeing this as a limitation or epistemological weakness to be avoided or denied, attending to knowledge practices *as* storying practices is a robust strategy for producing knowledge.

Haraway’s argument is not just a critique of scientific practices, it is also a provocation for all knowledge-making: the stories we tell about ourselves and the world are always partial, interested, and situated. In “Situated knowledges” Haraway argues that objects of knowledge are delineated in and through knowledge-making practices:

Boundaries are drawn by mapping practices; "objects" do not preexist as such. Objects are boundary projects. But boundaries shift from within; boundaries are very tricky. What boundaries provisionally contain remains generative, productive of meanings and bodies. (1988, p. 595)

Haraway emphasizes the performative aspects of knowledge production, advocating a reflexivity that “allows us to become answerable for what we learn how to see” (1988, p. 583). To describe is not only “to portray in words or by visual representation” but also “to mark; to delineate; to trace” (Oxford English Dictionary, 2023). Methods of knowledge production describe the boundaries of the world not only in the representational sense but also in this second sense: they trace its boundaries and in so doing mark it.

Like Haraway, Annemarie Mol (2007) stresses that it is not just the representations or ways of knowing that “shift from within,” but that objects of study themselves are constituted as discrete (knowable) things in and through these processes. In her book *The Body Multiple*, Mol

(2007) focuses on “atherosclerosis,” a condition in which thickening or hardening of arteries inhibits blood circulation. However, she finds that although they are all called “atherosclerosis,” the epistemic objects enacted in pathology, radiology, clinical practice, and surgery are not the same. While terms like *construction* tend to suggest a fixed end point, after which the object under construction is complete and relatively stable, Mol’s (2007) preferred term, *enactment*, draws attention to the unfinished and ongoing nature of this process. Realities and knowledges are never complete or singular; they are always *in-the-making* and *multiple*.

The constant, ongoing enactment of realities through practice generates not only multiple forms of knowledge, but multiple realities. Yet these multiple realities are able to coexist and be treated as one thing (most of the time). In the everyday practice of medicine, “different knowledges manage their coexistence” to make diagnosis, decision-making, and intervention possible (Mol, 2007, p. 76). Where multiple realities intersect and encounter friction, they can be reconciled, at least provisionally, by bracketing, rationalizing, translating, layering, excluding, or redefining them. These coordinating practices enable multiplicity to look like singularity: a diverse array of phenomena can be called by a single name (if only provisionally). Contradictions, inconsistencies, and gaps between various enactments can be articulated as a single story of a patient with a disease that can be treated (or not). This management has practical purposes, but as Haraway cautions, “Siting (sighting) boundaries is a risky practice” (1988, p. 595). Rendering multiplicity as singularity smooths frictions, allays doubts, and forecloses possibilities. Crucially, the preferred singularity has a nasty habit of excluding or abandoning bodies whose multiplicity cannot be made to cohere within it.

Echoing both Haraway (1988) and Mol (2007), Karen Barad offers another vocabulary, grounded in physics. Like Haraway, Barad insists upon “remaining resolutely accountable for the

role ‘we’ play in the intertwined practices of knowing and becoming” (2003, p. 812). Like Mol, Barad suggests that the unit of study shift not from objects to discourse (which still implies an object), but to phenomena. For Barad, “the boundaries and properties of the ‘components’ of phenomena become determinate and that particular embodied concepts become meaningful” when a specific apparatus “enacts an *agential cut*” (2003, p. 815). For Barad, agency *is* “an enactment, not something that someone or something has” (2007, p. 178). This formulation is self-consciously more-than-human, but as Barad explains, it also insists upon human action as consequential:

Agency is about changing possibilities of change entailed in reconfiguring material-discursive apparatuses of bodily production, including the boundary articulations and exclusions that are marked by those practices in the enactment of a causal structure. Particular possibilities for (intra-)acting exist at every moment, and these changing possibilities entail an ethical obligation to intra-act responsibly in the world's becoming, to contest and rework what matters and what is excluded from mattering. (2007, p. 178)

Although agency may not be strictly human, the particular possibilities of human agency entail an ethical responsibility for the apparatuses we construct, the cuts we make, the worlds we enact – and the stories we tell.

The question of how we construct apparatuses of knowledge production, where and when and how we cut, is usually called “method” and typically tends toward normative instructions. What are good methods? How to do them well? As Patti Lather puts it, “Methodology often diverts attention from more fundamental issues of epistemology” (2001, p. 203). Nevertheless, epistemology is inevitably also a question of accounting for methods – those apparatuses through which the particular phenomena we study are enacted and described as objects of knowledge.

In keeping with Haraway, Mol, and Barad, John Law (2004) proposes approaching method as “assemblage.” Building on Deleuze and Guattari’s (1988) term, Law defines method assemblage as “as the enactment or crafting of a bundle of ramifying relations that generates

presence, manifest absence and Otherness, where it is the crafting of presence that distinguishes it as *method assemblage*” (2004, p. 42). Otherwise put, if method is a way of doing knowledge production, then the method is productive (not just reflective) of knowledge. It enables some things to be made present and knowable (presence) in relation to others that are absent, but necessary. In any method assemblage, some of these absences are still felt and possibly even named as knowable (manifest absence), while others are enacted *only* as elision, utterly outside the knowable (Otherness). Doing research is always an active making and intervening in the world because it generates presence, but it is also always partial because to do so, it must also leave things out.

Method assemblages are not born fully-formed like Athena from the cracked-open skull of the researcher. Law (2004) notes the English term *assemblage* tends to suggest construction or cobbling together of discrete pieces that are more or less stable. These everyday connotations differ from the more spatial and flexible connotations of the originating French term, *agencement*, which suggests arrangements and orderings that are provisional and subject to change or rearrangement. This arrangement begins in the planning stages of the research, choosing some sites (and not others), some forms of “data” (and not others) and continues throughout the research as an ongoing process of decisions and omissions both intentional and accidental.

As a means of crafting relations, condensing presence (and generating absence), stories, like methods, can be assembled in a variety of ways and in so doing can generate a variety of realities. Indeed, in his discussion of a pamphlet about the land form Uluru (also known as Ayers Rock), Law describes “two styles of story-telling – or two very different method assemblages” (2004, p. 126). One of these is a collection of Aboriginal accounts related to Uluru. Although

these accounts are part of foundational explanatory frameworks, they are explicitly not singular, definite, or fixed in form, content, or even temporality. Crucially, this multiplicity and mutability “is not experienced as a problem” (Law, 2004, p. 129). He contrasts this with a Euro-American account, focused mainly on the geological significance of the site. Following Mol (2007), Law (2004) suggests that although Euro-American method assemblages also entail multiplicity, they tend to condense that multiplicity into singularity. Thus, friction or incompatibility between geological accounts of Ayers Rock rarely threaten ontological coherence because “A single, definite, prior and independent reality explains the statements” (Law, 2004, p. 127). In contrast, he writes,

Narratives and their enactments are not fixed in Aboriginal practice. They are negotiated and renegotiated. The fact that they are negotiable and in need of negotiation is entirely explicit. So too is the fact that those negotiations are strategic in character. The implication is that if singularity is achieved (and the extent to which this is the case is contingent and uncertain) then this is a local and momentary gathering or accomplishment, rather than something that stays in place. (Law, 2004, p. 129)

Arguably, an infinite number of stories can be told in any cosmology. Likewise, the same story can be told in many ways and still be understood as one story. However, like the Aboriginal and Euro-American stories of Uluru, the realities enacted by some stories are more compatible than others. Crucially – as many in the humanities take as given – the arrangement and rearrangement of presences, absences, and Othernesses *as stories* is part of what allows conflicting realities and ontological multiplicity to coexist peaceably much of the time. The partiality, uncertainty, and multiplicity that storytelling enables are not only inevitable but necessary and desirable prerequisites for knowledge-making.

Thinking about storytelling as “a continuing process of crafting and enacting necessary boundaries between presence, manifest absence and Otherness” helps me to articulate this capacity for flexible forms, changing relations, and rendering apparent contradictions compatible

(Law, 2004, p. 144). In practice, research, analysis, and writing were not discrete or separate activities but rather deeply recursive, moving freely (but not haphazardly) between experiences “in the field”, interviews, archival materials, secondary materials, and of course my own writing and sense-making. Questions and answers were mutually shaped by the processes of research and writing. Haraway describes this process as “promiscuously plucking out fibers in clotted and dense events and practices... to follow the threads where they lead in order to track them and find their tangles and patterns” (2016, p. 3). Amidst the “ethnographic dazzle” of classrooms, cadaver labs, conferences, archives and ephemera, formal interviews and informal conversations, these patterns – interlocking webs of references and metaphors, histories, conventions, and habits of thought, speech, and practice – coalesced as stories (Law, 2004, p. 108). Tracing various iterations of storytelling – as a normative imperative for practitioners, as a form of meaning-making and identity construction, as a feature of knowledge production – was a non-linear process of gathering together seemingly disparate methods. This tracing and weaving together of threads is neither uncoded and unaccountable “insight” nor rigorously coded data analysis, but rather a “dialectical-methodological chain” through which materials collected and partially ordered along the way are again sifted, rearranged, ordered, and edited into something called a dissertation (Bönisch-Brednich, 2018, p. 21). It is idiosyncratic, but not indiscriminate or arbitrary.

Assembling Methods

Storytelling evolved as a method assemblage through the work of “selectively attending to, amplifying, and so manifesting, possible patterns” in the worlds of past, present, and future medical illustrators (Law, 2004, p. 110). Although some of the practical methods I undertook to

find out about those worlds – such as sifting through archival materials or spending extended periods of time “in the field” – coincide with disciplines like anthropology or history, I do not locate my work neatly in either discipline and I am not particularly concerned with the boundary disputes that “stories” or “storytelling” might evoke in those disciplines. Likewise, although my approach to making sense of particular hi/stories is informed by similar practices in literary and cultural studies, discourse analysis, and narrative inquiry, this dissertation is not an inquiry into the nature of narrative or even representation itself.

This dissertation assembles a variety of historical and social research methods to investigate how epistemic values become entwined with medical illustrators’ material practices through graduate education and professionalization. My research included participant observation and interviews with students, faculty, and graduates of accredited graduate programs in North America, archival research, and additional interviews with related practitioners. Of the 14 training programs established in North America between 1910 and 1975, only Johns Hopkins (est. 1911), University of Illinois Chicago (est. 1921), University of Toronto (est. 1945), and Augusta University in Georgia (est. 1948) offer fully accredited graduate programs today. Others have folded, failed to secure or maintain accreditation, or offer only undergraduate certificate or preparatory programs at the time of writing. I concentrated on the three oldest and most interconnected of the extant accredited graduate programs – Johns Hopkins, the University of Illinois Chicago (UIC), and the University of Toronto. Although leadership in several programs has changed since I began my research, as of writing all three are headed by women.

My research took place between 2016 and 2019. The bulk of my time was spent at my primary research site in Toronto. Although the University of Toronto Biomedical Communications (BMC) program is the only such program in Canada, it draws together and

situates a number of histories and practices of medical illustration. As a result of a relatively porous border between Canada and the United States, the BMC shares much of its early history with both Johns Hopkins and UIC (which I explore in greater detail in Chapters Three, Four, and Five). It maintains strong connections with these American programs today. Canadian practitioners also corresponded regularly with their British peers well into the 1960s, enabling some additional points of historical comparison.

My time at the BMC consisted primarily in shadowing one graduate class over the course of their two-year program, including anatomy and cadaver dissection and introductory courses in surgical and pathological illustration, computer-aided rendering, business skills, and final research project development. I also sat in on additional courses with other cohorts, group and individual critiques, and elective courses including animation, graphic medicine, and game and app development. Some courses – particularly core requirements – I attended regularly, others only sporadically as scheduling permitted. In addition to my primary site, I visited two additional sites (Johns Hopkins and UIC) over shorter periods of a few weeks each, mainly near the beginning of their respective academic terms. I also joined student trips, attended special events and professional gatherings (including the AMI annual meeting), and engaged with students and faculty more informally in casual settings at all three sites. Lastly, I conducted semi-structured recorded interviews with more than 20 faculty, students, and practitioners. Most interviews were one-on-one, but several student interviews were conducted in small groups of three or four students. The majority of directly quoted material is drawn from transcriptions of those recorded interviews. The rest is drawn from verbatim sections of my field notes.

In addition to observation and interviews, I examined documents including correspondence, publications, and other ephemera related to the AMI, various academic

programs, and individuals associated with them. The Johns Hopkins Department of Art as Applied to Medicine (AAM) houses the Brödel Archive, a collection consisting mainly of materials related to the program's founder, compiled by his successor, Ranice Crosby, in the later years of her tenure. The BMC's archives included a variety of materials accrued by former directors as well as records of the Canadian Academy of Medical Illustrators (CAMI).

Unfortunately, I was unable to access the archives of the AMI as these were in transition at the time of my research. Although I hope to access these records in the future, my analysis of certain aspects of that organization's history has been limited by this omission. I also consulted publicly available documents ranging from journal articles to popular press and media, as well as online matter such as departmental and professional websites and social media presence.

Rather than taking documents at face value, I treat authorship as interested and documents as rhetorical objects. On one hand, the liminal quality of historical documents created by practitioners themselves presented a methodological problem, forcing me to alternate between addressing them as primary and secondary sources. On the other hand, some practitioners expressed concern about sensationalistic or simplistic portrayals of their field in popular media. An awareness of these anxieties informed my reading of documents written both by and about medical illustrators and helped to clarify the stakes of professional self-fashioning.

Unsettling medical illustration

Medical illustrators' professional identity formation provides insight into the labour required to make images appear credible, natural, and self-explanatory as well as the labour required to maintain or disrupt hierarchies of expertise and agency in scientific practice. According to Knorr-Cetina, the study of epistemic cultures enables the researcher to focus on

“the construction of the machineries of knowledge construction” (2022, p. 3). She asserts that far from being monolithic entities, cultures are layered accumulations, characterized as much by rupture as by continuity. This complexity is held together and made comprehensible in part through shared symbols and meanings: “inherited conceptions” that enable practitioners to, as Geertz (1973) explains, “communicate, perpetuate, and develop their knowledge about and attitudes towards life” (as cited in Knorr Cetina, 2022, p. 10). In this dissertation, I approach the creation and maintenance of professional institutions and professional identities as part of the boundary work that articulates and reproduces medical illustrators’ epistemic culture at the individual and disciplinary level (Gieryn, 1999).

As part of the inherited conceptions that define and perpetuate medical illustrators’ attitudes and practices, the shared symbols and meanings acquired through the process of professional identity formation cannot be disentangled from the knowledge they generate. As fabricators of boundary objects, foregrounding medical illustrators draws attention to the “missing work” of making such objects appear obvious and enables a richer understanding of what is at stake in doing so (Bowker & Star, 1999, p. 9; Star & Griesemer, 1989). Barad proposes that “reality is sedimented out of the process of making the world intelligible through certain practices and not others” (2000, p. 236). In this sense, what is at stake for medical illustrators is not “representations of an independent reality” but rather “the real consequences, interventions, creative possibilities, and responsibilities” of those practices and of their own agentive roles in the making of scientific and medical knowledge (Barad, 2000, p. 237).

The feminist basis of the project is not the existence of women in the field in question, but rather an analysis of the complex dynamics of gendered labour and the construction of epistemic values in science. Feminist approaches to science studies have long debated the

epistemic assumptions and roles that women in science might rewrite or complicate. Some of these projects have been primarily documentary or what Gerda Lerner calls “compensatory history,” looking to bring the work of overlooked female scientific workers to light in a variety of areas (1975, p. 5).⁷ Others have sought to outline possible feminist epistemologies of science (Code, 1991; Harding, 1991; Keller, 1983; Rose, 1983). My approach is neither merely documentary nor in search of a unique feminist epistemology of visual construal. If recuperative and compensatory histories make clear that women’s work has often been rendered invisible and that epistemic values are often gendered, the present study asks how rendering certain kinds of workers and certain forms of work as visible or invisible enables the epistemic values central to the machineries of knowledge to remain in place.

In order to make sense of the structural and epistemic implications of gendering particular kinds of knowledge work, I examine the means by which medical illustrators make their work visible and legible, including the often-invisible work of doing so. As Susan Leigh Star and Anselm Strauss point out, “it is impossible to define anything inherently as visible or invisible,” least of all work (1999, p. 23). What counts as “work” is not only contextual but also relational. Thus, “the relation between invisible and visible work is a complex matrix, with an ecology of its own” (Star & Strauss, 1999, p. 25). Understanding this ecology matters because making work visible involves trade-offs: on one hand, it can support claims to the legitimacy and value of one’s work; on the other, it can increase surveillance, particularly for workers for whom the exercise of agency or discretion is viewed as suspect. Strauss defines articulation work as “the specific details of putting together tasks, task sequences, task clusters, and even the work

⁷ Margaret Rossiter (1982, 1987, 1993, 1995, 1997) is a canonical source on this topic. See also Kohlstedt (1978, 1995), Light (1999), Richmond (2001), Sayre (1975), Twohig (2005).

done in larger units such as subprojects, in order to accomplish the work” (1988, pp. 174–175). In practice, this work might consist not only in the explicit work of completing the various tasks required for a project, but also the implicit work of managing and coordinating those tasks as part of a larger articulation process. Drawing on this concept, Star and Strauss argue that “[j]uggling one’s visibility is itself an act of articulation work, and under many circumstances vital to getting work done” (1999, p. 25). In other words, articulation work includes the tasks of creating and maintaining institutional and social structures through which certain aspects of work are made visible as expert labour while others remain invisible or unacknowledged.

I consider the work of articulating expertise and managing visibility as part of the process of constructing medical illustration as a recognizable profession. Although Strauss (1988) uses the term articulation in its anatomical or biological sense to emphasize the conceptual segmentation and interactional connections between parts of a project, the term also entails a set of meanings related to language and expression. In applying this concept to medical illustrators’ professionalization projects, I lean into this additional meaning to explore the work of juggling visibility both at the level of structure and at the level of discourse. I explore the discursive and symbolic structuring of medical illustration as an epistemic culture by attending not only to the ways disciplinary narratives are constructed and deployed in professional training and practice but also to the “missing work” of institutionalizing the profession in the first place. At the level of discourse, disciplinary narratives enable medical illustrators to make certain aspects of their work visible by describing who medical illustrators are and what they do. At the same time, canonical disciplinary narratives allow other aspects of the work to remain invisible, including the rhetorical work of constructing professional identity, the bureaucratic work of institutionalizing the field as a profession, and the interpretive work of rendering. By focusing on

this missing work, I offer an alternative account of medical illustrators' role in the production of knowledge that acknowledges both the generative epistemic potential of their work and also the ways it has contributed to continued inequities in medicine.

Understanding how and why womens' work contributes to the maintenance of inequitable systems is a prerequisite to imagining alternative possibilities. Murphy (2015) suggests "unsettling" as a generative framework for rethinking feminist politics of care and constructing more equitable futures. Murphy defines "unsettling" both as "a disruption to non-innocent narratives of belonging and a challenge to gestures of rescue, sympathy, and occupation that too often recapitulate colonial legacies" and as "the purposeful undoing and troubling of particular arrangements so that they might be acknowledged and remade in better, less violent, more livable ways" (2015, pp. 721–722). In keeping with this approach, my analysis seeks to both historicize and reckon with the "arrangements of race, nation, colonialism, and political economy" that underpin narratives of belonging and historical continuity in medical illustration (Murphy, 2015, p. 731). As Star and Strauss argue, "if the system does not account for the matrix of visible and invisible work and its questions of equity, those at the bottom will suffer" (1999, p. 25). Troubling the narratives and structures through which medical illustrators have managed the matrix of visible and invisible work and confronting the ways in which those strategies perpetuate colonial legacies allows us to become "become answerable for what we learn how to see" (Haraway, 1988, p. 583).

The assembling of methods as storytelling entails both finding patterns in the stories others tell and telling my own stories about the patterns I find. From a narratological perspective, stories consist not only of what is included but also what is excluded, glossed over, left out. As Friesen and Dionne point out, "Every telling makes choices, highlighting some parts of a story

and leaving some out, conveying what is deemed valuable or not, what matters or not” (Friesen & Dionne, 2022, pp. 80–81). Unlike Haraway (2016, 2018), I have not constructed intentional fabulations or speculative fictions. However, while they remain grounded in the dazzlingly complex worlds that medical illustrators and myself inhabit, these stories are (like all stories) necessarily limited by my own perspective and reflective of my own interests and political commitments.

Framing my own work as a kind of storytelling is an explicit acknowledgement of my epistemological situatedness. In attending to knowledge practices (including our own) as storytelling practices, we “[give] up nothing, except the illusion of epistemological transcendence” (Haraway, 2018, p. 64). I make no claim to comprehensiveness or universality. Like any narrative, my accounts are partial, subject to the limits of language and narrative coherence as well as my own perspective. The labour and craft of research and writing – observing, analyzing, interpreting, and describing – is inherently selective, interested, and productive of both presence and absence. (So too are the labour and craft of medical illustrating.) As Law suggests, method assemblage generates “silences and non-realities as well as signals and realities” (2004, p. 107). Crafting the presence of medical illustrators through these particular stories inevitably generates absences and Others.

My subject position, my embodied experiences, my emotional and intellectual investments delimit the conditions of possibility for conversations and observations throughout my research. While visible attributes such as my age, race, gender, and sexuality put some interlocutors at ease, others might be wary of those same characteristics and tailor their responses accordingly; in either case, they might respond differently to a different questioner. My own history and subjectivity also frame my perception of those interactions and the interpretations

available to me from incomplete information. Thus, I offer these accounts not as definitive or comprehensive but rather as an exploration and an invitation to others to explore other stories through different perspectives.

My research and analysis are also framed by the everyday materialities of research like time, money, and geography. Thus, some significant sources of data and modes of analysis were omitted or bracketed – such as the negotiation of disciplinary boundaries and belonging among allied areas of practice and the mechanics of membership and articulating certified knowledge through professional regulatory practices. However, these areas present compelling lines of inquiry for future work, which I will explore further in the conclusion. Likewise, I do not take up the analysis of medical images themselves, which is already a strong thread in existing literature. I sincerely hope that this work will contribute to deeper analysis of such artifacts in the future.

Lastly, this study does not provide an in-depth exploration of the material practices of medical illustrators. Having trained as a visual artist myself, I entered the research keenly aware of the incredible specificity and variety of visual media and rendering technologies, both digital and analog. Each apparatus of rendering entails particular qualities and affordances unique to it. Different media enable the user to produce different qualities of line, shape, colour, and scale (among others). They also entail different capacities for reproduction and distribution, manipulation and scalability, and of course the interactive and temporal qualities that distinguish many (not so) "new" media. Despite this seemingly endless variety, many of the ways of thinking and doing required to master these tools are surprisingly transferable. Indeed, as I will explore in later chapters, medical illustrators tend to highlight the transferability of their skills. In practice, practitioners often employ multiple tools in the same project to make use of their unique attributes. In other words, technical mastery of particular media and tools is part of the enactment

of an illustrator's knowledge but does not necessarily predetermine it. The myriad practices of skillfully producing something that might be called a medical illustration grow out of the interactions between the object or phenomenon to be rendered, the rendering technologies, the humans wielding them, and the other humans involved in the process – including commissioning scientists and employers, imagined audiences, and sometimes more.

I was also not only aware of but deeply committed to understanding the use of these technologies as embodied. Embodiment is often more legible in analog processes as pen, pencil, or brush extends from the hand and arm to sweep or stutter across a page. Bodies accustomed to these movements and media become sensitized to small changes in texture and pressure and adept at controlling them to produce varied effects. However, organic bodies are equally present in digital renderings. Digital pens drawn across electronic tablets still make a sound. Developing the desired quality of line with digital tools still requires practice, even for experienced draftspeople. Eyes trained on computer screens still blink and lose focus, bodies breathe, eat, and sleep, hands and backs stiffen after hours of concentrated effort.⁸ The bodies of artists bear the marks of this physical relationship in callouses, cramps, and other ergonomic exposures. This embodied aspect is as integral to artistic practice as the rendering materials or the subject matter. Acts of looking and mark-making, decisions and revisions, intentions and accidents are as inseparable from the product as they are from one another.

I remained deeply attentive to these material and embodied realities throughout my research and they inform the ways in which I interpret and tell stories about medical illustrators. However, it has been necessary to forego extended discussion of the material and embodied

⁸ Of course, this effort affects bodies differently. At one point, while discussing the physical toll of their work, a group of graduate students good-naturedly teased a peer, suggesting that her spinal fusion gave her an advantage when working for long hours at her computer.

practices of producing specific visual forms or analysis of the final forms themselves. Thus, I discuss only briefly the artifacts called medical illustrations and the many technologies (both digital and analog) which enable those artifacts to take shape, instead centering the people who wield those materials and produce images with such skill. I treat these materialities not as a black box whose function need not be examined, but rather as a richly textured background – what Law (2004) might call “manifest absence” – to the human relations I foreground in this account.

Other manifest absences enable this work, such as the many bodies with which medicine concerns itself, the very partitioning of bodies into categories, and the bodies of illustrators themselves. Instead, the methods I assemble here focus on the cultural forms that allow these artifacts, bodies, and categories to remain relatively stable, *despite* their dazzling complexity. This bracketing of practice is self-consciously provisional, but necessary to craft medical illustrators – whose manifest absence in much of the scholarship of scientific representation troubled me – as present. For Knorr-Cetina, culture “refers back to practice” in that it entails “the aggregate patterns and dynamics that are on display in expert practice and that vary in different settings of expertise” (2022, p. 8). Although focusing on practices helps to clarify the human agencies and material contingencies of knowledge production, it can also obscure “the ways in which the actors themselves are configured” and “the machineries of knowing in which these agents play a part” (Knorr Cetina, 2022, p. 9). The material practices of medical illustrators are crucial to the knowledge machineries of biomedicine. However, the range of potential forms these practices take is configured in part through the work of rendering (some of) them intelligible as professional expertise (but not necessarily as knowledge construction). By limiting my study largely to the cultural machinery of making medical illustrators into professionals, I foreground the discursive and symbolic structuring of their epistemic culture over the everyday

practices and the embodied performance of making images. This approach allows me to make sense of the paradoxical configuration of medical illustrators as actors without agency within the machineries of biomedical knowledge.

Telling the story

This dissertation weaves together thematic threads by moving between modes of enquiry and research materials. In this final section, I map some of the major threads and provide a rationale for gathering them together as I have. “Which thread is which remains permanently mutable, a question of analytical choice and foregrounding operations” (Haraway, 2018, p. 68). I offer this ordering not as a superior or definitive account but rather “as a way to *enable storytelling*, that is, to create an occasion for more stories [...] to be told and, perhaps, to permit new configurations” (Friesen & Dionne, 2022, p. 74). These stories should be construed as a temporary flattening and fixing of inherently multidimensional and mutable relations to see what new shadows they cast.

The AMI’s rebranding announcement in 2014 evoked a rhetorical shift in emphasis away from artistic and technical skill towards scientific knowledge, positioning medical illustrators as “storytellers” and translators of scientific knowledge:

This new look, from logo to tagline, shifts the focus from our art expertise to our science knowledge and interdisciplinary skills. We are visual storytellers who translate and empower patients and physicians to make informed health decisions. (Tonya Hines, AMI President, quoted in press release, Association of Medical Illustrators, 2014)

The statement re-aligns the work of the AMI’s members with the more stabilized expertise and epistemic values of physicians and researchers by privileging scientific over visual expertise. Furthermore, it emphasizes medical illustrators as a special kind of person: neither an artist nor a scientist, but rather a storyteller. The formulation of medical illustrators as “storytellers” and

“communicators” attempts to identify a unique form of expertise located not in technologies but in the medical illustrator herself.

As the re-branding campaign demonstrates, much of the contemporary work of professionalization is carried out through the molding and management of professional identities. Medical illustrators deploy both discursive and structural forms of professionalization to manage the pervasive epistemic anxieties that accompany both representational practices and the participation of women in science and medicine. While some of these strategies have been successful in establishing a unique niche, they also serve to entrench existing hierarchies of knowledge, including the continued devaluation of non-standard bodies and of medical illustrators’ own unique role in the production of medical knowledge. In the analysis that follows, I situate this apparent shift within the longer trajectory of the field’s approach to professionalization and professional identity. I argue that in order to stabilize their social and economic position as scientific workers, medical illustrators situate themselves and their knowledge practices within established institutions and forms of authority. In so doing, they limit the potential for their work to challenge those norms.

Chapter Two draws primarily on participant observation and interviews as the basis for a discursive analysis of medical illustrators’ personal stories and professional culture. I explore the transformation of new practitioners from “good at art and science” to “storytellers” during their graduate education as part of the professional project of situating expertise and belonging. The complexity of this identity work becomes clear as graduate students navigate an uncertain epistemic position by positioning themselves and their work in relation to cultural binaries of art and science. The identity of “storyteller” emerges as a mediator, necessary but essentially subservient to the financial and moral economies of physicians, researchers, and publishers.

Students and faculty articulate the skills and modes of thinking required to “tell a good story” by drawing on disciplinary origin stories and metaphors of kinship, in particular the patriarchal genealogy of the “founding father.” At the same time, the fluidity and variety of their own origin stories suggest the possibility of more protean and potentially inclusive forms of professional kinship and practice.

In the next three chapters, I explore the discursive and structural projects through which medical illustrators articulated their work as a recognizable profession in the mid to late twentieth century. I argue that twentieth century medical illustrators were caught in a double-bind of needing to establish the value of their expert labour without calling attention to the constructedness of their images. In order to manage these epistemic anxieties while also ensuring their own economic stability, they allied themselves both discursively and structurally with existing social hierarchies.

Chapter Three builds on the discursive approach and conceptual frameworks introduced in Chapter Two to analyze the construction and uses of canonical disciplinary histories, particularly the “founding father” origin story, in graduate training and professional communications. I explore the tenacity of the “founding father” narrative as part of the rhetorical construction of professional identity. I argue that emphasis on disciplinary narratives organized along lines of patrilineal kinship and genealogy helped a feminized group of practitioners to ground their knowledge claims in their relationship to the scientific and artistic genius of “great men.” I show that the rhetorical work through which the emergence of medical illustration as a recognizable profession is attributed to “founding fathers” obscures the structural and administrative work carried out by female medical illustrators to construct a professional apparatus to which women like themselves could have access.

Chapters Four and Five remain focused on the historical context but I shift my approach to present an analysis of archival documents which centers women (and de-centers men) as the key actors in the construction of medical illustration as a “profession.” Adopting this self-consciously strategically limited perspective enables me to destabilize the rhetorical emphasis on epistemic hybridity and patriarchal lineage that animates medical illustrators’ professional stories. In contrast to the patriarchal narrative of professional emergence, I explore the structural work of professionalization as “women’s work.” I focus on bureaucratic professional projects such as standardizing training and organizing professional bodies as a form of social reproduction carried out by female illustrators. Intentionally modeled on existing forms of professional organization, these institutional structures were strategies for making medical illustrators’ expertise legible to non-practitioners and affirming their compatibility with medical norms and values. However, although their class and racial privilege enabled these women to successfully navigate institutional structures, their gender coupled with the epistemic ambiguity of their work meant that many of these projects were only partially successful. By aligning themselves with hierarchies of biomedical knowledge production and emerging neoliberal economies, female medical illustrators succeeded in securing a degree of economic security for themselves, while at the same time re-entrenching racial and class hierarchies. However, by positioning themselves as subservient and limiting their knowledge claims, they ensured the continued invisibility of medical illustrators as expert knowledge workers.

Chapter Six weaves together historical and contemporary materials to emphasize the interrelatedness of these stories and their relationship to medical illustrators’ material practices. I return to the present (and also to the past) to situate the producers of medical illustrations in relation to their products. With a deeper understanding of who medical illustrators are, what they

value, and what they are good at, it is possible to approach diversity in medical illustrations as part of a larger system of medical knowledge informed by historical and economic conditions in which they operate. Contemporary representational practices are inextricably tied to the colonial histories through which anatomical and scientific knowledge has been constructed. They also possess the unique capacity to restructure those gendered and colonial norms. Challenging longstanding conventions of representation risks destabilizing the delicate balance of power that professionalization projects have achieved. However, that balance has never been stable and always comes at a cost. The contemporary focus on diversity and inclusion in medical imagery presents an opportunity to reimagine not just images but also the epistemic role of their creators in making medical practice more equitable.

I conclude by reviewing these partial perspectives of medical illustration as part of an ongoing project of assembling alternatives to canonical stories about who medical illustrators are, what they do, and how they contribute to scientific and medical knowledge. Neither the field of medical illustration nor this study achieves closure. As I explore in Chapter Five, “medical illustration” has not achieved closure as a profession according to traditional definitions that involve a monopoly over their field of practice. Much of this dissertation explores why this is so and how they have nevertheless succeeded in constructing themselves as members of a “profession.” I suggest that centering questions of gender in the history of science and medicine has implications far beyond simply filling in gaps or giving credit. As Haraway points out, “There is no way out of stories; but [...] there are many possible structures, not to mention contents, of narration. Changing the stories, in both material and semiotic senses, is a modest intervention worth making” (2018, p. 45). I invite both illustrators and scholars to resist

compensatory or revisionist narratives of inclusion, to cultivate the unsettling frictions of kinship, and to craft new stories.

Chapter Two: “Mutant fish only”

Storytelling as boundary-work

As night falls on a long charter bus ride between two graduate programs in medical illustration, a group of first-year medical illustration students discuss how they arrived in the program. With ample time to embroider upon their stories, each student traces their steps from high school, university, and beyond. The stories vary enormously in specific content: struggling to finish high school and then discovering and tailoring an undergraduate degree in technical illustration; a month spent preparing a last-minute portfolio while finishing an honours undergraduate science research project; an undergraduate degree in history while drawing cartoons for a student newspaper. They unfold at a leisurely pace, dwelling in specifics and feelings, doubling back to include additional details, leaving little out. The students’ excitement at having an audience for their stories is evident; other students listen and occasionally chime in with their own experiences and feelings. I am drawn into the complexities and the intimacy of students getting to know each other by sharing their histories in the dark; I don’t take any notes.

A year or so later, in 2018, another trip, another group of students: this time we are crowded awkwardly into seats on a suburban transit train, returning from an orientation-related social event. A few of the second-year students are discussing their process of finding this field. One asks whether others feel as though a part had always been missing, but here “you get to be whole.” She is met with nods and a general sense of agreement. Another compares her experience to being a “mutant fish in a pond of regular fish.” Coming to this program, she continues, is like being put into a pond that says, “MUTANT FISH ONLY.”

Over the course of my research and encounters with medical illustrators, I heard many describe their entry into the profession. Most stories follow a similar narrative arc: periods of searching or wandering, feeling out of place or incomplete, punctuated by a moment of discovery and connection. The first act usually includes an intense interest in either art or science, or both, while also feeling that the typical career and life paths afforded by these interests do not “fit.” Almost invariably, graduate students, faculty, and practicing medical illustrators position their background in relation to art and/or science. This binary is a key element of each story, regardless of the exact unfolding of events. As graduate students transition into professionals, this division between “art” and “science” is transmuted into an emphasis on communication, teaching, and “storytelling.” The denouement of the narrative is the integration of the teller into the community of medical illustrators, frequently compared to a “second family.” These stories emerge as relationships are forged both in graduate school and in professional life. Although each narrative is unique, most include some arrangement of these elements, which are mapped onto other versions in the retelling. They serve as a point of connection, enabling a sense of commonality despite a wide variety of individual trajectories and experiences. Personal stories become touchstones that mark the tellers’ belonging to the community and acceptance of its values and practices.

In this chapter, I explore the re-framing of personal narratives during graduate education as a form of professional self-fashioning. The process of graduate training and professionalization is one of “making-up” a new kind of person – the professional medical illustrator – who embodies and upholds the skills and values of the profession (Hacking, 1999). Medical illustrators’ personal narratives of entry into the profession situate them as epistemic misfits and hybrids, straddling the border between rhetorically opposed domains of “art” and

“science.” This tension is resolved in the course of their graduate education by recasting this border-crossing as “storytelling” and communication. As a form of professional boundary work, this rhetorical re-framing of expertise contains the potential disruption of epistemic hybridity by constructing their work as fundamentally subservient to established relations of power and privilege in biomedicine. Although the hybridity of their knowledge practices entails the potential to rework epistemic categories and boundaries, the disciplinary storytelling practices of medical illustrators navigate an insecure relationship to biomedical authority by reinscribing normative boundaries and hierarchies between knowledge practices, enabling social categories of gender, race, class, size, and disability to remain essentially undisturbed.

Sitting “in the middle of the fence”

Mutant fish

Prior to their decision to pursue the field, most medical illustrators articulate a sharp divide between the scientific and the artistic, two “sides” that seemed incommensurable. They tell stories of wandering, contradiction, or incompleteness. Many described not fitting into traditional programs of study or social groups and feeling that they had to choose or that something would always be missing. When I asked about his background, Eric, a junior faculty member, described a particularly zigzagging path:

So, I started a general degree, then decided I wanted to be in the sciences. Near the end of my science degree, I actually dropped out of my science degree because I found that all I was doing was making art. So I thought, I’m changing directions and this is my path. I am an artist. And I did a fine arts degree. And when I was completing the fine arts degree, I thought, this isn't quite what I want to do either. ... But all to say I just knew this wasn't quite – this wasn't the right fit. And frankly, I was missing dealing with some aspects of science and having that being more a part of my life.

Eric, like many students and faculty, expresses a sense of separation between the artistic and the scientific, contrasting them even as he describes the convergence of his own interests and

aptitudes. Parallel statements joined by a coordinating conjunction are common: “I always liked drawing, but I was always interested in biological science,” explained Brian, a faculty practitioner. Una, a graduate student, explained, “I was working in a research lab and I've always done art, but I didn't really think that there was a field that could combine the two.” Although this division is not always a source of tension, the assumption that such a division exists underpins the narrative arc and the respondent’s trajectory. These descriptions repeatedly frame science and art as seemingly irreconcilable bifurcating paths between which they felt they must choose.

The rhetorical demarcation of art and science as distinct and even opposing epistemic practices has a long history upon which the discursive boundary-drawing of medical illustrators is built. Despite ample evidence of the coproduction of scientific knowledge and representational practices, tensions between the two are a perennial concern (Kemp, 2010; Lynch, 1991; Smith, 2006; Wise, 2006). Indeed, Lorraine Daston and Peter Galison (2010) argue that the evolution of “objectivity” as an epistemic value can be traced through disputes over what constitutes proper practices of visual representation in science. They argue that the forms and usage of images in science reflect anxieties about both the role of human actors and the ability of representations to reflect a reliable and ontologically stable version of nature. As the substantial literature of scientific representation in Science and Technology Studies (STS) and related fields attests, the contours of these anxieties have changed over time and are also contingent on the precise nature of representations in question (Burri & Dumit, 2007; Coopmans et al., 2014; Frow, 2012; Vertesi, 2007). Although anatomical illustrations, graphs of experimental data, molecular models, and digital image processing each elicit different concerns, the epistemic character of images and image-making remains a core anxiety. Given this long history, it is perhaps not surprising that

tensions around representation and valid scientific knowledge lie at the core of medical illustrators' occupational insecurity and professional self-fashioning.

The early stages of medical illustrators' professional narratives not only recapitulate broader social assumptions about the place of art and science in society, they also illustrate the ways in which educational and career structures organize around and reinforce these divisions. Practitioners often describe having come to science or art late, having dismissed one in favour of the other at some earlier point in life. For example, those who began in science careers or pre-medical studies described having seen art as something to be done "on the side," while science was not only more serious and difficult, but also more economically stable. Several confessed that they or their families had not considered art an acceptable or sensible career path. For example, Julie, an early career faculty practitioner, described being introduced to the field by her mother, a lecturer in biology, at a young age, "I think she was like, oh man, I hope she doesn't think 'I'm a fine artist!' You know, because of the financial issues with that." Faculty member Freja joked that "making my living as a painter" really meant painting while "doing other things to make a living." Although many were supported and encouraged by family members, others encountered resistance to their change in focus. A graduate student who left a lucrative engineering position to attend intensive drawing classes and prepare graduate school applications described navigating a good deal of family tension over his choice. Although he attributed much of the friction to the cultural expectations of his Asian-American family, other students commiserated. Pursuing medical illustration not only requires explanation but also justification, especially when giving up a more easily understood and economically secure STEM career.

Those who began as artists, illustrators, or graphic designers before (re)discovering an interest in biological sciences often described having been deterred from sciences and math early

on in school. Rachel, a graduate student, explained that she had “kind of just closed my mind off to like, science and math.” She attributed this attitude to the prevailing climate that “if you're talented enough at the art that you do, don't worry about the academics.” Similarly, Freja summed up her reasons for at first dismissing a scientific career:

At a certain point in your life it's like, oh, you're an artsy-type, oh, you're the science-type. And there's this kind of division that happens, or at least when I was in high school. [...] And that kind of sense that you couldn't somehow bridge those camps was very, you know, it was really deeply engrained.

On the other hand, some took advantage of this unequal footing when navigating educational trajectories. Brian, another mid-career faculty member, described his attempts to organize his undergraduate education around his interest in medical illustration,

Like a lot of schools, if you're a science major you can't take fine art courses, but if you're a fine arts major you have to take some science courses for your general liberal requirements. Okay, fine, so I enrolled in the fine art program and then for the outside courses I took a lot of biological science and anthropology.

These narratives recapitulate not only the incommensurability of science and art but also conventional hierarchies of knowledge which situate scientific careers and subjects as more necessary, difficult, and economically valuable while arts and humanities are institutionalized as facultative and even opposed to “academics.”

Most students and practitioners I spoke with repeatedly identified the fields of art and science as distinct, even opposite, and thus incompatible domains, until medical illustration offered a place for both at once. For a short biography commemorating her 40 years as head of the field's oldest institutionalized training program, Ranice Crosby's biographer asked her “how a young person can determine if he or she is inclined toward a career in medical art.” She responded, “Do you sit on the fence, trying to be comfortable and satisfied? Are you afraid to fall in the science or art pasture and never see over the fence again? You've got it!” (as cited in Cody, 1993, p. 17). Like many others, Crosby positions the field in the borderland of two seemingly

irreconcilable worlds. Medical illustration emerges as the resolution of division, a third way, or as Crosby puts it, “a place to sit happily ‘in the middle of the fence’ and not be accused of fault or indecision” (as cited in Cody, 1993, p. 17). The discovery of “a field that could combine the two” enabled respondents to resolve feelings of division and cease their wandering (Una, graduate student).

The pursuit of medical illustration as a career not only offers a resolution to the tensions between science and art, it also sparks an ardent and enduring commitment. Many practitioners described a pivotal moment of connection with the visual culture of science, which shifted their focus away from a more traditional career, with a flush of excitement:

I was still interested in going into medicine, loved art, went to a nursing career seminar because my guidance counsellor knew I was interested in life sciences [and] health profession[s] and there was a brochure, like a book, that had all of the different health professions that you could go into. Just like, a typical book you'd get from a guidance counsellor. And there was this picture of a woman sitting at a drawing table, much like the one you see right there, with a skull and this eyeball in the background and all these pictures, and I – being a visual person, I didn't read the article, I just kept looking at the picture and thinking, what is that? And then I read about it, and it was like this epiphany. Like, life-altering [laughs] utopian choice that I'd never even thought of, and I immediately went to the library and looked up everything I could about the field. And the more I learned, the more I – this was like, a calling. (Karen)

Like Karen, a mid-career faculty member, students and practitioners usually described this “a-ha moment” (Genesis, graduate student) in a heightened affective register, peppered with exclamations, gestures, and emphatic repetition. Most described this turning point as a coming together of oppositional extremes, as though the order of things that the speaker had previously accepted had been utterly upended and replaced with an entirely new vision of the world. For some, this meant applying “the next day,” (Diana, faculty practitioner), while others single-mindedly dedicated months or years to completing the requisite science coursework, developing a portfolio (as required by all four accredited graduate programs), and applying, sometimes

multiple times. Feelings of relief, excitement, and passionate drive accompany the discovery and subsequent decision to pursue medical illustration as a career.

Hybrids and border-crossers

In 1993, Bruno Latour suggested that the tidy distinctions and dualities (most particularly of “nature” and “society”) that post-modern intellectuals of the late twentieth century had eagerly sought to dismantle never really existed in the first place. Instead, he argues, these two poles are established and maintained through the practices of “translation” and “purification”:

The first set of practices, by “translation,” creates mixtures between entirely new types of beings, hybrids of nature and culture. The second, by “purification,” creates two entirely distinct ontological zones: that of human beings on the one hand; that of nonhumans on the other. (Latour, 1993, pp. 10–11)

Practices of translation between poles create hybrids whose existence (and necessity) is dependent on the purification of these two ontological categories into distinct and totally separate realms. Indeed, Latour argues, “the second has made the first possible: the more we forbid ourselves to conceive of hybrids, the more possible their interbreeding becomes” (1993, p. 12). This “modern paradox” enables the proliferation of fantastical polymorphic nature-culture hybrids whose existence depends upon the very binaries that fail to contain or explain them. The constant repetition and purification of binary categories makes hybridity and mediation possible precisely by ensuring they are kept separate. Furthermore, this separation into binaries is as inherent to western technoscientific modernity as the hybrid techno-cultural formations, knowledge, and networks of human/non-human forms it produces.

As I explore further in Chapter Six, the emblematic knowledge practices of modernity, science, and biomedicine are mutually constituted through colonial histories and instantiated in representational practices. As Daston and Galison (2010) show, the epistemic significance of

separating human and non-human elements in the production of scientific images extends far beyond instrumental concerns or divisions of labour. The policing of boundaries between representational practices and scientific knowledge production reflects deeper ontological anxieties and makes clear the historical and cultural situatedness of concepts like “objectivity.” Crucially, Walter Mignolo and Madina Tlostanova (2006) assert that modernity is an epistemic project which is by definition colonial: what counts as knowledge is constructed in and through colonial and imperial projects of geographic expansion and classification. Furthermore, Rosalba Icaza argues that the duality of modernity/coloniality should not be conceived as a binary but rather as a constitutive relation of power in which “modernity cannot be thought, sensed, and experienced without its underside: coloniality” (2017, p. 28). In this sense, Latour’s “modern paradox” suggests that scientific knowledge must be kept separate from representational practice precisely *because* the skillful work of rendering is necessary to construct scientific facts – including the “fact” of racial and sexual difference – as both knowable and self-evident. To dissolve such divisions is to trouble the foundations of what constitutes legitimate scientific knowledge, not only the total separation of humans and non-humans but also of “moderns” and their colonial “others.”

As Latour implies, the repetition of supposedly obvious boundaries is both a discursive marker of categorical anxieties and the instrument of their durability. Homi Bhabha describes the stereotype as a feature of colonial discourse that constructs otherness as fixity, “a form of knowledge and identification that vacillates between what is always ‘in place,’ already known, and something that must be anxiously repeated” (2004, p. 95). Similarly, Judith Butler asserts that “sex” is “materialized” through reiteration of norms, further asserting that the necessity of this constant reiteration “is a sign that materialization is never quite complete” (1993, p. 2). In

other words, boundaries are only ever provisional and contingent, mobilized and operationalized in discourse and in practice but never truly fixed in place. They must be “anxiously repeated” because the spaces and categories that they delineate can only be made to matter through the boundary-drawing process itself.

Gloria Anzaldúa’s foundational work *Borderlands* challenges the modern paradox from the point of view of the impossible hybrid. She describes life along literal and metaphorical borders as not only a clash of cultures but of forms of knowledge, “[the] coming together of two self-consistent but habitually incompatible frames of reference” (2012, p. 100). She proposes that the “new *mestiza* copes by developing a tolerance for contradictions, a tolerance for ambiguity” (Anzaldúa, 2012, p. 101). For Anzaldúa, this ambiguity is resolved through the formation of a *mestiza* consciousness which allows her to “break down the subject-object duality that keeps her a prisoner” (2012, p. 102). However, as Paula M. L. Moya (1996) points out, although the generative, boundary-crossing potential of hybrids is formed at the nexus of friction – physical and social locations where cuts and borders have been imposed – this position is not inherently liberatory. Indeed, Moya points out that although hybrid cultural identities enable “a critical perspective,” these embodied and often painful realities are not inherently “transgressive” simply by virtue of their indeterminacy within established cultural categories (1996, p. 182). In their personal narratives and everyday practice, medical illustrators embrace a hybrid identity – the mutant fish – that enables them to navigate the contradictions and ambiguities of scientific and representational knowledges. However, throughout their graduate education, the potential for a critical perspective – whether born out of epistemological borderlands or embodied experiences of difference – is kept in check through the process of enculturation into the dominant category.

Drawing boundaries

Storytellers

Medical illustrators are fashioned as professionals both bureaucratically and socially throughout their graduate school experience. Graduate programs institutionalize professional norms by establishing a curriculum that reflects the core competencies and specific knowledge deemed necessary for credentialization by their professional organization and the larger legitimizing structures with which it is affiliated. Curricula and faculty also actively define what constitutes professional expertise and comportment through the rhetorical shaping of the student's work and experiences, often reworking the ways in which graduate students make sense of their personal trajectories. This process enables the emergence of a new kind of person, the storyteller, whose role is to act as authorized mediator and translator between purified worlds.

Sociologist Thomas Gieryn introduced the concept of “boundary work” in 1983, defining it as a rhetorical practice (enacted primarily by scientists) involving the “attribution of selected characteristics to the institution of science (i.e., to its practitioners, methods, stock of knowledge, values and work organization) for purposes of constructing a social boundary that distinguishes some intellectual activities as ‘non-science’” (1983, p. 782). Through this work, Gieryn argues, scientists establish and maintain their own credibility and authority to make statements about the world by describing and differentiating their work from other kinds of knowledge. This differentiation takes three basic forms: protecting their own autonomy and authority from incursions by political or corporate interests, expanding their “ontological domain” as a reliable source of knowledge, or rejecting the legitimacy of other knowledge claims, groups, and practices as *unscientific* (Gieryn, 1999, pp. 15–17). Subsequent studies have expanded the framework to encompass internal boundary work within and between scientific disciplines as

specialties and practitioner groups compete to establish authority and autonomy over new technologies and areas of practice (Amsterdamska, 2005; Burri, 2008).

What remains constant throughout the scholarship on boundary work is the “cultural space of science [as] a vessel of authority” (Gieryn, 1999, p. 15). The precise shape and contents of the vessel may be in dispute, but not its existence or importance as a location of authority. Gieryn argues that “the epistemic authority of ‘science’ as a cultural space is chronically reproduced [and sustained] through repeated and endless edging and filling of its boundaries” (1999, p. 14). Like the reiteration and anxious repetition of racial and sexual categories, the boundaries separating science and non-science must be endlessly re-drawn precisely because they “can never really, in discourse, be proved” (Bhabha, 2004, p. 95). What is at stake, then, is not the location of the boundary but rather the categories and relationships that it defines. The malleability of cultural boundaries exposes that their ultimate role is the maintenance not of divisions themselves, but of the hierarchies they enable.

In the case of medical illustrators, professional boundary work involves a rhetorical move which first inscribes a boundary between art and science, then constructs professional expertise as the ability to move across that boundary while remaining within the legitimate domain of science. Professional self-fashioning is then the act of fashioning oneself (and by extension, the profession) *as hybrid*. In the course of graduate education, faculty model professional boundary work and professional values for future medical illustrators by transmuting the art/science binary formula into a concern for “communicating effectively.” Like students, faculty explanations of medical illustrators’ expertise also hinge on aligning certain abilities with “art” and others with “science,” but they reorient this relationship to privilege science as the position of knowledge in

need of transmission, reducing art to a set of technical skills or tools deployed in achieving that purpose.

“I kind of feel like we're artists that think like scientists,” posited one program director, George. He explained that thinking “like scientists” meant thinking “analytically” and being highly concerned with accuracy and “getting things right.” Although attributes like creativity and problem-solving ability were sometimes described as artistic traits, George explained, “[i]t's not a fine art kind of creativity.” Indeed, at one point he even deftly reclassified “really keen observational skills” as something that “scientists have.” George referred to the science/art dichotomy repeatedly, not only to make sense of his own trajectory into medical illustration, but also to situate the history of the profession: “I've seen that shift in the profession where it was, like, we're artists, you know, and we do science. And now it's sort of like we're both scientists and artists, if not more science.” He believed this shift reflected the increasing volume and complexity of scientific and technical knowledge required, alongside economic pressures to produce and adapt ever more quickly. However, he explained, regardless of changes in technology or scientific knowledge,

it'll still have the communication problem, something you need to educate someone on and you have to analyze it and figure out how to do that and how to do it the best way. I don't see that changing, how could it? We wouldn't be doing the same thing anymore. It wouldn't be our profession anymore. (George)

Although his description suggests a synthetic aspect to their work, he identified communication as the through line connecting disparate and evolving material practices. For George, “teaching and problem-solving” is “the foundation” of the profession.

The border-crossing experiences and hybrid knowledges of medical illustrators are transmuted through this third element: communication. In an interview, the head of another

graduate department, Lisa, hastily sketched a Venn diagram with three overlapping circles. She explained,

When students come in, I think that they think that it's science and art. Part way through the program, we help them realize it's science, art and communication, and my belief is that the most effective medical illustrator has science and art, but a solid, solid foundation of communication and that's what -- that the science has to be accurate, but it's not the beauty of the art or the power of the art, it's the art *in service of* communication, I think. (Lisa, italics mine)

It was not her first time using this explanation, and indeed her colleague Karen referred approvingly to having seen her present it in a recruitment session. Karen echoed Lisa's "three parts," emphasizing the need for "good rendering skills," scientific training, and communication skills:

It's like, if you can't communicate putting all those things together, your illustrations are not going to teach anything. An illustration is a piece of artwork that teaches, and if it's not teaching anything, then it's just a piece of art. Yeah. You have to be able to tell a really good story.

Like most practitioners I spoke with, Karen's description explicitly distances their work from "just a piece of art" by stressing its purposiveness and prioritizing functional goals of teaching and storytelling over aesthetic flourishes. This repeated emphasis on purposiveness and instrumentality establishes a field that is neither art nor science, but rather a mediator between them. Moreover, the art must always remain subservient, reinforcing the epistemic authority of science. The end goal is to "tell a really good story" about science.

The vocabulary of storytelling is pervasive in the field: "the storytelling really is where the magic happens," laughed, Julie, a faculty practitioner. Although one might expect the idea of story in medical illustration to refer to the temporal unfolding of a natural process or clinical encounter, the discourse of storytelling extends beyond narrative functions. For medical illustrators, "storytelling" encompasses decisions about elements or details to include or omit, providing context such as spatial relationships and scale, and managing affective responses

through aesthetic choices ranging from font and colour palette to illustration style and format. The language of story and storytelling becomes a shorthand to describe the plotting and management of a viewer's experience. The audience's attention must always be focused on the *right* things, collectively understood as "the story."

"Storytelling"

While the notion of an illustration telling a story is not totally novel, the transfiguration of narrative from analytic framework to instrumental or normative outcome warrants scrutiny. The rhetoric of storytelling in communications and design has become so ubiquitous that one recent publication is titled simply, *Design is Storytelling* (Lupton, 2017). This narrative turn in design coincides with other threads emphasizing the role of narrative in medicine around the turn of the millennium, including "medical humanities" (Evans & Greaves, 2010; Greaves & Evans, 2000), "narrative medicine" (Charon, 2001), and "graphic medicine" (Williams, 2012). Around the same time, storytelling also surfaced in the non-academic world as a tool for "enlivening communication and employee commitment" and improving "user experience" (Collison & Mackenzie, 1999; Quesenbery & Brooks, 2010).

The idea of "storytelling" became pervasive in design with the emergence of "design thinking" in the early 1990s, usually traced to the extremely successful California-based design firm IDEO. In 1993, Bill Moggridge, one of the founders of IDEO, published an article purporting to explain some of the firm's design process, entitled "Design by Storytelling." The article describes a four-step process for designing objects or products, using design for aging and disabled people as his example "market." He gives the most fulsome explanation for the third step, visualization. Building on "understanding" and "observation" of an imagined user (such as

simulating disability), visualization entails what he describes as “scenario building or storytelling” (Moggridge, 1993, p. 15). Like previous steps, storytelling involves describing an idealized experience in which the design should provide a solution to a problem that an imagined user might encounter. No actual user need necessarily take part in these steps. Since Moggridge’s essay, similar “design thinking” processes have been mapped out by various practitioners. Although the trajectories of these formulae vary, most include “storytelling” as a step in the chain.

The emergence of storytelling as a dominant discourse in design coincides with a more widespread adoption of storytelling and narrative as both natural and good. Proponents of these approaches often suggest that the storytelling impulse is a human universal, with the power to connect emotionally, transport, and ultimately persuade.⁹ Some even assert that the ability to construct a narrative is inherently connected to the constitution of a unified and coherent self. Angela Woods critiques these “two dogmas of narrative in the medical humanities and in the field of medicine more broadly” (2011, p. 114). Woods draws on Galen Strawson, who describes the “psychological” thesis, which asserts that “human beings typically see or live or experience their lives as a narrative or story of some sort, or at least as a collection of stories” and the “ethical” thesis, which asserts that such a narrative orientation and organization of experiences is “a good thing” (2004, p. 428). As Woods (2011, 2012) points out, these two assumptions, aligned in various combinations and degrees, underpin a great deal of research in the medical humanities.

Together, these assumptions give rise to a normative impulse that seeks not only to understand the role of narratives in human lives or to understand lives through narratives, but to

⁹ See, for example, Ahlzen (2019) and Strawson (2004). These critical texts usually assume (often explicitly) that the stories in question are necessarily constructed in language; there is currently little critical assessment of narrative and storytelling discourse in visual production.

mobilize and instrumentalize narrative and storytelling toward tangible outcomes. Thus, narrative medicine seeks to improve patient care and experiences by incorporating narrative competencies into medical education, while a variety of narrative and creative research methodologies claim to empower ill, disabled, and marginalized populations through stories and storytelling. Much like “design thinking,” these approaches transform the notion that stories are both primordial and necessary into an ethical imperative to intervene by crafting particular kinds of stories (and particular kinds of selves) for the betterment of humanity. However, the use of similar methods to meet the institutional goals of corporations and militaries makes clear that the crafting of stories is hardly inherently liberatory. On the contrary, the persuasive potential of “a good story” is at the heart of its institutional appeal.

The stories that medical illustrators tell about bodies and scientific knowledge are grounded in specific cultural locations and are always, necessarily, partial. Far from being universal, the construction of a coherent narrative necessarily involves transmuting a potentially infinite amount of events, settings, characters, experiences, and emotions into a form that is recognizable within a given culture. As I explore further in Chapter Six, focus on the craft of “telling the story” as a straightforward question of navigating and manipulating an audience recasts the specificities of context as deviations from an unquestioned norm, while at the same time rendering the audience as a passive receptacle for knowledge. Moreover, it recasts subservience to medical epistemologies as a moral imperative.

“Transparent vessels”

The subservience of the illustrator to the hiring anatomist, physician, or surgeon is a longstanding social and professional arrangement. As I explored in Chapter One, the inclusion of

lengthy assurances in the preface that the anatomist supervised and directed the artist are so common as to constitute a generic convention of anatomy texts well into the twentieth century. As I explore further in Chapter Three, for contemporary North American illustrators, Max Brödel marks a turning point in which the interpretive and investigative agency of medical illustrators began to be acknowledged in the form of visible signatures and occasionally even co-authorship. However, this shift is generally understood as an “elevation in status” for the artist, not as an epistemological shift in scientific thought (Wilson-Pauwels, 1993b, p. 55). Although this restructuring situates medical illustrators as a kind of expert, it ensures that they are not perceived as a threat to scientific hierarchies of knowledge by rendering their expertise as the ability to ensure that material and craft knowledge remains subservient to scientific knowledge.

Focus on the craft of “telling the story” as a question of navigating and manipulating an audience often obscures whose story is being told, and why. In both graduate education and promotional literature, it is accepted as given that a story needs to be told and that medical illustrators should tell it. Medical-legal work, a distinct branch of the field, is one of the few areas where these distinctions are made more explicit.¹⁰ A 2016 press release on the Association of Medical Illustrators (AMI) website promoting a radio interview with AMI member Leslie Leonard explains,

“With the medical legal art, you're trying to educate the jury and you're also trying to tell *the story [that] whichever side you're hired by is trying to tell,*” Leonard said. That could mean illustrating a surgery in all of its bloody, messy confusion for the surgeon's case. The patient's illustrator may choose to “clean up” their picture, showing the mechanism of injury instead and focusing on trauma or pain. Both illustrations are accurate.(Association of Medical Illustrators, 2016, emphasis mine)

¹⁰ For reasons of scope, I have largely omitted medical-legal illustration from my research. However, it presents a complex array of questions worthy of future exploration by scholars working at intersections of STS, medical ethics, and the law. Of particular interest are the aesthetic restrictions imposed by various jurisdictions and types of legal appeal, such as the presence or absence of blood and facial expressions conveying strong emotion.

This statement is one of the only descriptions I have encountered which overtly acknowledges that there might be more than one version of “the story.” Indeed, although their work is often explicitly constructed to achieve specific outcomes (such as encouraging certain behaviours in particular populations or commercial adoption of medical products), the social, political, or economic investment of the storyteller in the story being told is surprisingly rarely acknowledged.

As Steven Shapin and Simon Schaffer (2011) have explored, the development of experimentalism as the dominant scientific paradigm in the west owes its structure in part to the legal system. In particular, witnessing as a form of evidence to support knowledge claims builds on legal frameworks. The peculiar role of visual scientific evidence in the contemporary courtroom reformulates these configurations of authority and expertise. Simon Cole’s (1998) study of the professionalization and normalization of fingerprint analysis as courtroom evidence traces how the material and social limitations of digital traces and visual discernment were built into the knowledge claims of latent fingerprint examiners (LFPEs). Cole’s fingerprint examiners are able to make stronger knowledge claims precisely by limiting the scope of their expertise, “Fingerprint matches, they argued, were not matters of opinion because all LFPEs’ opinions agreed” (1998, p. 699). Any identification about which disagreement is possible can only be ruled “inconclusive,” thus maintaining consensus within the professional body. In other words, only two rulings are possible: either a positive match, which any other LFPE would confirm, or “inconclusive.” LFPEs are able to position themselves as technicians practicing a science with objective (and replicable) results by limiting their claims and validating their individual expertise in the consensus of their professional community. They harness the prestige afforded to science in the courtroom while at the same time positioning themselves as “modest” witnesses.

As a form of professional boundary work, repeated classification of medical illustrators' knowledge and skills in terms of science, art, and communication situates a small and difficult to categorize field of practice within the broader system of medical and scientific professions. Rather than make the case for a special form of knowledge-making, they frame their expertise as mediation. To maintain credibility within a field that has long been suspicious of representational practices (and women), medical illustrators position themselves as what one faculty member self-reflexively called "transparent vessels," invisibly and seamlessly translating and repackaging knowledge generated elsewhere. Like fingerprint analysts, medical illustrators manage their position in the ecosystem of biomedical professions by locating themselves modestly, as "storytellers."

Making storytellers

When graduate faculty and working professionals emphasize communication or storytelling as the key elements of professional expertise, this influences how students understand the work they are doing. Students are enjoined to "show the story of it..." and to include or omit details depending on whether they are "part of our story." As they progress through the program, students quickly adopt a similar language, which in turn structures their personal narratives and professional values. As graduate students transition into professionals, their personal stories become touchstones that mark the tellers' belonging to the community and acceptance of its values and practices. Early effervescent excitement about "art" and "science" is transmuted into an emphasis on communication, teaching, and "storytelling."

Although some students I spoke with earlier in their graduate work mentioned storytelling and communication, they had difficulty articulating themselves and acknowledged

that certain concepts which they believed to be important were “still kind of fuzzy” (Wes). By their second year, students had developed a more robust vocabulary to describe and situate their own expertise, often in very similar terms to their program directors. For example, Xenia, a second-year student, linked the shift toward thinking about her work in terms of communication and problem-solving directly to her coursework and conversations with faculty:

We talked about it and before that I had just been like oh, a medical illustrator is somebody who understands science and somebody who draws. And it's not just that, visual problem solving is what we're really good at. How do you come up with a solution that will fit your audience? How will you integrate all of this information into something that communicates effectively? So it's not just like, a pretty picture plus science because anybody can draw a pretty picture of a heart or a pretty picture of bones or nerves if they use good references. But trying to communicate what those things do? That's something that not everybody can do if they just are good at art or they're just good at science. So, communication, effective communication is the biggest thing, I think.

Unlike incoming students who struggled to put their thoughts into words, she proudly declared, “That’s my spiel about medical illustration.” Over the course of their graduate education, students reconfigure the science/art dichotomy by learning to construct their expertise as “effective communication.” As they progress through the program, they model this “spiel” in conversations and critiques, both honing and reinforcing its explanatory force. Becoming a *professional* medical illustrator requires a transformation from “good at art and science” to “storyteller.”

Graduate education smooths the epistemic uncertainties and contradictions of medical illustrators’ early experiences into a coherent narrative which reiterates binary distinctions and positions professional medical illustrators as mediators firmly allied with scientific values. By articulating science and art as incommensurable ways of knowing between which they are uniquely able to move, the personal narratives of medical illustrators enact Latour’s (1993) “purification” of modern categories, where science is construed as a reflection of non-human nature and art as human(made) culture. At the same time, the rhetoric of communication and

storytelling positions medical illustration as “translation,” constructing medical illustrators and their profession as hybrid figures uniquely capable of travelling between the two poles. As the 2016 AMI press release explains, “The medical illustrator is the translator between the layperson and medical professionals” (Association of Medical Illustrators, 2016). The construction of the medical illustrator as the translator of a story manufactured elsewhere (by scientists) enables them to resolve the tensions between art and science by recasting their expertise as mediation. This move not only reinforces the binaries and borders at the heart of their epistemic conflict, it obscures and devalues the unique contributions of medical illustrators to knowledge-making itself.

Border-crossing

The head of one graduate program, Adam, suggested, “I think a lot of people just generally with artefacts of visual culture, they just see them all the time and they have no sense of the kind of effort that goes into them, which is part of the reason they're comparatively undervalued as intellectual property.” He hypothesized that in a culture teeming with visual productions – from films to newspaper photographs to cartoons, “to take in an image is almost – it's almost too easy, so it makes you – you don't accord it the same value as you do words, which you know were hard to learn” (Adam). Thus, he speculated, most people with typical visual acuity do not experience seeing as “effortful” in the way they might understand writing or reading. This kind of effort is difficult to explain or account for externally as a form of knowledge work.

During our interview, Adam reflected deeply on the core skills that his program seeks to develop in its students. At one point, he described two forms of visual rendering expertise,

observational and imaginative. He explained that these were skills faculty look for in incoming students, usually with greater emphasis on observational skill. Like others I spoke with, Adam emphasized the importance of close observation from life and getting to know a subject at a level of deep detail. His injunction to “observe it, don't paint from a photograph, please just observe it directly and do it” seems to echo longstanding disciplinary emphasis on authenticity and “original research” drawn from Brödel (Hodge, 1955, p. 305). However, Adam’s emphasis was more pragmatic:

...one of the difficult things about the eye is, it’s not a measuring tool. You can't measure with the eye. It's learning the various techniques you need to be able to create a kind of convincing tonal representation across the visual surface. Because it's also true when you focus with the eye you can see light and dark in a particular area and you might work that up as being a fore-range of light and dark but then that doesn't leave you enough dark to go dark where you really need to in another part of the image.

In other words, the eye is only one part of a complex apparatus of visual processing and interpretation that enables us to understand complex spatial relationships. For example, when viewing a 3D scene in real life, humans with a typical range of visual acuity and neurological structure can discern and interpret details at various distances across an extremely wide range of lighting conditions nearly instantaneously. Not only does the eye quickly focus and adapt to variations in distance and lighting, binocular vision (two eyes, set apart from one another) enables the brain to interpolate slightly different perspectives, providing additional spatial information. Rendering the scene as a 2D illustration requires fixing that physiological and neurological complexity in place. As Adam explains, this is not simply a matter of mechanically measuring distances or gradations of light, but of continually shifting between perspectives in order to build up a “convincing” representation.

For Adam, the necessity of shifting perspectives and accounting for complexity is not a weakness but rather a strength. The material form of the representation demands specificity and

coherence: “You know, you're concretizing this thing and you can't kind of wave your hands about it” (Adam). The generative possibilities of this process become clear when the demands of material form cannot be met with available information. Adam provided another example of a student discussing a molecular animation with the commissioning scientist:

The student is saying, “Okay that molecule is in the nucleus, and then how does it get out?”

“Oh well, this chaperone protein comes and binds it and then it eventually finds its way to the membrane.”

“Okay, then how does it get its way across the membrane?”

“I don't know.” And then they say, “You have to show it crossing the membrane.”

“Okay how does it get across the membrane?”

“I don't know, you know.”

“Okay, but I have to show it but what am I going to do?”

“Well, one way could be—”

It actually forces them to be specific [...] And I think that the scientists learn things when they're forced to be specific and when they don't know it brings to the fore, “Well that's really interesting that you don't know that and what are the implications of not knowing that?” And sometimes they need to go off and do other things and investigate more stuff or, you know...

The material exigencies of representational forms necessitate both synthesis of available information and close attention to detail, which in turn enable medical illustrators to identify gaps and discrepancies. Because animation must account for each step of the temporal and spatial aspects of the process, it raises questions when some causal structure has not been adequately accounted for. A 2D or 3D illustration can force the illustrator to notice variations and discrepancies in the available reference material, such as when a particular angle of view is missing. Although it is possible to minimize gaps in knowledge through various aesthetic choices (such as using a jump cut to bypass the molecule's passage across the membrane), the need to

make that choice consciously opens up possibilities for addressing those gaps and generating new questions. When faced with incomplete information, the affordances of specific forms enable certain liberties while limiting others.

Material contingencies also enable more speculative work, which Adam referred to as “imaginative drawing.” Illustrators are often called upon to synthesize information in order to depict a viewpoint from inside a cell or to include hidden anatomical landmarks and tools in a single frame illustrating a surgical field. But sometimes even more inventiveness is called for when working with processes or structures that are not fully understood. Adam explained, “a lot of what we do [is] imaging stuff you can't actually see, or you don't actually have a reference for, or you have limited reference for.” In order to derive 3D form from 2D slices or to integrate knowledge at different scales, the illustrator must be able to imagine and manipulate objects in space and time in plausible ways and to make complex inferences from incomplete information (Goodsell, 2005; Hopwood, 1999; Mazierski, 2022). Such speculative renderings use available but limited information to generate a plausible hypothesis about how structures fit together and function by synthesizing disparate sources of information. Adam suggested that these “visual hypotheses” enable one to “start to think differently about how this actually might work.”

Adam’s thoughtful analysis suggests that the forms of observational and interpretive knowledge medical illustrators employ can and do constitute a form of knowledge making, not simply the interpretation of ready-made scientific knowledge. The possibility of ontological multiplicity is immanent to the everyday practice of medical illustration as they move between spaces, scales, and forms of knowledge from molecular biology to pathology to clinical practice (Brierley, 2013; Mol, 2007). However, most of the faculty I spoke with did not acknowledge or reflect on the generative potential of biomedical illustration as a material and craft practice.

Indeed, in spite of his nuanced reflections, Adam conceded that, “that ability to draw from imagination is something that we undervalue or we don't actually formally look for.” Rather than make the case for a special form of visual expertise or original contributions to knowledge, medical illustrators tended to position their work modestly.

As is clear in the case of medical illustration, hybridity is not inherently disruptive to existing borders. Indeed, those who exist along the borders can be effectively recruited to patrol them. However, Adam's emphasis on imaginative and speculative work makes clear that the position of medical illustrators at the borders of scientific and craft knowledge, seeing and making visible, also entails the potential to intervene in those hierarchies and exclusions. The labour of medical illustrating not only encompasses substantial research, conceptual ability, decision-making, and rendering skill, but also inventive and speculative work. Conceptual synthesis and inferences from available references and resources is a common component of medical illustrators' practice, even in seemingly traditional anatomical illustrations.

The shorthand of storytelling repackages these generative practices as the ability “to create an image that tells the story *that the specialist wants*” (Paul, senior faculty member, emphasis mine). This construction situates medical illustration as purely documentary and medical illustrators as fundamentally subordinate to the researchers and physicians with and for whom they work. Despite the ambiguous epistemic character of their material practices, this shrinking of knowledge claims elides the generative potential of visual practices by positioning their work as merely documentary. Framing their expertise as “communication” or “storytelling” realigns and tames the epistemic hybridity of the medical illustrator both by limiting the scope of their knowledge claims and by reasserting allegiance to the power and authority of science and medicine.

Finding family

By establishing new boundaries of expertise and of professional belonging, the process of “enculturation” enables students to reformulate their individual experiences as part of a narrative arc that ends with incorporation into the professional “family” (Subramaniam & Wyer, 1998).

Prior to pursuing medical illustration, personal origin stories often focus on division, incompleteness, and not fitting into established categories. Integration into the profession elicits expressions of belonging and kinship. Upon graduation, one student posted giddily on Instagram that, “more than anything, I got a second family.” The 2017 annual meeting of the AMI was peppered with similar expressions of familial attachment and support. One long-time member even referred to the meeting as “a family reunion... these people are my extended family.”

Another member, presenting a lifetime achievement award, described the AMI as “a calling, a family, a labour of love.” Several laughingly explained that medical illustrators often pair up romantically as well, legitimating their metaphorical kinship. As an ethnographer interloper, I knew that some degree of integration had been achieved when a faculty member assured me that my presence in their department would be missed: “[It’s] like you’re one of the family.” For graduate students, this incorporation into the professional family marks the conclusion of a process through which they transition from wandering disciplinary misfits to members of a new cohesive professional community. This rhetorical and emotional shift from misfit outsider to privileged insider – from “mutant fish” to family member – is one of the most profound markers of successful professionalization as a medical illustrator.

As I will explore in Chapter Three, family also functions as an organizing metaphor for the profession through emphasis on a founding father. The professional origin story of medical

illustration establishes Brödel as not only a patriarch and progenitor, but as the apotheosis of the medical illustrator: not only a master draftsman but also a “born investigator” and a “true scientist” (Cullen, 1945; Schultheiss et al., 2000, p. 1138). To trace one’s lineage to such a person is to claim that some of that authoritative metaphorical DNA as one’s rightful inheritance. The personal origin stories and community-building narratives of the profession enact a second form of kinship. While patrilineal lineage asserts authority through relation and provenance, this metaphorical kinship constructs family-like relations amongst practitioners through an emphasis on affinity, care, and mutual support. The socialization of medical illustrators thus involves two very different kinds of kinship: on the one hand, a linear, genealogical narrative, grounded in patriarchal lineage and pedigree; on the other, a networked kinship of affinity and hybridity.

Profession as family

The two narratives seem contradictory, but their coexistence is a vital part of the boundary work required to maintain the profession. If binary discourses of art and science construct a distinct professional identity and practice compatible with biomedical norms, communitarian notions of professional peers as “family” enable the proliferation and interbreeding of these nature-cultural hybrids. While the patrilineal origin story constructs family as a linear and hierarchical relation along the patterns of biological reproduction, the field-as-family narrative draws on a social imaginary of kinship as affinity and affective relation, or what Alison Kafer calls “networked interdependencies” (2019, p. 6). The first grounds expertise in patriarchal authority while the second celebrates them as a community of misfits with access to a special form of expertise. Each draws on a particular cultural imaginary of “kin”: on one hand the biologically (and legally) defined family of origin with father at its head, mother as helpmeet

and nurturer, and progeny crafted in the image of the father; on the other, an idealized vision of freely-chosen affective relations. Taken together, they construct a field that can claim epistemic authority (by virtue of its “father”) and be inherently inclusive (by virtue of its affective knowledge community). Both kinship narratives establish acceptable forms and paths to belonging by providing a framework for the social reproduction of “family values.”

Family metaphors create a common grounding of professional identity as resemblance and belonging, while also constructing a secure niche for their work within the existing epistemic cultures of biomedicine. The genealogical family resemblance is based in a set of traceable shared experiences and training trajectories, values passed down from generation to generation. The affective “second family” is based in a set of shared interests, experiences, and specialized skill sets, values understood to transcend individual experiences in the service of “communicating science.” Belonging is achieved when a medical illustrator is able to incorporate family values and narratives and to perpetuate them by embodying good practice. The formation of a professional “family” descended from the father anchors hybridity in a stable genealogical narrative ensuring belonging through lineage and the social reproduction of epistemic values.

However, not all families get on well. As Janet Carsten points out, “hierarchies and exclusions ... are part of what kinship enables” (2013, p. 250). Jeanette Edwards and Marilyn Strathern (2021) have addressed the prevalence of the family metaphor in constructing ideas of community in Euro-American cultures, marked by an emphasis on positive aspects of social connectedness and affective alignment while eliding the tensions and antipathies that can also characterize “family.” They point out that ideas of belonging are not value-free, “as though there were something productive and generative about making connections as such” (Edwards &

Strathern, 2021, p. 227). Academic analysis tends to follow these discursive habits, drawing uncritical connections between kinship and positive affect in a “sentimentalized view of sociality as sociability and of kinship (‘family’) as community” (Edwards & Strathern, 2021, p. 227).

What is left out of benign accounts is that belonging and inclusion also imply both possessiveness and exclusion, establishing relatability (or lack thereof) as a product of “the characteristics one owns and the people claimed as one’s own” (Edwards & Strathern, 2021, p. 228). Ideas of family and community (and the discursive slippage between the two) are embedded forms of social boundary-making, the same processes that permit the exclusion of those who do not fit in.

Emphasis on this “big happy family” obscures the hierarchies and exclusions enacted both within the profession and in the products of medical illustration. Banu Subramaniam has explored the persistent undercurrents of colonial classification practices and eugenic thinking in evolutionary biology and how “these complex histories are entirely erased within disciplinary histories” (2014, p. 67). Similarly, as I explore throughout this dissertation, the training of professional medical illustrators overlooks its foundations in both unequal gender relations and the colonial classification of human differences. As I discussed in Chapter One, the AMI has begun to address the lack of diversity – most often construed as racial diversity – in both their membership and the images they produce through a variety of diversity initiatives including a dedicated committee and conference slot, an official statement, and active recruitment among underrepresented demographics. Individual medical illustrators have also devoted considerable effort to bring these issues to the fore and to challenge representational norms in their own work. However, as I explore further in Chapter Six, practitioners’ attempts to expand the range of

bodies in their work are often limited by social and economic pressures to deliver uncontroversial products quickly or risk their own livelihoods.

As Sara Ahmed, Chandra Talpade Mohanty, Subramaniam and others have deftly explored, “diversity and inclusion” initiatives often serve to obscure the structural exclusions and colonial histories at the heart of institutional and economic structures (Ahmed, 2012). Such projects often defuse the threat of disruption to fundamental structures by recasting difference as “benign variation” and historically-produced social inequalities as deficits to be overcome in order to fit in (Mohanty, 2003, p. 193). Ahmed asserts that for diversity initiatives to be put into place, they must be made commensurable with the existing institution and with the larger ideological space within which it functions: “the story of diversity thus becomes the story of diversity’s inclusion into the terms of an institution” (2012, p. 9). As Subramaniam pointedly asks, “What does it mean to recruit a group into an enterprise that simultaneously teaches them about their own biological inferiority?” (2014, pp. 221–222). A diversity predicated upon incorporation into the normative professional body fortifies the very structures that have excluded them by constructing the standards and norms of culturally dominant groups as “normal and neutral” (Beagan, 2000, p. 1262). In other words, the process of enculturation into the AMI “family” may in fact undermine diversity and inclusion efforts by excluding those people and practices who do not evince sufficient family resemblance or adhere to family values.

Kinship as friction

Medical illustrators inhabit multiple worlds at once. In this sense, they exist in what Susan Leigh Star calls the “high tension zone,” navigating an insider/outsider position much like Anzaldúa’s *mestiza* (Star, 2015, p. 279). However, the enculturation and professionalization

process tends to flatten and diffuse this tension, remaking practitioners in the image of the founding father, regardless of their gender or other individual attributes. As Star proposes, “[a] set of uncertainties is translated into certainties: old identities are discarded, and the focus of the world is narrowed into a set of facts” (2015, p. 280). In a study of Canadian medical students, Brenda L. Beagan describes this transition as the adoption of “a new ‘natural attitude’, a set of shared assumptions held in common so pervasively that to even question these assumptions disrupts everything” (2000, p. 1258). This “socially neutral physician” is expected to embody a scientific ideal of dispassionate, impartial, universal knowledge, regardless of individual students’ gender, ethnicity, or other social identities (Beagan, 2000, p. 1262). Although the graduate training of medical illustrators is generally less homogenizing, it also “demands that members of formerly excluded groups assimilate to standards and norms that are supposedly neutral and universal, but in fact are socially and culturally specific” (Beagan, 2000, p. 1262). Of course, as Star argues, norms and standards are never universal. Moreover, as I make clear in Chapter Six, culturally “marked” bodies are rarely understood as neutral in medical illustrations.

The idealized goal of the socially neutral biomedical illustrator is the frictionless transfer of information to the (socially neutral) viewer. As contributors to biomedical knowledge-making, biomedical illustrators strive to create images that are self-evident: intuitive and correctly interpretable by every viewer, at least within the intended audience. A successful visualization should convey the intended information without calling attention to the medium itself nor the effort involved in creating it. In short, a well-constructed image should speak for itself. However, as Star argues, “[n]o networks are stabilized or standardized for everyone” (2015, p. 278). Indeed, “part of the public stability of a standardized network often involves the private suffering of those who are not standard—who must use the standard network, but who are also

nonmembers of the community of practice” (Star, 2015, p. 277). For those who have been excluded from them, these conventions and standards are instead “a source of chaos and trouble” (Star, 2015, p. 276).

Kafer offers a glimpse of what a more complex notion of kinship might look like when they include friction and power as immanent to any notion of kin through a profoundly reconfigured queer crip kinship: “kin is a site of power, friction, and potentiality” (2019, p. 6). The 2016 AMI presentation on diversity introduced friction to the frictionless, teleological account of kinship in medical illustration. In the face of this “big happy family,” the talk called attention to the hierarchies and exclusions enacted both within the organization and in the work of medical illustration. Addressing these critiques meaningfully requires more than an integration of “diverse” bodies into the “terms of the institution” precisely because those terms value a frictionless, cohesive, teleological version of family, biomedicine, and embodiment (Ahmed, 2012, p. 9). The presence of misfit bodies entails the presence of friction and therefore a radical reframing of terms like family and belonging as well as reframing fundamental assumptions about the functions and possibilities of biomedical visualizations.

Kafer’s alternative kinship, like the exhortations of crip technoscience studies more broadly, emphasize what Aimi Hamraie and Kelly Fritsch characterize as the “collective, messy, experimental, frictional, and generative” (2019, p. 22). To build a very different kind of kinship within a field that produces and re-produces the standards of biomedical normalcy requires dismantling the kinship narratives that currently dominate, in particular those that are built on the reproduction of heteronormative genealogical sameness. Within these institutional terms, kinship requires mutant fish and misfits to adapt to existing structures. Enacting a queer, crip kinship amidst the vast diversity of human embodiments demands a broader reevaluation of the terms of

inclusion and the epistemic values upon which the field is built. It also requires an investment in discomfort and friction, in images that are not ready-made but rather demand attentive engagement and restructuring of categories. It requires medical illustrators to acknowledge their own agency and epistemic power and to be intentionally and actively complicit in re-making biomedical epistemologies.

The process of professionalization turns epistemic misfits into the standard-bearers of the scientific story, domesticating and containing the disruptive potential of “mutant fish.” Although personal origin stories begin by acknowledging the insufficiency of modern categories, the process of professionalization contains and defuses the potential of this hybridity to disrupt those categories and the colonial hierarchies that structure them. The boundary work of professionalization repositions medical illustrators not as dangerous border-crossing hybrids but as translators and mediators whose work re-inscribes (often literally) hierarchies of knowledge.

Chapter Three: Founding Fathers

Genius, genealogy, and the cult of great men

Who named Max Brödel “Poppa”? I don't know. Perhaps no one does. Maybe it just grew like the snow man. But we do know it seemed quite appropriate. Mr. Brödel worked and worried over his students as much as any parent. He must have felt perplexed and baffled many a time by his somewhat unruly full-grown family. (Hopper Ross, 1953, p. 32)

In the first week of classes, a faculty member at the University of Toronto Biomedical Communications program (BMC) addressed a fresh cohort of graduate students in medical illustration as he shared examples of carbon dust illustrations: “a name you’re going to hear a lot of is Max Brödel... referred to as the ‘Father of Medical Illustration.’” He explained that Brödel had founded the first training programme for medical illustrators at Johns Hopkins and that they were (rightly, he supposed) “possessive of their heritage.” He explained that many Canadian illustrators in the early part of the twentieth century, including the Toronto program’s founder Maria Wishart, had trained under Brödel “and then they went forward and multiplied.”

In November of 2017, the Biomedical Visualization (BVIS) program at the University of Illinois Chicago (UIC) hosted its biannual Frank Armitage Lecture series, attended by students, faculty, and working medical illustrators.¹¹ The head of the department, North America’s second-oldest accredited graduate program in medical illustration, opened the event with a short talk

¹¹ Frank Armitage was an illustrator, muralist, and set designer best known for his designs for *Fantastic Voyage* and for his work at Walt Disney Corporation on both animation and theme park design for exhibits such as the *Wonders of Life* pavilion at EPCOT. A number of Armitage’s original works were donated to the BVIS program in 2006 and are on display in the halls of its home building. In conjunction with this donation, the lecture series was established “to honor this visionary and to highlight other ‘visual geniuses’ who translate complex biomedical information into visual form” (2016 UIC Frank Armitage Lecture, 2016).

about Armitage and the program's founder, Tom Jones: "This is really a tale of two men..."(2016 *UIC Frank Armitage Lecture*, 2016). The audience, however, was mostly women: students from several graduate and undergraduate programs, current and retired faculty, and practicing medical illustrators of all ages. In fact, since the founding of professional training programs in the early twentieth century, the profession has been predominantly female.

I began my research expecting to learn more about the ways in which the legacies of early women medical illustrators were passed down within graduate programs. However, within a few months it became clear that while some of their stories and images certainly circulated, the most iconic stories seemed to be about men. By far the most common (and consistent) of these men was German émigré Max Brödel. Although emphasis on Brödel is strongest within the program he directed at Johns Hopkins, the mythos of "the Father of Medical Illustration" permeates each of the programs I visited, as well as the professional association and written documents on the profession. References to Brödel are also commonly sprinkled into presentations at professional gatherings, usually as a mode of situating the presenter's lineage and professional connections or establishing rapport with the audience with a well-placed allusion. As one presenter remarked, "I guess it's required by law to quote Max Brödel." Invariably accompanied by the epithet "the Father of Medical Illustration," the story of Brödel is an ever-present background narrative from which others can be oriented.

In this chapter, I explore the role of disciplinary origin stories in crafting the professional identity of medical illustrators in North America, focusing on the "founding father" narrative of Brödel. I argue that these stories serve two key purposes: first, to establish the legitimacy and credibility of medical illustrators as experts and second, to articulate a distinct form of expertise within the wider system of medical knowledge. Disciplinary narratives organized along lines of

patrilineal kinship and lineage align the profession with established markers of authority and credibility in the sciences and broader culture, including hierarchies of gender, race, and class. The founding father narrative also enables practitioners to articulate key values and epistemic practices of the profession by locating and embodying them within a single individual with procreative powers. This discursive gambit enables a historically female-dominated field to claim credibility by situating it within biomedical regimes of authority.

Image 2

Portrait of Max Brödel



Photo by the author. Photos and artwork in the Johns Hopkins Art as Applied to Medicine Department.

Founding fathers

In 1954, physician Ernest W. Goodpasture opened the seventh annual Brödel Memorial Lecture at the annual convention of the Association of Medical Illustrators (AMI) in Nashville, Tennessee, with recollections of his own medical education at Johns Hopkins:

... so far as I know, there was only one professional medical artist in the world at that time; but fortunately he proved to be a prolific progenitor. In intervening years... professional medical illustrators, taking advantage of the situation, proved themselves so indispensable that their race has multiplied many fold. So significant and so numerous have they become in fact that, in recent years, they felt the need to embody themselves in a professional clan, the Association of Medical Illustrators. (1955, p. 39)

Goodpasture's speech takes to its apotheosis a metaphor which pervades disciplinary narratives of medical illustrators both before and since: Brödel as father, professional field as family. While this metaphor is undeniably present in many fields, this pervasiveness requires explanation. The peculiarity of a powerful father figure at the head of a female-dominated field provides an opportunity to question the given-ness of this narrative and to instead examine the kinds of constructive work that such narratives do.

Although the expansion of training programs, the creation of professional societies, and the public promotion of the field occurred after his death, Brödel is credited with "professionalizing the discipline of medical illustration and leading it into the 20th century by establishing the first academic program to offer university courses in medical illustration" (Wilson-Pauwels, 1993b, p. 33). This "first academic program" was the Department of Art as Applied to Medicine (AAM) at Johns Hopkins, where Brödel worked and taught from 1894 until his retirement in 1940. The program was endowed and began taking on students in 1911. A second training program developed independently of Brödel at UIC under Jones. Jones had trained in art and worked as an anatomy illustrator in St. Louis, Missouri before joining the staff of the UIC Department of Medicine's illustration studios. The department at UIC was extended

into an apprenticeship-like academic program in 1921, which he continued to head into the mid-fifties. Nevertheless, only Brödel is routinely credited with “revolutioniz[ing] medical illustrating in the United States and Canada” (Cullen, 1945, p. 5). Brödel’s death in 1941 coincided with the entry of United States into the Second World War. As I explore in more detail in Chapter Four, after a brief period under the direction of James F. Didusch, 27-year-old Ranice Birch (later Davis, Crosby) took over the program in 1943 and remained at the helm for the next forty years.¹² During and after the Second World War, additional programs were established, headed almost entirely by former students of Brödel.

The first and only of these programs in Canada, at the University of Toronto, shares early history with both John Hopkins and UIC. Wishart, who founded the Toronto program in 1945, had been a student of Brödel, while her successor Nancy Joy trained with Jones in Chicago. The University of Toronto was also the home institution of anatomist John Charles Boileau (J.C.B.) Grant, whose *An Atlas of Anatomy*, published in 1943, was the first such work to be written, illustrated, and published entirely in North America (Sawchuk et al., 2011). Produced in response to difficulty accessing German textbooks (which had predominated prior to the First World War), Grant’s *An Atlas of Anatomy* (now known as *Grant’s Atlas*) included hundreds of original illustrations by Joy and another former Brödel student, Dorothy Foster Chubb (Sawchuk, 2012; Sawchuk et al., 2011). Today, the BMC maintains close ties with both Johns Hopkins and UIC,

¹² For the purposes of this dissertation, I will use either the name by which historical actors were known during the period in question or the name by which they are most commonly known, where appropriate. Ranice Birch married veterinarian and former merchant marine Garrie Robert Davis in 1944, but he subsequently filed for divorce from Florida in 1956, “on grounds of desertion” (“Notice to Appear,” 1956). John Cody attributes the breakdown of the marriage to “[l]ong separations and the husband's resentment of the need to accept his wife's financial support” (Cody, 1993, p. 29). She retained the name Davis until her marriage to Reverend Jon C. Crosby in 1969. She is most commonly referred to by her final married name, Ranice Crosby.

as well as an archive of illustrations including many of those used in *Grant's Atlas* (now in its 15th edition).

Image 3

Portrait of Tom Jones



Photo by the author. Portrait and decorative biographical sketch hung in the UIC Biomedical Visualization Department.

In graduate programs and professional gatherings, practitioners frequently refer to the work of past medical illustrators, especially those with ties to their own program. They habitually describe any historical figures that do not predate Brödel in relation to him (taking whatever

detour is necessary) before describing their individual accomplishments. While faculty at Johns Hopkins might boast that their department is “a lineal descendent of its great progenitors” (Cody, 1993, p. 1), others trace a more meandering route, referring to their own lineage through a teacher or mentor “who was a student of students of Brödel” (author’s notes). Faculty at UIC are least likely to trace their lineage directly to Brödel, but his legacy remains a touchstone and a point of comparison when situating the department’s history. Thus, faculty and students of the UIC program refer to Jones as a “Father of Modern Biocommunications,” contraposing his interest in newer media such as film and photography to the more “traditional” media of Brödel. Nevertheless, although Jones became the first president of the AMI in 1946, paternity of the field is rarely claimed for Jones by practitioners outside of the Chicago program.

Post-Kuhnian social studies of science have critiqued the Whiggish tendencies of internalist disciplinary histories, but it is empirically significant that such histories remain touchstones for many practitioners. Like the material properties of their research objects and the social organization of their labs, the stories practitioners tell about disciplines and bodies help to establish the kinds of stories that can be told about them in the future and frame analyses of changing circumstances. Disciplinary histories and origin stories serve legitimating functions, such as claiming nationalist origins of a discipline, establishing its epistemic boundaries, or confirming its very basis as “scientific” (Graham et al., 1983). They also serve as repositories for the moral and political values of a discipline (Bensaude-Vincent, 1983, p. 76). Canonical histories and origin stories – accounts of disciplinary formation often written by a practitioner and often focusing on exemplars of research or founder figures (usually framed as “fathers”) – take on mythological status (Fuller, 1991; Lenoir, 1997; Samelson, 1974). In keeping with these observations, the bulk of historical work addressing medical illustration in the twentieth century

recapitulates canonical institutional histories and accounts of notable actors like Brödel and Grant (Cody, 1993; Crosby & Cody, 1991; Cullen, 1945; Mackay, 2005; Polk & Wall, 2009; Robinson, 1993). With the exception of media studies scholar Kim Sawchuk (2012; 2011), most authors have also had direct connections to the people and institutions in question. Shared narratives, institutional histories, and recitations of lineage are a mode of building community by establishing connections between illustrators and over time.

As Ben Harris (2011) argues with reference to the role of the “Little Albert” myth in the history of psychology, such stories may be read as cultural myths, indicative of shared beliefs and values in disciplines or epistemic cultures that are invested in their retelling. However, although certainly many feminist scholars have remarked upon gender disparities in the history of science and of knowledge-making more broadly, few have examined the mechanics of these gendered retellings of history and the dynamics through which these histories come to take on the forms that they do. To understand patriarchal narratives of knowledge and progress, it is necessary to take seriously their constructive role in the formation and ongoing maintenance of epistemic cultures. In a profession dominated by women, it is noteworthy that shared disciplinary narratives do not focus on the accomplishments of women in the field, but rather on a founding father figure. The example of medical illustration lays bare the contradictions of telling these kinds of stories and makes clear what is at stake and what is to be gained by adhering to the “Father of the discipline” script.

The construction of founding narratives around the figure of Brödel is a necessary but fraught form of professional boundary-making which claims the legitimacy of the masculine domain of science for its female practitioners, while simultaneously demarcating their expertise as interpreters of scientific knowledge. Family metaphors create a common grounding of

professional identity as resemblance and belonging, while also constructing a secure niche for their work *within* the existing cultures of biomedicine. The genealogical family resemblance is based in a set of traceable shared experiences and training trajectories, values passed down from generation to generation in the form of stories and technical exercises like carbon dust rendering. The story of Brödel helps to establish the criteria for inclusion and exclusion in the field by establishing Brödel's credentials (and therefore the field's) as "scientific" and embedded in existing social hierarchies of authority.

The father of medical illustration

"There was in Baltimore a kindly, curly-headed man of quiet demeanor, beloved of his friends and possessed of a passion for music. He was a born artist and during his forty-eight years in Baltimore revolutionized medical illustrating in the United States and Canada; his work has reached even the uttermost parts of the earth. No other man who has ever lived has done as much to improve the beauty and accuracy of medical illustration." (Cullen, 1945, p. 5)

As with most disciplinary stories, key events, elements, and themes span most versions of the Max Brödel story, although emphasis varies. The roots of Brödel's presumptive greatness are traced via major life events, including his arrival in Baltimore from Leipzig, his marriage to Ruth Huntington, and the founding of the Department of Art as Applied to Medicine. The predominant source materials for the standard Brödel narrative are numerous biographical sketches penned by his friends and colleagues as well as one article written by the man himself scant months before his death. An article written by Brödel's longtime colleague and friend Thomas Cullen and published in the *Bulletin of the Medical Library Association* in 1945, forms the basis for most subsequent accounts up until Ranice Crosby and John Cody's 1991 biography, *Max Brödel: The Man who put Art into Medicine*. Crosby and Cody draw upon substantial archival resources

collected by Ranice Crosby, Brödel's successor at Johns Hopkins, during the later decades of her tenure there. Additional details and perspectives passed on in teaching or in oral histories by other medical illustrators pepper written accounts, but most refer back to Cullen for key events. Even those composed of substantial independent research, such as Linda Wilson-Pauwels' 1993 dissertation on the development of medical illustration programs, tend to recapitulate the general premises found in Cullen's 1945 article. Additional evidence from archives and oral histories is typically mobilized as confirmation of the events, character, and implicit values set forth in previous Brödel narratives. Despite the range of authorship and intended audiences, the story of Brödel and the discursive role it plays remain remarkably constant.

The story begins with Brödel's arrival in Baltimore from Leipzig in 1894. As a young art student, Brödel had worked as a scientific illustrator for Carl Ludwig, an aging professor of physiology at the University of Leipzig. There, Brödel made the acquaintance of several soon to be well-known figures in turn-of-the-century North American medicine, including anatomist Franklin P. Mall, who first extended the invitation to Baltimore sometime in 1891. By the time Brödel arrived in Baltimore a few years later, Mall no longer had use for him. Instead, he was installed as illustrator to gynecologist Howard Kelly. At Johns Hopkins, he associated freely with these and other major figures, including the rest of the so-called "Famous Four" – William Osler, William Welch, and William Halstead – as well as Cullen and Harvey Cushing (Crosby & Cody, 1991; Cullen, 1945; Treadgold, 1958). Most accounts attribute some degree of Brödel's success to these relationships with "men of influence" (Wilson-Pauwels, 1993b, p. 50). British medical illustrator Sylvia Treadgold asserts that in the early days of Johns Hopkins, the single men lived "in the hospital together" (1958, p. 203). They also ate, drank, and played piano together at the "Saturday Night Club" which included additional contemporaries like H.L. Menken, a tradition

that continued as the men married and graduated to fishing trips and vacationing together at their neighbouring cottages in Canada (Cullen, 1945, p. 29).

Basing her account on Cullen's, Treadgold credits Mall with having influenced Brödel's life a second time by "engaging a Miss Ruth Huntington from Ohio as an artist in his department" (1958, p. 204). Although Huntington was already working as a medical illustrator prior to their meeting, Cullen's account emphasizes that Brödel "showed her the drawing technic [sic] he had developed for his students" and "supervised" her work for Kelly (1945, p. 14). However, according to another former student, Brödel would later joke that "her artwork in Kelly's *Vermiform Appendix* book was so outstanding that he had to marry her rather than to have her as a competitor" (Hodge, 1982, p. 19). Cullen mentions their having co-written the anatomical chapter for the work "incidentally," crediting this collaboration primarily with nurturing their eventual romance (1945, p. 14). In any case, the couple married in 1902 and had three children, of whom one daughter, Elizabeth, would follow "in her father's and mother's footsteps" to become a successful medical illustrator herself (Cullen, 1945, p. 14).

Brödel's comfortable social and professional existence was threatened when in 1910, the Mayo brothers' well-known private clinic sought to lure him away from Johns Hopkins. To prevent this loss, Brödel's close friend Cullen mythopoetically (corn cob pipe in hand) "dreamed of a department of art as applied to medicine [sic] in the Johns Hopkins Medical School [where] artists who wanted to make medical art their life work could get a training of two or three years..." (1945, p. 17). Cullen henceforth sought external funding to that end. In subsequent years, funding and eventually an endowment were indeed secured through private donations, establishing "the only Department of Art as Applied to Medicine in the world" (1945, p. 18).

The department is typically described as the “first” or “only” department “of its kind” in “America,” “North America,” or “the world.” Much like variations on “the Father of Medical Illustration,” similar phrasing appears with slight variations in most versions of the story. This language not only locates the department as unique and novel, it also rhetorically marks its founding as a turning point in the history of medical illustration. Brödel continued to work and teach in the new department for another thirty years, until his somewhat coerced retirement in 1940, followed by his death less than a year later (although there is no evidence that the two events were related). Department records, though spotty during this period, confirm that an average of four students per year completed training between 1912 and 1939, ranging anywhere from one to a high of eleven students in any given year. Although most sources recapitulate Cullen’s claim that “[d]uring the thirty years of its existence the art department has trained nearly two hundred medical illustrators,” the program’s list of graduates totals 109 during Brödel’s tenure (1945, p. 24).

Following Brödel’s departure, his nominal successor was Didusch, one of Brödel’s first students (having finished his studies in 1914), who had been working in the Department of Embryology. However, within a few years, leadership of the department was taken over by one of Brödel’s last students, 27-year-old Ranice Birch. She would head the program for the next 40 years, graduating a total of 133 students at an average of three to four per year. I will return to the question of Brödel’s succession in Chapter Four. In the rest of this chapter, I examine how the founding father story of Max Brödel is constructed and the role that this story plays in the construction of medical illustration as a profession.

What makes a father

Brödel narratives emphasize three key points: 1) his individual genius, 2) his relationships to other “great men”, and 3) his genealogical relationship to the present profession and practitioners. Each builds upon and is imbricated in the others: relationships with other men underwrite both Brödel’s founding status and the freedom he enjoyed to exercise his talents to their fullest; his presumed genius provides the basis for admittance into this fold as well as the charismatic authority required to inspire devotion in students and colleagues; and his founding father status necessitates the teleological explanation provided by biographical details such as social connections and individual accomplishments. Each pillar of the narrative serves a legitimizing function for the profession, building both the epistemic authority and values of medical illustrators through their relationship to a model founding figure.

Genius

As I explored in Chapter Two, the management of epistemic hybridity is a core component of medical illustrators’ professional self-fashioning. The rhetorical construction of Brödel as uniquely gifted in both art and science contributes to this hybrid identity by providing the ideal model of the medical illustrator. Like his close relationships with physicians and surgeons, the clarity, beauty, and accuracy of Brödel’s work is routinely lauded as the product of what Crosby called “EXCEPTIONAL” talent (as cited in 1993, p. 21).

In a broad history typical of the field, William Loechel, a director of medical illustration based in Washington, D.C., opines,

What characterized this man and why was his work to influence every medical illustrator since his time? To put it simply, he had everything. There was classic beauty in his drawings; he had the scientific approach; he was cognizant of the printer and publisher problems; and he was sincerely interested in devoting his life to his work. He employed

new methods and established new techniques. His half-tone drawings had the authenticity of a photograph but were better because the camera couldn't think and select. His pen drawings no longer looked like etchings; the lines fairly breathed life and flexibility and natural form. He employed unique devices to present a complex subject in a minimum of space. He did research work of his own, the result of enthusiasm and accomplishment in a field where ingenuity is always a welcome ingredient. Brödel's work had such impact that men of vision saw that the specialty should be taught to others to insure the same kind of thoroughness among future medical authors. Today there are a dozen schools patterned after the Brodel-Hopkins school, many supervised by his former pupils. (1960, pp. 170–171)

As Loechel makes clear, what makes Brödel so exceptional is not only his extraordinary artistic ability but also his active contributions as a researcher, made possible through his connections to “men of vision.” Brödel's ability to lay claim not only to virtuoso rendering skill but also to a high degree of scientific rigour cements his role as a founding figure by providing the ideal model that future illustrators should strive to emulate: “To put it simply, he had everything” (Loechel, 1960, p. 170). Loechel's florid description is not particularly extreme. Within both graduate programs and the profession's culture, the subject of Brödel and his work is consistently treated with the utmost reverence.

Some of the awe derives from an appreciation of the aesthetic quality of Brödel's detailed and meticulous renderings. Among other contributions, the “carbon-dust” technique is often credited with changing the practice of medical illustration. The technique entailed the use of finely ground carbon on a white clay-coated illustration board known as “Ross board,” developed in concert with Brödel (or so the story goes). Using a combination of carbon pencils and brushes, an experienced illustrator could achieve an extremely broad and nuanced tonal range from dark shadows to bright highlights (created by gouging into the clay coating) in the final image. The detail and tonal range afforded by these materials allowed the illustrator to create a surprising sense of depth, texture, and realism in the image, while remaining extremely

malleable and forgiving to work with. The sheer sensory pleasure of apprehending original carbon-dust illustrations is undeniable and frankly difficult to describe.

The technical quality of Brödel's carbon dust artwork is impossible to reproduce, in more ways than one. First of all, the carbon dust technique is extremely time-consuming and labour-intensive. Even in their heyday, techniques like carbon dust rendering were in some ways a luxury. Comparing original drawings to the publications in which they were circulated, it becomes quickly apparent that the majority of (affordable) printing techniques available at the time were not able to reproduce the range or quality of tone found in the originals. Even with improved reproduction methods, the degree of realism and detail that carbon dust enables is rarely required or even desirable in today's market. Indeed, the manufacturer eventually ceased production of Ross board due to low demand. Nevertheless, most graduate programs still teach the technique in the early months of training, using generic illustration board. Although this permits a demonstration of the general idea and enables discussion of close observation and artistic decision-making, even the best results cannot compare to early twentieth century originals. Instruction in obsolete modes of production like carbon dust rendering in graduate training is as much a matter of enculturation to the profession's history and values as it is a technical one.

Explanations of Brödel's importance to the field typically extend far beyond stylistic or technical prowess as a draftsman. Students, faculty, and working illustrators use Brödel's work as a reference not only for aspects of technique, such as the quality of line and tone or the composition of images to convey desired meanings, but also for its reputed accuracy and innovation. As proof of his unique significance to the field, biographers emphasize Brödel's contributions not only to the dissemination but also to the production of knowledge. Unlike most

contemporary medical illustrators, Brödel had ready access to specimens for dissection, ample time to develop his work, and the freedom to pursue personal interests through his relationships with physicians like Kelly and Mall (Cullen, 1945; Patel et al., 2011; Treadgold, 1958). Most histories mention this experimentation alongside a litany of innovations, including new surgical methods, as justification for Brödel's exceptional scientific quality:

In this way over the years Brödel became a true scientist. Two of Brödel's most important contributions to medicine are still connected with his name today: dissection studies of the intrinsic blood vessels of the kidney defining an avascular line for nephrotomy (Brödel's white line) and the description of a modified suture technique for nephropexy (the Brödel suture). (Schultheiss et al., 2000, p. 1138)

Although this "original research" (Hodge, 1955, p. 305) was made possible through his alliances with influential men, they attribute these achievements to an "inquiring, scientific spirit" (Coleman, 1947, p. 102).

Importantly, this construction is also hierarchical. While descriptions of Brödel exalt his technical prowess as an artist, they are always careful to affirm that he was *more than just* an artist: "Max Brodel was not only a wonderful draftsman: he had also a wide knowledge of anatomy and was a born investigator" (Cullen, 1945, p. 7). Adherence to a "scientific approach" (Loechel, 1960, p. 170), emphasizing independent direct experience, experimentation, and observation of specimens, is a key element differentiating Brödel from those who would be, as Crosby put it, "just the illustrator" (as cited in Cody, 1993, p. 21). The analogy to canonical ideas of scientific method is both an articulation of professional values and a justification for the medical illustrators' instrumental place within the scientific and medical field. Emphasis on the *scientific* nature of Brödel's practice reinscribes the hierarchical position of science in relation to art and places Brödel on the right side of that unequal divide.

The characterization of Brödel as "a true scientist" is not only a way of differentiating Brödel (and by extension, his successors) from mere illustrators or technicians, it also serves as a

rhetorical counterweight to the feminization of the profession by claiming a legitimate place for Brödel as “founding father” and part of a circle of “great men” in medicine and the sciences. Brödel’s ability to excel in both the artistic and the scientific embodies the epistemic ideal of “art in the service of science,” but the aura of genius implies some extra, innate, superlative quality, independent of circumstances (Cutler, 1987). Alongside his alliances with powerful men, Brödel’s reputation as an incomparable genius helps to justify his apotheosis as role model and virile progenitor of the profession.

Great men

The existence and material effects of professional social networks of powerful men is a truism upon which patriarchy as a historical fact is predicated; it rarely demands further explanation beyond begging the question. This tautological construction of “great men” figures prominently in the Brödel narrative, but Brödel’s social milieu is not merely an interesting context or anecdote. Rather, biographical facts ranging from association with Johns Hopkins’ “great men” to the publication and authorship of images and texts serve as both evidence of and explanatory framework for Brödel’s genius. His ties to powerful networks of men both demonstrate and justify his position as “Father of Medical Illustration.”

In her dissertation on the development of academic programs in medical illustration in North America, medical illustrator and director of the University of Toronto program from 1986 to 2008 Wilson-Pauwels devotes thirteen pages to “Max Brödel and his contemporaries at Hopkins.” She repeatedly draws explicit links between Brödel’s success and his association with other men of note:

The company of internationally acclaimed authors and artists such as Ludwig, Braune and Spalteholz undoubtedly inspired Brödel to greatness.

Many physicians surgeons/scientists for whom Brödel worked had, or acquired later, enduring fame in their profession and functioned as mentors in the early development of his career as a medical illustrator. Chief among them were Franklin P. Mall, Howard A. Kelly and Thomas Cullen. Also, men such as William H. Welch and William Osler, who had a great influence on the early development of The Johns Hopkins School of Medicine, strongly affected his career. (Wilson-Pauwels, 1993b, p. 43)

Wilson-Pauwels' dissertation is one of few academic works documenting the history of medical illustration in North America in the twentieth century. As the work of a medical illustrator and head of a graduate program, Wilson-Pauwels' dissertation seeks above all to answer questions applicable to her own position: to understand both "why some academic programs flourished while others closed, and ... which qualities seem best to characterize superb academic leadership" (1993b, p. 7). Indeed, the pursuit of a masters and then a doctorate in Education aided Wilson-Pauwels' efforts to grow the program she directed and to secure its future by bolstering her own credentials and by providing her with a historical blueprint for sustaining such academic programs. During her 22-year tenure as director (1986-2008), she oversaw the physical and administrative relocation of the University of Toronto Art as Applied to Medicine program (re-baptized "Biomedical Communications") into the Department of Surgery in 1990. She also helped transform the program from an undergraduate to a graduate degree in 1994, on the heels of her dissertation. Additional administrative and physical re-arrangements followed both during and beyond her tenure.

As Wilson-Pauwel's research makes clear, such arrangements and rearrangements of bureaucratic, economic, and administrative ties are common for programs in medical illustration and play a substantial role in the biographies of individual academic programs. As I will explore further in Chapter Four, throughout the profession's history, those who successfully allied themselves with stronger departments and faculties within their institutions were better able to adapt to changing institutional ecologies. Those who did not forge such alliances, or chose the

wrong ones, would lose resources and status within the profession if they did not fold altogether. By the time I began my fieldwork in 2016, the BMC program had successfully become allied with Biology and Health Sciences programs as well as the Faculty of Medicine. These changes not only solidified the department's administrative footing, they also enabled the program to expand out of the basement of the medical building on the University's main campus, which had housed it for many years, into a newly constructed, light-filled building at the satellite campus in Mississauga, Ontario.

Wilson-Pauwels' dissertation maps and documents the development of North American training programs in medical illustration from the mid-twentieth century to the early 1990s, drawing primarily on published documents (such as previous internalist histories and articles written by medical illustrators, physicians, and surgeons) and oral interviews with some historical actors and their former students. Although her work repeatedly describes the ways in which economic and administrative concerns affected the lifespan of programs, she rarely addresses the mechanics of these issues and how they were navigated (successfully or not). Despite her own experience and clear skill in navigating the politics and bureaucratic frameworks of her own institution to the benefit of her program, her analysis tends to gloss these practical questions in favour of character assessments, with Brödel as the model for leadership: "few directors of academic programs had the winning combination of the skills of Max Brödel: a scholar, expert draftsman, sensitive fine artist, caring teacher, charismatic leader, and competent administrator" (Wilson-Pauwels, 1993b, p. 61). Although she roughly explains administrative challenges and tactics, her analysis often lingers on evaluations of the personality and character of individual actors. This approach presupposes that, like Brödel's genius, professional

leadership is an innate quality best measured by the strength and type of one's social ties and by the ability to perpetuate one's own "influence" in the field.

The proliferation of stories shared over the years between members of the community of medical illustrators ensures that some versions of the history become canonical, while others fade from memory (and view). As Wilson-Pauwels notes, her assessment of accuracy in the accounts hinges on "agreement;" any data which did not produce "consensus" were excluded from the analysis (1993b, p. 6). This methodological approach intentionally excludes or minimizes controversial and less well-known figures and activities while privileging those whose personalities and activities were more visible and acceptable within the social frameworks of the profession. Emphasis on oral and internalist histories extracts some otherwise undocumented material changes in programs, but often dwells on hagiographic recapitulation of the narratives and values instilled by mentors and forebears. Thus, her evaluation of the influence of particular actors in the development of academic programs in medical illustration depends as much on their ability to inspire positive evaluations of their personality and adherence to professional values as on their material contributions to the construction and maintenance of professional programs. This methodology and the conclusions drawn from it take as given not only that the relative success of any individual can be measured by his ability to reproduce himself in others by enrolling them into his networks, but also that the qualities of leadership inherent to the person can be discerned from the successful mobilization of networks in which they are enrolled.

Brödel's social milieu undoubtedly enabled his achievements as an illustrator, chiefly by facilitating his access to resources. The patronage of various Johns Hopkins physicians and surgeons ensured his access to cadavers and laboratories in which to experiment with techniques of revealing and intervening in anatomy, which underpin Brödel's reputation as "an innovator

and trend-setter” (Wilson-Pauwels, 1993b, p. 50). It is no accident that the actors invoked in biographies and stories about Brödel are not only scientists and “medical men,” but also journalists like Menken and eventually philanthropists such as Henry Walters, whose financial commitments enabled the creation and endowment of AAM at Johns Hopkins. Indeed, the founding of the department for which Brödel is given credit was achieved through the marshalling of influence by Cullen, another successful friend who wished to keep him close.

The amassing of networks of powerful and influential men around Brödel is not merely a descriptive element of the narrative or even an explanation for the resources at his disposal. On the contrary, it functions primarily as proof of his success, rationalization for his inclusion in the canons of medical history, and most importantly, justification for his position as “founding father” of the field. Defining and emphasizing Brödel’s embeddedness in networks of powerful men is a key strategy for enrolling Brödel in the construction and maintenance of the field.

Brödel’s access to and inclusion in networks of powerful men becomes exemplary of the material advancement of medical illustration:

“When considering the men of the time, it is not difficult to see that Brödel made many distinguished and influential friends. He had continuing assistance and encouragement from the world’s leaders in physiology, surgery, anatomy, embryology, and pathology. Ludwig recognized Brödel’s talents immediately and helped him at an early age to develop his knowledge of anatomy and physiology. Brödel drew in the operating area for Kelly, Halstead, Cushing, Cullen and other leading surgeons. Mall provided Brödel with specimens from an enormous collection of embryos. The physicians/surgeons at Hopkins gave tribute to Brödel and other medical illustrators by including their names on their publications. That in itself was a major elevation in status for the profession, since until that time artists had seldom been recognized. (Wilson-Pauwels, 1993b, p. 55)

In a single, densely packed paragraph, Wilson-Pauwels draws together Brödel’s social connections, access to resources, and changes in the status of the field itself. From early acquaintance with German anatomists in Leipzig who “undoubtedly inspired Brödel to greatness” to “famous physician[s]” whose “continuing assistance and encouragement” would

enable his career, Brödel's connections with other successful men prove his greatness (Wilson-Pauwels, 1993b, pp. 43, 46, 54). She ends the paragraph with a quote drawn from Johns Hopkins alumnus Bertram Moses Bernheim's (1948) hagiographic history, *The Story of the Johns Hopkins: Four Great Doctors and the Medical School they Created*, in which he asserts that the institution "somehow seemed to excel in getting the proper type of mind" (as cited in Wilson-Pauwels, 1993b, p. 55). This reference implies that the well-known figures of twentieth century medical history were drawn to Brödel because he too was in possession of that "proper type of mind." Establishing Brödel's embeddedness in networks of prominent, powerful men helps to establish the field itself as a source of legitimate knowledge within medicine. That influential men would be interested in and support Brödel's work substantiates both his genius and his status as "father" of the field.

Genealogy

Just as Vesalius employed illustrators, so the early men of medicine of this country sought to employ them. The Johns Hopkins Hospital acquired Max Brödel in the 1890's, whose work is so well known that he stands as the father of modern medical illustration. (Loechel, 1960, p. 170)

Like many internal histories of the field, Wilson-Pauwels begins her dissertation with a summary of the long history of medical illustration, giving special attention to "firsts," as well as the roles of specific illustrators (where known) and locally relevant highlights such as the production of J.C.B. Grant's *An Atlas of Anatomy* at her home institution. In this and other accounts, the recitation of this longer history is not only a matter of providing background to the field, but part of the framework necessary to position Brödel as the "father" responsible for "leading [medical illustration] into the twentieth century" (Wilson-Pauwels, 1993b, p. 33). The

narrative is built progressively by first establishing an unbroken continuity through successive generations of artists and anatomists, then articulating Brödel's uniqueness as a break in the existing epistemic order, and finally culminating in the institutionalization of the new epistemic order. Once established as significant and foundational, the father figure becomes the model for the shared values that bind the professional "family" together. This origin story thus serves as both explanation and justification for the unique expertise to which professional medical illustrators can lay claim, and by extension the gate-keeping criteria upon which belonging can justifiably be based.

In 1955, the University of Michigan *Medical Bulletin* published a series of articles on medical illustration. The first was penned by Gerald Hodge, a medical illustrator who had trained under Crosby, primarily as an introduction to the profession and to his own fledgling program at the university (Hodge, 1955). In addition to Hodge, medical illustrator Mary Lou Cummings provides an overview of the long history of medical illustration, culminating in Brödel (Cummings, 1955). The final article in the series, "The influence of Leonardo da Vinci on the Development of Anatomy and Physiology," written by a former medical student, expounds upon the uniqueness of da Vinci (Lucas, 1955). The series reflects the ways in which the history of the profession and Brödel in particular are deployed in positioning the field, both for outsiders and for medical illustrators themselves. Brödel emerges as the most recent in a line of "fathers" through a teleological history of representing human bodies. By positioning him within the longer history of medical illustration, narrators establish Brödel as the rightful successor to earlier founding figures like Galen, Vesalius, and da Vinci. This familiar modernist formulation of medical history as a linear progression, punctuated by epistemic breaks, constructs Brödel as the first of a new representational regime.

Narratives which position the profession historically can be counted on to list Leonardo da Vinci, Vesalius (and his presumptive illustrator Jan Stefan van Calcar), and finally Brödel. Histories written for broad medical or lay audiences gloss only briefly subsequent developments in medical illustration, if at all. Those intended for medical illustrators tend to expand upon the list slightly, devoting particular attention to those cases in which the illustrator's name is known and those which represent notable advancements in technique such as lithography and photogravure. The implication in these lists is not only of "greatest hits" but of historical periodization.

The most commonly accepted periodization of early medical illustration aligns with that of anatomy more broadly. Vesalius' monumental (in size as well as historical influence) *De Humani Corporis Fabrica* stands out not only for its production value and the style of the images contained within it, but for its basis in human dissection and detailed descriptions in which the anatomist breaks with several centuries of anatomy guided by the works of Galen. Though not, strictly speaking, a medical illustrator, da Vinci's detailed drawings based upon dissections of human bodies stand out substantially in both style and content from the anatomical illustrations in circulation in that period. Although da Vinci slightly predates Vesalius, the drawings were never reproduced or published. Nevertheless, both the quality of the drawings and the artist's overall historical stature make them a common point of reference for medical illustrators. Though a great many significant anatomists, artists, and technical developments followed da Vinci and Vesalius, only da Vinci, Vesalius, and Brödel are ever referred to with the epithet of "father" (Donald, 1986; Jones, 1959; Whillis, 2001). Rhetorically positioned as successive "fathers," da Vinci, Vesalius, and Brödel each demarcate a substantial turn in the development of medical illustrations.

Image 4

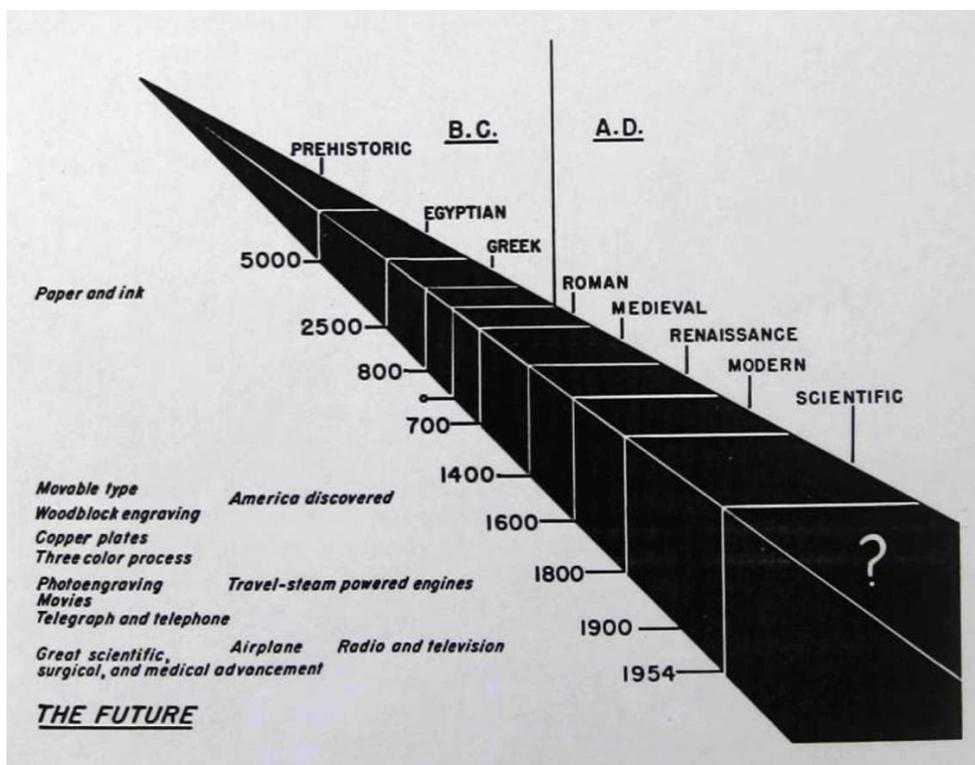
“Our Heritage”

Illustration by Muriel McLatchie Miller, from McLatchie Miller (1955)

While the founding father narrative demarcates an epistemic break with past practice, the invocation of a longer history places Brödel as the most recent in a longer line of great men. Like most accounts of this longer history, Cummings ends with Brödel. However, she does not emphasize Brödel’s primordial status in the contemporary field. Instead, she positions Brödel as a continuation of “the earlier traditions of graphic art” (1955, p. 318). Like most, she views Brödel’s skills as transferrable, asserting that “it is certain that much of the old-school training was acquired, in turn, by his students” (Cummings, 1955, p. 318). The implication here and elsewhere is that what is passed on through the academic genealogy is not only a set of skills and tacit knowledge, but a set of values and work ethic which the father embodies. Through the

invocation of previous fathers, the texts rhetorically position Brödel's innovation and influence as on par with da Vinci and Vesalius, a substantial turning point in the field. References to the longer history enable a sense of continuity by situating Brödel as its rightful heir.

“The first of its kind”

As with many founder-father narratives, Brödel's paternity is established through “firsts,” rhetorically marking a temporal break, the founding of a new line. In an historical article for the *European Journal of Obstetrics and Gynecology*, Urologists Dirk Schultheiss and Udo Jonas revel in the novelty:

In 1907 Brödel was appointed Associate Professor and his career culminated with the establishment of the first “Department of Art as Applied to Medicine” at Johns Hopkins University in 1911. It was the first institute of its kind in the world and for the first time art students were trained specifically as medical artists.... During the following decades, Brodel's students founded new departments at other institutions and thus a new profession had been born and given its own educational system. (1999, p. 115)

The repetition of firsts invokes past, present, and future in a linear narrative of scientific progress. Adverbs of sequence always point elsewhere, suggesting a longer series by establishing one temporal location. To be the first implies both that a void existed in the past and that a second, third, and so forth will occur in the future. The past is construed as a lack, a time before the important contributions of the father were realized. The metaphor of biological reproduction in announcing the birth of a profession simultaneously implies ancestors, celebrates newness, and anticipates a heritable future. Being the “first” marks a break with the old and a shift to a new epistemic order.

Although rarely so heavy-handed, contemporary teaching and professional talk echoes these concerns with past and future. The history of the profession has long been explicitly included in the curriculum, but its role is changing in an effort to keep pace with expanding academic requirements for accreditation. In recent years, programs like BMC have cut their

standalone course covering the history of medical illustration. However, they continue to incorporate it into the curriculum in a more piecemeal fashion through lunchtime talks and occasional lectures during regular coursework. Describing the shift, faculty member Brian situates the profession as simultaneously old and new:

You know, we try to make it connected to what we do now because it is connected and it's not that old of a profession, really. I mean, there's a history going way back. You know there's medieval things, the renaissance and so on. And there's a couple of figures that will always be discussed even if we don't teach a history course. All of our students will know who Vesalius was and who Max Brödel was. There are a few, kind of you know, key characters that define what we do and were kind of landmarks in the representation of medical images.

As I explored in Chapter Two, the tension between “a history going way back” and “not that old” reflects the disciplinary boundary work required to align medical illustration’s epistemic values with the settled credibility and authority of biomedical sciences while simultaneously asserting a distinctive professional niche. Decisions about which parts of that history matter and why are part of contextualizing not only the profession but the work of representation in medicine.

The three *Bulletin* articles work in concert to situate the contemporary profession within a longer history. This framing casts Brödel as both the last in a line of father figures in the field and the first of a new house of *modern* medical illustration, whose progeny can be expected to inherit and carry on the new legacy as well as the old. Hodge’s article mobilizes the founding story as a way of introducing “plans for a similar department” at the University of Michigan, which he would eventually head from 1964 to 1985 (1955, p. 307). In a single paragraph, Hodge links the department with Brödel’s genius, social relations, and foundational status:

The first department of medical art in the United States was established at Johns Hopkins University in 1911 under the direction of Max Brödel, who had come from Germany in 1894 to illustrate Dr. Howard A. Kelly's book, *Operative Gynecology*. Professor Brödel was an exceptionally accomplished artist who also did much original research in the field of medicine. The whole development of medical illustration in this country might be traced to Brödel and his work at Johns Hopkins, and his influence continues to be felt through the work of his students and his family. Mrs. Brodel, the former Ruth

Huntington, worked and studied with Brodel prior to their marriage, and is particularly noted for her fine drawings in Kelly's *The Vermiform Appendix and Its Removal*. Her daughter, Elizabeth Brödel, one of the top illustrators today, is associated with the New York Lying-in Hospital. (Hodge, 1955, p. 307)

The account not only situates Brödel as an exceptional and agential actor working in close communion with scientific experts, it also evokes his students and family as inheritors of this genius, conflating biological and academic lineage. The inclusion of his wife and daughter's careers within the summary of Brödel's accomplishments positions them as extensions of his line, not as autonomous practitioners.¹³ Although early accounts make clear that she was already a practicing medical illustrator when they met, Hodge's version of the story recasts Ruth Huntington as Max Brödel's student. Repositioning Brödel as antecedent to all medical illustrators in North America, even those who technically predate his arrival in Baltimore, enables him to become "the first" from whom all others are descended.

As Hodge's article makes clear, the "father" role for Brödel is not purely metaphor. Although the origins of the nickname "papa" (or "poppa") amongst his students are unclear, it seems to coincide roughly with the period in which his own daughter was also a student, from whence it persisted until his death. His institutional successor (and later his biographer) Crosby was one of the last students to have trained with Brödel before his retirement and subsequent death. In her own biography, she addresses the topic: "No student would have dared to address him by his first name, and the endearing name 'Papa' was used by students only among themselves" (as cited in Cody, 1993, p. 17). Her biographer and collaborator in the Brödel biography *The Man who put Art into Medicine*, medical illustrator John Cody, obliquely adds, "In those years he was teaching a class for exclusively male medical students and physicians, and

¹³ For discussion of female family members' incorporation into the scientific enterprise, particularly in the eighteenth and nineteenth centuries, see also Rossiter (1987), Richmond (2001), Sheffield (2006), Lykknes et al. (2012), and Roos (2012).

Ranice was quick to notice that all addressed him respectfully as ‘Mr. Brödel’” (1993, p. 17).

Although Cody’s meaning is frankly unclear, it suggests that the less formal nickname was also indicative of a gendered relationship, circulating particularly amongst Brödel’s female students.

If fathers mark shifts in epistemology, the litany of fathers tells a modernist story of progressive improvements. Emphasis on Brödel as an epistemic break constructs a linear, progressive narrative of contemporary medical illustration, with Brödel as a turning point between old and new. The positioning of the father as first is essential to the role in that it establishes the father as the sole progenitor from which all others spring, and thus foundational. The creation of an endowed department at Johns Hopkins marks the institutionalization of Brödel’s position as patriarch of this new regime of bodily knowledge. In a profession characterized by epistemological and technological change, the system of values embodied by Brödel provides a uniting thread.

“The man becomes a school”¹⁴

Descriptions of disciplinary father figures dwell not only upon famous friends, “firsts,” and reproductive capacities, but also upon the disciplinary values and practices to which those developments are attributed, values that the fathers most perfectly embody. The story of Max Brödel personifies professional values and transmutes them into the foundation of the field:

Brodell's high standards of scientific accuracy and excellent draftsmanship, as evidenced through his work and his instruction, were responsible for establishing medical illustration as a significant paramedical profession. (Stebbins, 1963, p. 2)

Emphasis on Brödel’s dual nature as both artist and scientist articulates not only the practices and values that his progeny should inherit, but also the place of those values within the broader

¹⁴ Section heading from Wilson-Pauwels 1993, p.55.

epistemic culture of biomedicine. Brödel's genius, diluted but still essential in his progeny, is the ability to reconcile the binary opposition that entrenches "science" and "art" as unique and incommensurable forms of knowledge. His superlative individual qualities and his enrollment within a network of great men substantiate his epistemic authority. Moreover, they enable him to perpetuate that authority through its institutionalization: the creation of an academic department that can stand in metonymically for the profession itself. The institutionalization of professional reproduction enables the proliferation of an identifiable "professional clan" and completes Brödel's apotheosis as "founding father."

What fathers make

One normally becomes a father through reproduction: the production of offspring (which in turn produce further generations). Metaphorical academic fatherhood is accomplished through epistemic self-reproduction: publishing and broadcasting of ideas or the founding of a research or educational programme through which one's ideas and techniques can be transmitted (Paul, 2011). For medical illustrators, the educational program, improbably birthed by the father, becomes the mechanism of his self-reproduction. Brödel's students beget new students, the academic program begets other programs, and a professional organization is born, creating a sustainable professional family. The metaphor of biological reproduction transmutes interruption into continuity, implying not only the passing on of genes or knowledge but also a "family resemblance" which unites them and continues to reflect the father's influence long after he is gone. As I will explore in Chapter Four, the conception, birth, and rearing of academic programs is not quite as immaculate as the narrative implies, but for now, I want to unpack the given-ness of the narrative and what that implies for the field it describes.

Family values

As I explored in Chapter Two, family is a foundational organizing metaphor for the profession. Dutch historian Hermann Paul writes, “Father figures vindicate current scholarly practices by serving as their mythic origins” (2011, p. 253). Paul argues that the stories told about mythic progenitors not only serve institutional, discursive, or legitimizing roles, they also establish and perpetuate particular “values, aims, or methods” as fundamental to professional or disciplinary identity (2011, p. 253). As the heroes of disciplinary origin stories, founding fathers establish credibility, regulate the boundaries of the field, and embody its epistemic values and cultural norms of belonging. For medical illustrators, the discursive construction of Brödel-as-father is achieved through his genius in combining the ostensibly opposed domains of science and art, his connections to great men, and his ability to institutionalize and reproduce himself. Each of these aspects contributes to establishing Brödel and his professional family as trustworthy authorities capable of transmitting legitimate biomedical knowledge. Through both institutionalized and informal stories, the values that fathers represent come to stand in for the values that all medical illustrators should strive to embody.

Contemporary practitioners call upon this metaphor of biological reproduction not only through references to Brödel as “the father of medical illustration,” but also through recitations of their own lineage and those of colleagues. Although this habit also extends to individual practitioners outside of the academic stream, it is particularly notable within graduate programs, where instructors routinely locate themselves and others in the family tree. “A lot of us can say, you know, Max Brödel trained Ranice Crosby, who trained me,” boasted Lisa, a faculty practitioner. Similarly, the head of her department, George, explained, “I’ll say, you know, it

hasn't been that many generations, you know? Brödel and Jones, they taught students. Those students taught the people that taught me and now I'm teaching you. It's not that [laughs] many generations ago, you know?" The tracing of lineage as a measure of success forms the basis for Wilson-Pauwels' (1993b) dissertation methodology, which links leadership of academic programs to training lineage. Although Wilson-Pauwels acknowledges that social and economic factors also played a part in the growth of particular programs, she relies heavily on the metric of self-reproduction in the form of students and institutions, as well as in discourse. She interprets the number of students who went on to lead academic programs as evidence of the "influence" and success of "role-model[s]" like Brödel, Jones, and Hodge (whose program closed in 2004) (1993b, p. 192). Furthermore, she adds, "they are also the directors most often spoken about within the field of medical illustration in North America" (1993b, p. 192). Reference to one's training and lineage position the speaker within the extended "family" of the profession.

Though less common than Brödel, disciplinary fatherhood is also claimed for Jones, particularly by writers and speakers with ties to the department he founded. However, they usually situate him in relation to Brödel's unassailable position, not in competition with it. When invoking the father role for Tom Jones, speakers usually defer to Brödel's primacy as the "first" but challenge the narrative by claiming paternal authority over a slightly different aesthetic space and, importantly, over innovation. Jones' candidacy for father status rests on this separate lineage, distinctive technique for creating continuous tone illustrations (ink wash as opposed to Brödel's carbon dust technique), and most importantly his commitment to technology and new media such as film and photography. Attempts to claim a place for Jones in the canonical history emphasize a comparable scientifically-inflected "genius" quality and assert his own "firsts," such as his figurehead role in the founding of the AMI. These accounts draw connections to Brödel

where possible while styling Jones as “father of modern biomedical communications” (George) or “father of biomedical visualization” (2016 UIC Frank Armitage Lecture, 2016). Although Jones cannot be established as temporally first, his distinctiveness lies in his ability to embody professional values of technological innovation and duty to the profession as an institution.

Unlike descriptions of Brödel which establish him as an over-arching progenitor, origin stories that valorize Jones explicitly tie both figures to the cultural values of their respective departments. Practitioners link the high-tech orientation of the UIC-BVIS program with Jones’ technological innovation, foresight, and commitment to “using media and whatever the current technology was to help educate” (George), associating Brödel with virtuoso draftsmanship and direct observation (and perhaps an excessive commitment to outmoded analog media), characteristic of training at Johns Hopkins. The Georgia program, founded in 1948, is loosely associated with the “traditional” Johns Hopkins orientation. The BMC program in Toronto draws on lineage from both Brödel and Jones, as well as emphasizing the unique contributions of Canadians such as *Grant’s Atlas* illustrators Chubb and Joy (the program’s second director). This layered departmental genealogy is tinged with both national pride and a somewhat more feminist orientation towards the profession’s history.

Each department, and by extension, practitioners who have trained in them, mobilizes their lineage both as cultural capital and as a way of positioning themselves within the field. As programs compete to attract and later place students, subtle differences in value systems and professional priorities emerge, with each program emphasizing its distinctive relationship to both the past and future of the profession and the continuity of its commitments. Nevertheless, as the “first” and most perfect representation of disciplinary values, Brödel stands as an iconic, unmatched ideal to which others may aspire, but whose primacy is nearly unparalleled.

The habit of tracing academic pedigrees is hardly unique to medical illustration. A number of projects, predominantly in STEM fields, such as Mathematics, Chemistry, and Neuroscience, have attempted to document and trace networks of mentorship in the form of “academic genealogies” such as the Mathematics Genealogy Project and the Neurotree project. Unlike projects in the history of science which explore the social, economic, and political contingencies affecting the development and proliferation of particular “research schools,” academic genealogy projects tend to assume a fairly straightforward relationship between the existence of a documentable supervisory relationship and the transmission of particular ideas and values to the next “generation” (Geison, 1981, p. 20). While most acknowledge the limitations of this assumption, their research questions are nonetheless predicated on the idea that the qualitative “success” (or failure) of mentorship and even research itself can be measured not only through publications and citations but through “the fecundity of doctoral students,” that is, whether the students go on to supervise others (Heinisch & Buenstorf, 2018, p. 353). Thus (so the theory goes), the relevance of a “father” is dependent on his students not just inheriting but passing on his values. The author of one such genealogy of organic chemists opines, “In fact, the most effective way for a scientist’s work to live beyond their time is for them to populate the next generation of academics with people that they have mentored, otherwise their names and work will inevitably be driven to extinction” (Andraos, 2005, p. 1405). This kind of metric is tautologically self-evident: those who successfully perpetuate their own line control the discourse, and thus the evaluation of their own importance. Not all such projects lean quite so deeply into the Darwinian metaphor but built into these methodologies is the assumption that student output is a meaningful measure of research relevance. Those who do not successfully reproduce themselves will be forgotten along with their ideas and contributions.

That the victors write history is banal aphorism, but as proponents of symmetry, feminists, and post-colonial theorists alike have argued, the corollary is that the writers of histories decide what (or who) victory looks like (Haraway, 2018; Shapin & Schaffer, 2011; Subramaniam, 2014). As such, the very act of tracing such genealogies imbues them with significance and surplus meaning. When the metric for epistemic validity is output, the social, historical, or economic factors that influence the capacity of particular actors to train large numbers of students or to be credited with substantial contributions to the intellectual field are factored out (Merton, 1968; Rossiter, 1993).

Male tales

Sharon Traweek's canonical study *Beamtimes and Lifetimes* describes how both career trajectories and behaviours proper to high-energy physicists are constructed as inherently masculine in and through the stories that are told about them. Thus, "the diverse criteria for a successful career" in high-energy physics can "only be men's stories" (1988, p. 74). Although physicists are coded as male through stories of "individual great men," theories, science, and nature itself are construed as female (Traweek, 1988, p. 78). Such findings are common in feminist science studies, but what is less clear in studies of the gendered construction of scientific fields is the mechanics of *how* great men come to be so universally accepted as great. Male tales provide evidence of the dominance of men, but they do not explain it.

The recitation of names whose credibility, authority, and social influence are already established (through their own embeddedness in networks of power and influence) serves a legitimating purpose by enacting a "multiplication of witnessing experience" which helps to construct figures like Brödel, and by extension his profession, as legitimately scientific (Shapin,

1984, p. 483). In their canonical examination of the emergence of experimental science in the seventeenth century, Steven Shapin and Simon Schaffer argue that “The credibility of witnesses [to Boyle’s experiments] followed the taken-for-granted conventions of that setting for assessing individuals’ reliability and trustworthiness: Oxford professors were accounted more reliable witnesses than Oxfordshire peasants” (2011, p. 58). For Shapin and Schaffer, this assertion requires no further explanation; it is taken-for-granted that readers still understand these conventions. Although the authors point to questions of “moral constitution” and “knowledgeability,” the more obvious differences between an Oxford professor and a peasant – money, access to both education and leisure, and political and social power – are merely inferred (Shapin & Schaffer, 2011, p. 59).

The categories and characteristics of inclusion and credibility tend to coincide with established social order. As Shapin puts it, “the cultural practices linking truth to honor in gentle society were adapted and transferred to provide substantial practical solutions to problems of credibility in seventeenth century English science” (1994, p. 42). The simplest way to decide who could be deemed credible in the manufacture of scientific facts was to enshrine existing cultural practices as ontological prerequisites. Credibility and authority to speak and act in the name of science is contingent upon already possessing a socially legible form of credibility, embodied as gender, race, and the social position into which one is born. Shapin’s later work, *A Social History of Truth*, explores the constitution of the social (and in the Elizabethan context, epistemic) category of “gentleman” through wealth, lineage, and a moving target of “virtue”: “Contemporary actors understood the gentleman’s qualities, including the guarantees of truthfulness, to be grounded largely in his placement in social, economic, and biological circumstances” (1994, pp. 42–43). One may not be born “great,” but one’s social status and

access to wealth at birth is hardly immaterial. Social and economic status grants privileged access not only to the materials with which to construct new knowledge, but also to the social networks and cultural authority required to be taken seriously.

In addition to questions of class, the inherently gendered construction of gentleman establishes attributes such as maleness and whiteness as prerequisites for reliable witnessing. In Shapin and Schaffer's account, the requirement of being male nearly goes without saying. This is presumably because the traits of the gentleman include "free action" and "control of land and the disposition of labor on that land," to which even gentlewomen of the period could lay little claim (Shapin, 1994, p. 48). In a colonial context, much of the wealth to which gentlemen could lay claim was derived from the subjugation of non-Europeans. Establishing the reliability of witnesses through the criteria of gentlemanliness was in turn a mechanism for restricting entry into the space of experimental science by essentially begging the question: "Either by decision or by tacit processes, the space was restricted to those who gave their assent to the legitimacy of the game being played within its confines" (Shapin & Schaffer, 2011, p. 336). In other words, those whose inclusion in the proceedings was considered legitimate tautologically assented to boundaries which included them while those constitutionally outside of those boundaries had no legitimacy with which to question them.

As Donna Haraway explores, the cultural construction of science as a masculine domain was hardly a simple one-way translation of a pre-existing cultural imaginary: "the world of scientific gentlemen was *instrumental* in both sustaining old and in crafting new 'gendered' ways of life" (2018, p. 28, italics original). Part of Haraway's argument is that the underlying narrative structure of science has been one of "heroic action," present in both classical tales of scientific "revolution" and in the counter-narratives of early science and technology studies (STS). She

discusses the ways in which the early (and now rather sedimented) works that established the bases of actor-network theory and the sociology of scientific knowledge drew on the same heroic tropes and metaphors of battle which establish the scientist (or social researcher) as a modest warrior of knowledge. Embedded in these tropes is another image, that of the amassing of allies. The elaboration of networks and the fixing of narratives takes place by “enrolling” supporters and forging webs of connection. The more connections and enrolled parties one can enlist, the stronger one’s social-epistemic position and ability to control the narrative. In this sense, the twentieth century process of enrollment has much in common with the seventeenth century processes by which one’s credibility as a scientist depended upon pre-existing recognition by others as a credible or valued sort of person (or thing).

Although the actor-network acknowledges and incorporates the agential realities of previously objectified “actors” like microbes, microscopes, and scallops, their credibility remains substantiated through the successful construction and mobilization of a dense network of allies. One’s powerful friends may include non-humans like scallops or sheep, but only if they are able to recruit sufficient witnesses to their own position as credible actors (Callon, 1984; Law & Mol, 2008; Wynne, 1992). The resilience of tautological definitions lies in the fact that they are both self-sustaining and difficult to challenge. The recasting of (social-material) networks as explanatory mechanisms for success or failure demystifies science as a wholly “natural” (as opposed to social) phenomenon, but in turn reifies the successful formation of networks as a measure of success itself. Furthermore, the flattening of relations into “networks” runs the risk of allowing certain actors and relations of power to remain invisible, along with “the invisible work that keeps many of them stabilized” (Star, 2015, p. 278). The correlation between moral or professional greatness and access to power and economic stability depends upon the construction

of social networks (of gentlemen) as natural, inevitable, and indicative of qualities inherent to those included in (and correlatively, those who are excluded from) them.

Disciplinary origin stories naturalize these networks as self-sustaining genealogies through the attribution of genius and generative power. As Helène Mialet argues, the unfolding of a narrative which attributes the transformation of a field and of practitioners' judgements to "the intellectual and inventive capacities" of an individual also enacts a transformation of the individual (1999, p. 557). "This process of attribution redefines the place of the author," she explains, combining "[his] competence and his very conditions of existence" (Mialet, 1999, p. 557). This central position is maintained precisely by his dispersal throughout networks of knowledge: "the more an actor is distributed, socialized, collectivized and multiplied, the more he is singular, an ego, a non-interchangeable body" (Mialet, 1999, p. 562). As Mialet points out, this transformation is also an embodied one. The "distributed-centered subject" is not only constituted in and through the social and material worlds he inhabits, but also in how his body is projected outward via his networks, into different spaces and contexts which feedback both knowledge and renown in return (Mialet, 1999, p. 561). However, not all bodies are equally distributed; the centering of some requires the de-centering of others.

In the professional origin story of medical illustrators, the founding of a distinct profession unfolds not through the labour of constructing a legible profession but through the constitution of Max Brödel as a distributed-centered subject: the father of medical illustration. The cohesive origin story of the profession relies on the ability to tie each major event, institution, and contribution to the field to the figure of Brödel, whether directly or via lineage. The form and structure of historical accounts and institutionalized practices privilege Brödel's

“singlehanded” paternity over all other steps toward professionalization (Association of Medical Illustrators, n.d.-b).

As I will explore in Chapter Four, much of the practical work of building a profession – from founding, maintaining, and growing educational programs to organizing practitioners and facilitating communication and networking – was accomplished by women in the years after Brödel’s death. Despite acknowledging some significant contributions by women, disciplinary stories attribute the birth of a profession to the seminal patriarch, not these gestators and caretakers of the field. This focus on Brödel’s inherent generative powers obscures not only the invisible labour of building and stabilizing the profession but also the role of women in maintaining the gendered, racialized, and classed systems of exclusion that give the founding father trope its legitimating power.

Chapter Four: Mother Hens

Women and the social reproduction of medical illustration

A 1940 cartoon, drawn by medical illustrator Eila Hopper Ross on the occasion of his retirement, depicts the student experience under Max Brödel: a young woman in a lab coat sits hunched over a drawing board sketching the *os coxae* (hip bone), as a jovial older man wearing spectacles and a lab coat stands over her (Peter, 1998). She appears frustrated but determined. Indeed, many of Brödel's former students jokingly referred to "idiosyncrasies" of the infamous first assignment.¹⁵ Throughout the late twentieth century, photographs of teachers and students replicate a similar iconography. Most such images have a staged quality to them, intended to tell a story about what medical illustration is, who does it, and how. The instructor leans attentively over a student at a drafting table, faced with a specimen (often the hip bone). Usually, one or both are clad in a lab coat, symbolic of the scientific nature of their work. Taken together, drawing boards, specimens, and lab coats suggest that artistic skill, direct observation, and scientific demeanour are key elements of medical illustration. Like their German forebear, the instructors' postures suggest generous but stringent oversight, as well as a community of practice. The student is gently guided by her teachers; she is responsible for her own work, but she is never on her own. In individual portraits, medical illustrators often appear in the act of drawing from a specimen, surrounded by their work and reference materials. They are rarely pictured doing paperwork.

¹⁵ Illustrator Dorothy Foster Chubb's decorated page for Brödel's retirement wishes him "a well-earned rest from teaching aspiring medical artists the idiosyncrasies of the [sketch of *os coxae*]" (Foster Chubb, 1940).

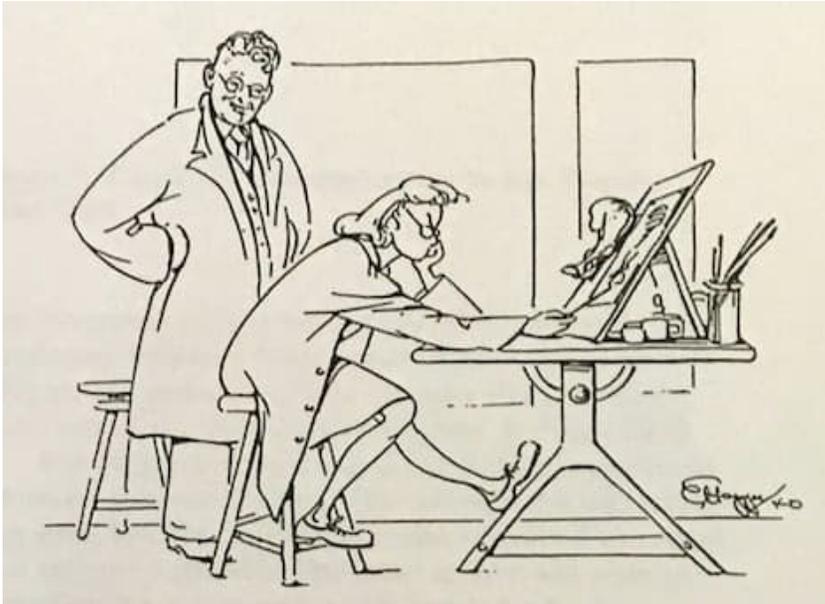
Image 5*Caricature of Eila Hopper Ross as a student*

Illustration by Eila Hopper Ross (1940), from Peter (1998).

The evocative anecdote usually entails an element of the spectacular or extraordinary. It suggests, *there is something to see here*. But administrative work does not photograph well, and it does not produce great anecdotes. As Susan Leigh Star points out, “[m]any aspects of infrastructure are singularly unexciting” (Star, 1999, p. 377). Moreover, the labour of creating and maintaining infrastructures is often construed as mundane, tedious, unskilled, or uninteresting, and therefore unimportant – precisely because it is hidden from view. This chapter is populated by four main characters, all formidable women who headed medical illustration programs and contributed to the institutionalization of medical illustration in the mid-twentieth century. While these stories may entail prolonged struggles against adversity (as these women’s stories sometimes do), they rarely culminate in a heroic arc or memorable dénouement. As I explore further in Chapter Five, professional programs and organizations take shape through the

accretion of everyday activities like writing letters, designing and filling out forms, revising documents, and attending committee meetings. When these efforts are unsuccessful, they appear only as a blip the historical record, easily forgotten; when they are successful, they fade unremarkably into the background of everyday practice. It is this apparently unremarkable character that gives infrastructure its power and that makes the stories of its construction worth telling.

A professional origin story grounded in exceptional father figures tends to obscure the labour of female medical illustrators, both as skilled practitioners and savvy administrators, over the second half of the twentieth century. The period between 1940 and 1950 included not only Brödel's death but also a world war and an unprecedented expansion of medical practice and technological innovation. Against this backdrop, the explosion of medical illustration departments and training programs and the creation of both North American and British professional associations over the course of the decade often appears inevitable, "the natural result of growth and progress and the need of the times" (Jones, 1947, p. 58). Codification, standardization, and regulation of the field seem like logical steps, unfolding equally naturally, if not always smoothly. However, much of this expansion and codification depended on the administrative and bureaucratic labour of female medical illustrators. The erasure of their ongoing efforts in favour of just-so masculine origin stories obscures the material and social practices by which female practitioners cemented medical illustration as a recognizable profession. Moreover, overlooking this labour enables the infrastructures, standards, and social organization of the profession to appear both inevitable and natural.

In contrast to canonical histories outlined in Chapter Three, which emphasize individual genius, masculine camaraderie, and intellectual pedigree, this chapter focuses on the efforts of

female medical illustrators to transform their field into a recognizable profession in the mid-twentieth century. With less access to the kinds of informal networks, status, and privileges from which men like Brödel benefitted, Ranice Birch Crosby, Maria Wishart, and Muriel McLatchie Miller strove to secure their positions by creating legible structures that would externally substantiate the legitimacy of their expert knowledge. Crosby, Wishart, and McLatchie Miller developed new curricula and teaching standards, expanded and acquired degree-granting status for their programs, and worked to build professional groups that would support them in jurisdictional challenges, validate their expertise as part of a legible profession, and establish clear markers of their stature within it – all while continuing to produce work as medical illustrators. A fourth founder, Mary Maciel, provides a contrasting example of one who did not engage in this administrative and organizing work. Together, the trajectories of these figures paint a picture of the often-invisible work of (re)producing medical illustration as a profession.

Institutionalizing authority

Ranice Crosby and Johns Hopkins

North American medical illustrators routinely credit Brödel with “professionalizing the discipline of medical illustration and leading it into the 20th century by establishing the first academic program” (Wilson-Pauwels, 1993b, p. 33). However, although the endowment of the Department of Art as Applied to Medicine (AAM) at Johns Hopkins did ensure a degree of economic stability that no other such department has enjoyed before or since, this first step towards institutionalizing the training of medical illustrators did not guarantee the longevity of the program, much less the eventual apotheosis of medical illustration as a “profession.” As I

explored in Chapter Three, the Brödel origin story provides a powerful “founding father” narrative for the profession. However, it elides the decades-long process through which early medical illustrators turned ad-hoc social and economic arrangements into enduring institutions and redefined medical illustrators as professionals. Indeed, most of what Magali Sarfatti Larson refers to as the “visible characteristics” of a profession – including formalized and regulated training and certification, professional organizations, and codes of ethics – were cemented after Brödel’s death in 1941 (1977, p. 208).

Brödel’s death brought to a close an era in which to train as a medical illustrator one needed simply an interest, basic art training, and an informal recommendation (often from a family friend or neighbour) to “write Professor Max Brödel and tell him I sent you” (Blackstock Thomson, 1981, p. 13). In 1940, Brödel was formally asked to retire as head of Johns Hopkins AAM, in keeping with increasing formalization of university policies and careers. Brödel had been solely responsible for the department for nearly 30 years. Despite having trained more than 100 students, he had not trained a successor. The training program existed primarily in an endowment, a brief course description, a single descriptive article (M. Brödel, 1941), and the collective experiences of his former students. Endowed essentially as an enticement for him to remain in Baltimore, the department depended on Brödel’s reputation as an illustrator and teacher, coupled with a sufficient capacity for administration. It was unclear what the department would become without him.

Although there is little direct documentation of Brödel’s transition out of the role of director, it seems little thought had been given to his succession, leaving the department “in a state of some confusion” (Sweezey, 1995). A committee was duly formed to determine Brödel’s replacement, but the appointee, James F. Didusch, seems to have been selected out of

expediency. An early student of Brödel, Didusch had been resident illustrator for the Carnegie Department of Embryology since its inception in 1913 (Altemus, 1992). His younger brother William Didusch was also an accomplished medical illustrator working in Johns Hopkins' Brady Urological Institute (Schultheiss et al., 2000, p. 1141). The combination of established technical skill and nepotistic familiarity meant that the elder Didusch brother was "invited to assume the post," almost immediately upon Brödel's retirement, at the grade of "Associate Professor" (JHU Dean's Report, 1940, p. 70). Without Brödel at the helm, the state of teaching in the department was "less than ideal" (Sweezey, 1995). Although he had apparently been hand-picked, it quickly became clear that Didusch was not "temperamentally suited" to teaching (Wilson-Pauwels, 1993b, p. 60). He resigned in 1943 to return to his former post in Embryology (JHU Dean's Report, 1943, p. 50). Didusch's undistinguished stint in the role confirmed that running a successful program required more than just skill as an illustrator.

The selection committee reconvened and considered candidates. According to one biographer, these included Brödel's daughter Elizabeth, although she already enjoyed a secure position at the New York Lying-in Hospital, a position she held for 30 years (Cody, 1993). Eventually, the committee "recommended that the conduct of the department be entrusted to" Ranice Birch (later Davis, Crosby) and Elizabeth Cone (later Blumenthal) (JHU Dean's Report, 1944, p. 37). Canadian-born Birch was one of the last students to complete her training under Brödel. Since finishing her studies she had been working on illustrations for two obstetrics texts with Dr. Nicholson J. Eastman, Chief of Johns Hopkins' Department of Obstetrics, who had recommended her for the post. Cone was employed with the Johns Hopkins Hospital doing medical photography and moulage for plastic surgery and teaching. Although she had not been trained by Brödel, she would assist with expanding the program to include those techniques.

Both women were appointed at the “Instructor” grade. For the first few years Birch was also contracted to continue her obstetric illustration work in addition to overseeing the department (Wilson-Pauwels, 1993b). She was promoted to “Assistant Professor and Director of the Department of Art as Applied to Medicine” in 1947. According to Crosby, the appointment came as a surprise, as she knew that “women physicians were not advancing in faculty appointments” (as cited in Cody, 1993, p. 25). Her pay, however, remained lower than her male peers – although, in her own estimation, “even Brödel’s salary wasn’t in line with his position, years of work, and contributions” (as cited in Cody, 1993, p. 25). Unlike Brödel and Didusch before her, her appointment did not include a position on the board of the Henry Walters Foundation, responsible for the department’s endowment. Nevertheless, despite their relative youth (Birch was 29, Cone was 27) and lower rank, the two set to work rebuilding the program.

A description of the contents of the Johns Hopkins AAM course first appeared in the mid-thirties as a three-inch by six-inch card inserted in the University Circular. It provided for both full-time instruction and supplemental instruction for interested medical students and staff. Full time students would be exposed to a variety of gross and microscopic anatomical and pathological specimens as well as rendering techniques such as half-tone (for print reproduction), watercolour, pen and ink, and preparation of classroom charts, with an emphasis on “the correct attitude of the medical illustrator toward problems in medical research and toward the conception of a medical illustration in general as an aid to the text and also as a work of art” (JHU Catalogue, 1939, p. 86). Almost all of this anatomical and artistic instruction was delivered by Brödel himself, in addition to producing his own illustrations. The course was highly individualized and awarded no official diploma or degree. The duration of a student’s training would “of necessity depend on the talent of the individual,” anywhere from two to four years

(JHU Catalogue, 1939, p. 85). The training was deemed complete when she or he found gainful employment: “When a student has shown that he can make a correct and technically perfect picture, some member of the medical profession is apt to discover him and seek his services” (M. Brödel, 1941, p. 671). Much like medical illustrators of the previous century, a good deal of the career was learned on the job, and employment was largely a matter of finding a suitable match with a surgeon or anatomist in need of illustration services.

This course remained essentially unchanged until Brödel’s retirement in 1940. Although there is little documentation of his tenure, Didusch whittled the course description to its bare bones, one-third its previous length. In 1940, the program hosted a total of seventeen students, but the intake of new students dwindled in 1943 and 1944, presumably as a consequence of shifting wartime priorities and policies affecting higher education, Didusch’s lack of engagement, and uncertainty regarding his eventual replacement (JHU Dean’s Report, 1943, p. 50). Upon assuming the helm in 1943, Birch returned to a more fulsome (though less florid) course description drawn from Brödel’s (with the addition of techniques that Cone would be teaching) and cemented the duration of the program at three years. In 1944, only five active students remained in the program, but despite her divided attention (as she was still completing work on Eastman’s obstetrics texts), for the remainder of the decade Birch admitted at least four new students a year and as many as nine in 1949.¹⁶ Over the second half of the decade and throughout the next, Birch oversaw and expanded the program considerably, both in media and illustration techniques as well as medical topics. By 1955, the department had added five additional instructors and lecturers in various techniques (JHU Catalogue, 1955). By 1959, she

¹⁶ Unlike other accredited graduate programs, which have expanded to cohorts of 15-20 students per year, as of writing the Johns Hopkins program remains intimate, typically admitting no more than 4-6 students per year.

had succeeded in converting the program from an informal apprenticeship to a Master of Arts degree (Wilson-Pauwels, 1993b).

Image 6

Ranice Crosby teaching



Uncredited photo, from Cody (1993).

Birch was not alone in accomplishing such rapid expansion and institutionalization. No longer able to simply recruit trained assistants or send promising candidates to Johns Hopkins,

other former students of Brödel also began to train their own pupils and to formalize training within the hospitals and universities where they worked. Prior to 1940, the only other training available for would-be medical illustrators in North America was an apprenticeship-style arrangement with Tom Jones at the University of Illinois at Chicago (UIC). By 1947, there were six training programs, four of which were headed by women (Coleman, 1947). All four were former students of Brödel and they carried forward many of the techniques and philosophies they had learned from him in their teaching. At the same time, they expanded into new media and areas of practice, entrenched their programs within their institutions, and formalized previously loose social networks between illustrators.

Maria Wishart and the University of Toronto

During the early part of the century, the border between Canada and the United States was extremely porous for European settlers like Brödel and his students. Many of Brödel's students, (including Crosby, Wishart, and McLatchie Miller) were Canadians, some of whom would remain in the United States while others returned to practice in Canada. Brödel's family even maintained a lakeside cabin in Algonquin Park (Ontario). However, over the second half of the century, national differences would solidify into more distinctive patterns in the two countries, in medicine and beyond. The medical field expanded both technologically and socially, especially as first Canada, then the United States, were pulled into the Second World War. Increasing demands for rapid and reproducible medical educational materials both during and after the war meant that demand for medical illustrations and trained artists to produce them was fast outstripping what Brödel's school had ever produced. Although Jones was also taking on students at UIC, that training was even less formalized than Brödel's and could not keep up

with demand. War mobilization shifted both labour supply and gendered expectations, but it also brought an end to the era of easy traffic in personnel between Canada and the United States. Ad-hoc recruitment of new medical illustrators would no longer suffice and the future of the field was anything but assured.

Brödel graduate Maria Wishart established the first training program in Canada at the University of Toronto in 1945.¹⁷ Wishart had been appointed as artist to the Faculty of Medicine of the University of Toronto in 1925 (UofT Dean's Report, 1926). For the rest of the decade, Wishart worked alone in the university's Anatomy Building producing "numerous half-tone drawings, sketches, colour drawings, pencil drawings" and wax models (UofT Dean's Report, 1926, p. 21). By 1930, she was moved to the new Banting Institute and was able to hire both an artist-assistant and a secretary-technician, enabling "a steady increase in the output as well as the covering of a more extensive range of work, such as ophthalmology and moulages of fresh specimens" (UofT Dean's Report, 1932, p. 38). However, this steady expansion of work did not coincide with steady access to financial and material resources. The new space was constantly under threat of appropriation by more powerful faculty and the department's financial stability was often strained.

In 1934, the Medical Art Service, which had previously been overseen by the Faculty Council, was made a department, of which Wishart remained director. It was also the first year in which "women medical students were represented by their president [as] a voting member of the Medical Society" (UofT Dean's Report, 1935, p. 47). Although it did not change much in the day-to-day functioning of the Art Service, this administrative change did cement the status of the

¹⁷ Maria Torrance Wishart began her career as staff medical illustrator at the University of Toronto in 1926 after studying with Max Brödel at Johns Hopkins from 1922 to 1925. She founded the Department of Art as Applied to Medicine in 1945 and remained as head of the department until 1962.

department and its director within the medical school by formally recognizing both the growing importance of their services and Wishart's functional responsibility and autonomy. It would also allow her greater control over the management and finances of the department. Nevertheless, the benefits of departmental status were short-lived. Demand continued to increase over the next decade, but output was constrained by a loss of workspace in 1936, "necessitating all working in one room" (UofT Dean's Report, 1937, p. 45). The strain on physical and human resources was keenly felt, but difficult to address. The department expanded gradually, but not fast enough to keep pace with the volume of work.

Wishart began training medical illustrators out of necessity. Early on in her tenure, Wishart recruited twenty-year-old Dorothy Foster (later Chubb) to assist Wishart with primarily technical tasks such as lettering and graphs. Having completed art courses at Central Technical School and the Ontario College of Art, Foster was admitted to Brödel's program at Hopkins in 1930, after which she returned to Toronto and rejoined the Art Service as artist assistant. She married Sydney Chubb in 1938 and left the art service the following year, but she was enlisted shortly thereafter to illustrate a new atlas of anatomy by the Chair of the Anatomy department J.C.B. Grant.¹⁸ Foster was replaced by Eila Hopper (later Ross), who had also studied under Brödel.¹⁹ However, she resigned only a few years later due to marriage (UofT Dean's Report, 1939, p. 10). In addition to insufficient space and continuing demand, Wishart was once again faced with a dearth of qualified personnel.

¹⁸ In addition to creating several hundred original illustrations for the first edition of Grant's *An Atlas of Anatomy*, Dorothy Foster Chubb continued to work with Grant and fellow illustrator Nancy Joy on updating and expanding *Grant's Atlas* for over 30 years.

¹⁹ Eila Hopper Ross (1913-2000) began working as assistant to Maria Wishart in the University of Toronto Department of Art as Applied to Medicine after completing her studies with Max Brödel at Johns Hopkins. She married Dr. John Ross in 1941 but continued working in the department until 1948. She returned to illustrating full time in 1960 at the Hospital for Sick Children in Toronto and founded the Department of Medical Art at Sunnybrook Medical center in Toronto in 1968. She continued to work freelance after her retirement in 1973.

Image 7*Maria Wishart teaching*

Uncredited photo from Schrag (1949). The figures in lab coats are Wishart and Elizabeth Blackstock (both standing) and student Louise Gordon (seated); the third standing figure is departmental secretary Elizabeth Meredith.

Canada's entry into the war in 1939, followed by Brödel's retirement, meant that Hopper Ross's replacement would be much more difficult to find, but it also opened the door to establishing a homegrown training program. After nearly a year of "untrained, spasmodic assistance," Hopper Ross was replaced with 23-year-old Marguerite Drummond in 1941 (UofT Dean's Report, 1942, p. 35).²⁰ Although she had some art training from the Ontario College of Art, Drummond had "no training in medical art" and was therefore taken on only at half-time as "pupil assistant" (UofT Dean's Report, 1942, p. 35). In addition to the necessarily slower pace of a less experienced artist, time spent training Drummond was time not spent producing work. As the war dragged on, Drummond's studies were hindered by "the pressure of routine work" (UofT Dean's Report, 1944, p. 8). Another young artist, Elizabeth Blackstock, had worked in the department since the mid-1930s as a part-time assistant on technical tasks such as lettering and etching but she did not have sufficient scientific or medical training to undertake more complex work.²¹ In an attempt to make up the shortfall, Wishart engaged recent Johns Hopkins graduate Eleanor Swezey to assist for several months in 1942. Swezey's brief association with the University of Toronto established a link with the department that would endure for many years, as I will explore in Chapter Five.²² Nevertheless, her assistance was only a temporary solution.

²⁰ Barbara Marguerite Drummond (1918-2011) began working as a part time "pupil assistant" to Maria Wishart after graduating from the Ontario College of Art in 1941. She was one of the first students to graduate from Wishart's training course, in 1946. She became head medical artist for the Department of Visual Education at the Hospital for Sick Children in Toronto where she worked from 1947 to 1962. She also taught anatomical illustration and departmental organization at the University of Toronto from 1950 to 1958. In 1962, she became assistant medical illustrator under her former student Victor Doray in the Department of Biomedical Communications at the University of British Columbia.

²¹ Elizabeth Blackstock (1911-2009) served as a part time technical assistant to Maria Wishart beginning around 1936. In 1946, she became one of the first graduates of the University of Toronto Department of Art as Applied to Medicine (now BMC), alongside Marguerite Drummond. The departmental library of the University of Toronto BMC program, which houses both archival and reference materials for use by students, is named for her.

²² Eleanor Swezey (1915-2007) began studies in medical illustration at Johns Hopkins in 1940, after receiving her BA in mathematics from Queens University in Canada. She worked with Maria Wishart at the University of Toronto for three months in 1942 before eventually securing full time employment at the Queen Mary Veterans' Hospital in

Wishart encouraged Blackstock to study anatomy in order to expand her skills and Eila Hopper Ross returned to assist part time in 1943, but the women still struggled to keep up with demand.

It was clear that Wishart could no longer rely on a steady supply of trained assistants from Johns Hopkins, but neither was she fully equipped to provide adequate training in addition to service work, especially in cramped quarters. Throughout the early 1940s, Wishart's reports to the Dean of the Faculty of Medicine stressed the increase in volume, inadequate staffing, and lack of adequate space. Rushed requests, "red-tapism (a necessary evil)," and "incidental interruptions [... took] their toll of time urgently needed for creative work" (UofT Dean's Report, 1943, p. 35). Despite the added pressures, Wishart reflected that "the experience gained from undertaking to teach a pupil assistant [in] Art as Applied to Medicine from the beginning proved to be valuable in a most unexpected way" (UofT Dean's Report, 1943, p. 35). Upon Didusch's departure from the Johns Hopkins AAM program in 1942, Wishart was contacted by the committee appointed to review the program "asking for advice regarding the teaching and organization of the department" (UofT Dean's Report, 1943, p. 35). Along with practical concerns and "the increasing interest shown by Canadian artists," this exchange seems to have emboldened her to take the matter of training into her own hands (UofT Dean's Report, 1946, p. 16). In her 1944-45 report to the Dean of the Faculty of Medicine, Wishart explained that "[w]ith the death of Professor Brödel, [...] that school lost its pre-eminence and our Faculty decided that the time was ripe for the establishment of a school here" (UofT Dean's Report, 1945, p. 10). In order to secure the future of her department, she needed to expand.

Although the negotiations required to achieve this feat are not well-documented, in order to make her case for a department Wishart needed to assert the utility and necessity of expansion

Montreal. This position later expanded to include acting as an advisor all Canadian veterans' hospitals, which she continued for over 30 years.

as well as to secure support from faculty patrons. Wishart's reports over the next few years noted her outreach efforts with medical professionals, editors, and publishers and the department's involvement in exploring new media such as film. At the same time, as "a child of the elite in Toronto" (Helen, retired medical illustrator), her social ties and familiarity with Canadian medical society also contributed to the success in building the program. Her father, David James Gibb Wishart, had been a professor of Otolaryngology at the University of Toronto and her brother was also affiliated with the university and was Chief of Otolaryngology at Toronto's Hospital for Sick Children. She was able to garner support from high-ranking faculty including Charles Best (Chair of Physiology), William Boyd (Chair of Pathology and Bacteriology), E. S. Ryerson (Assistant Dean of the Faculty of Medicine and grandson of Edgerton Ryerson), and W. A. Scott (Head of the Department of Obstetrics and Gynaecology) (UofT Dean's Report, 1946, p. 15). Wishart's ability to leverage social connections not only provided "help to one unversed in Faculty procedure" and informal advocacy on her behalf, these connections also enabled her to secure temporary loan of additional space while awaiting more adequate accommodations for the fledgling program (UofT Dean's Report, 1946, p. 15). The Council of the Faculty of Medicine approved conversion of the Medical Art Service into a combined teaching and service department in December of 1944 (UofT Dean's Report, 1945). Re-christened "Art as Applied to Medicine," the new department would include both the existing illustration service and a three-year diploma-granting training course, to "be administered under the Faculty of Medicine in a manner similar to other departments" (as cited in UofT Dean's Report, 1945, p. 14).

Administrative expansion of the Medical Art Service Department to include a formal diploma course could provide a steady stream of trained hands and income from student fees as well as helping to secure additional space and recognition from the university, but this promise

would not bear out right away. Over the first three years of the teaching program, four students were admitted per year. Despite relatively small numbers, learning and working conditions were far from ideal and not all candidates were able to finish the program. More and better accommodations were desperately needed, as “the increasing handicap of inadequate, poorly adjusted space, created a state of disorganization which was almost paralyzing” (UofT Dean’s Report, 1946, p. 15). Although the department was offered an additional room in a nearby “old church,” the space lacked water and air pressure facilities and its location made access to autopsies and operating rooms difficult (UofT Dean’s Report, 1948, p. 14). It was also unbearably cold, forcing students back into the already crowded workspace during the long winter months. Her pleas for additional space became increasingly desperate but the permanent space promised by the Faculty of Medicine still failed to materialize.

The knock-on effects of inadequate space were significant. Without adequately trained staff and space for them to work, the department continued to struggle to meet demand. Wishart’s reports during the post-war years stressed both the expertise required for their work and the detrimental effects of inadequate material circumstances by enumerating the breadth of subjects, techniques, and individuals being served throughout the university and beyond. Nevertheless, the inadequacy of working conditions continued into the 1950s:

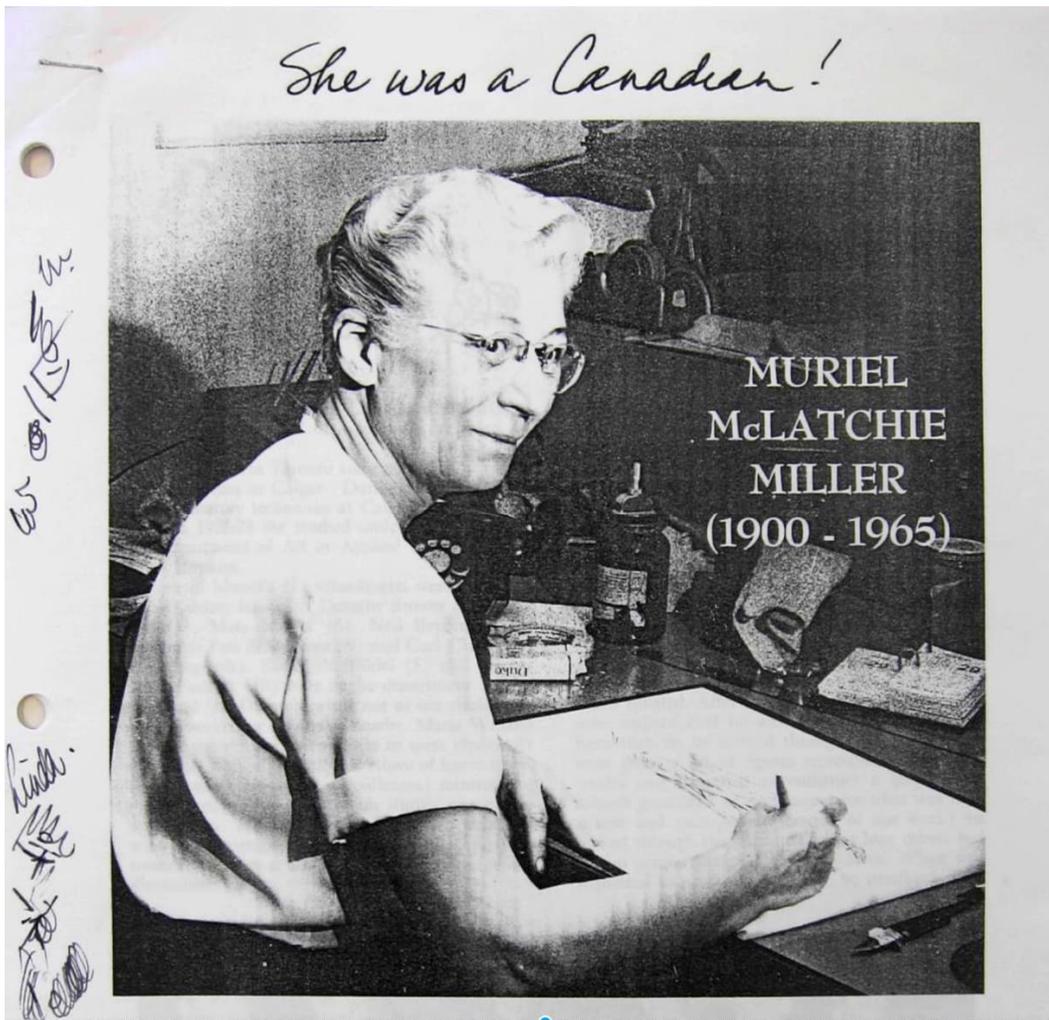
During the past year the nature and source of work has noticeably broadened. The number of individuals served has again surpassed all previous records. Numerically the volume of work has been maintained. There has been no change or increase in the staff of the Department.

Although taking on students could potentially increase the department’s budget via student fees and assistance with service work, reductions in service work due to inadequate space negated those gains and prevented further expansion. Well into the 1970s, departments of medical illustration continued to operate “on a shoestring,” with little clerical assistance and often

inadequate space, despite increasing volumes of work and short timelines (MacArthur Moseley, 1971). Although Wishart had succeeded in establishing her own program, it was clear that more work was needed to improve working conditions and to establish medical illustration as a viable profession.

Figure 8

Muriel McLatchie Miller



Uncredited photo from Hill (1965). Marginalia most likely added by Linda Wilson-Pauwels.

Muriel McLatchie Miller and the Association of Medical Illustrators

Brödel's death had left a gap in training opportunities for medical illustrators that female illustrators were able to fill, but the apotheosis of the field as a profession required more. Like Wishart, Muriel McLatchie (later Miller) was a Canadian and former Brödel student. She began taking on students in 1941 at the Massachusetts General Hospital (MGH), where she had been staff medical artist and head of the Medical Illustration Service Department since 1932 (McLatchie Miller, n.d.). Although the hospital provided space and some material support, she ran the School of Medical Illustration privately until her retirement in 1960. McLatchie Miller took full responsibility for both the administration and financial management of the program, in addition to providing instruction and continuing to fulfill her role as the hospital's head illustrator. However, like Wishart, McLatchie Miller found that a training program alone was not sufficient to address the precarious position of medical illustrators within the rapidly transforming landscape of medicine in North America.

At the start of the Second World War, working medical illustrators remained relatively few and they were both geographically and institutionally dispersed. Some who had studied together or lived and worked in larger cities kept in touch, but many found themselves isolated both from their peers and in their work (Hill, 1965; Jones, 1947). Whether freelance or attached to a hospital or university, the medical illustrator often worked alone in a cramped studio, with limited contacts and treated as "a negative factor in the affairs of his [sic] institution" (Jones, 1947). In an obituary article, McLatchie Miller's friend and former Johns Hopkins classmate Edna Hill explained,

There was no central clearing house for professional news or exchange of tips on technic [sic], materials or methods. Our colleagues in the profession were located by spotting a published, signed illustration and contacted by writing in care of the author. On our rare

visits, Muriel often discussed this situation and deplored the fact that there was no central means of communication or exchange of ideas. (1965, pp. 29–30)

As I explore more deeply in the next chapter, this lack of communication was not merely a matter of social isolation, it was also an economic issue, compounded by the longstanding gendering of the field. Although some medical illustrators were employed on a salaried basis within institutions, many were paid on an hourly basis or by project. With no “central clearing house,” rates of pay and working conditions could vary enormously. However, isolated practitioners had few frames of reference on which to base or justify their quote or advocate for themselves. The lack of transparent communications also exacerbated the inherent inequities of relying on informal social networks and word-of-mouth for employment opportunities. Researchers and publishers in need of illustrations were likely to hire less skilled illustrators on the basis of familiarity rather than skill or specialized training. Thus, female illustrators in particular often found themselves either passed over or underpaid and under-appreciated. Professional organizing was one way of responding to this precarity.

Far from being “the natural result of growth and progress and the need of the times”, the creation of a professional organization for medical illustrators required many years of networking and administrative labour, much of which was taken on by female practitioners like McLatchie Miller (Jones, 1947, p. 58). Although some sources mention early attempts to organize medical illustrators by Jack Wilson (founder of an extant program in Augusta, Georgia) and Elon Clark (director of the Department of Medical Art and Illustration at Duke University Medical Center) in the mid-1930s, these efforts seem to have been limited to a few letters and bore little fruit.²³ In a letter to Ranice Crosby, Elizabeth Brödel mentions Wilson’s “attempt to

²³ Although a few sources mention this attempt in passing, it seems little came of it and Wilson-Pauwels dismissed the claims as unsubstantiated (Cassell, 1946; Jones, 1947; Wilson-Pauwels, 1993b).

start an organization,” noting sceptically that “Papa, amused, referred to it as a union” and he was unlikely to have been interested (E. Brödel, 1979). In the event, organizing a viable professional organization would take far more than a letter or two. Hill recalls that McLatchie Miller’s “efforts to arouse interest in a professional organization” included not only locating other artists, but also “much correspondence, several trips and a number of interviews,” all funded out of her own pocket (1965, pp. 30–31).

After several years of networking with medical illustrators across the country, McLatchie Miller had accrued sufficient interest to take the next step. She visited Chicago in 1944 to pitch her plan to program head Tom Jones and W.C. Shepard, a medical illustrator working for medical publisher W B. Saunders (Cassell, 1946; Hill, 1965; Jones, 1947). The two men’s powerful positions in the field gave them the financial stability to underwrite starting costs as well as the social connections and moral authority to spearhead the organization and recruit additional members. With Jones as a figurehead, the painstaking process of gathering medical illustrators under one umbrella gathered greater speed and urgency. However, the work of building a viable organization was only beginning.

In July of 1945, 30 delegates from across the two countries, of whom two-thirds were women, convened at an organizing meeting in Chicago. There, delegates “formulated a constitution and bylaws, elected officers and the Board of Governors, decided on dues and categories of membership, and prepared an agenda” for the first annual meeting, to be held in Philadelphia the following year (Demarest, 1995, p. 13). Jones and Shepard were elected president and vice-president, respectively. Clark became Chair of the Board of Governors. McLatchie Miller and Elizabeth Brödel became Secretary and Treasurer, respectively. They continued to serve in these roles for the next few years. The Association of Medical Illustrators

(AMI) was officially incorporated on February 8, 1946 and held its first meeting in Philadelphia in September of that year (Demarest, 1995, p. 13).

Image 9

First AMI meeting, 1946



Uncredited photo from ami.org. Muriel McLatchie Miller is seated in the front row, third from the left. Tom Jones is seated to her left.

Organizational structures tend to allocate high-status executive roles to men while women take on lower-status but often labour-intensive administrative positions. While women have comprised at least a two-thirds majority of the AMI for most of its existence, they make up only a third of the association's past presidents. This distribution of rank and responsibilities also makes it difficult to trace the contributions of these women in disciplinary histories that focus on executive roles. Indeed, medical illustrator Robert Demarest's 1995 history, written to mark the associations' fiftieth anniversary, lists only presidents and vice presidents after the first few

years. Nevertheless, it is clear that Ranice Crosby, Maria Wishart and Muriel McLatchie Miller were all deeply involved in building the AMI. In addition to overseeing the creation of the first educational standards, Wishart was elected as the first female president in 1950, followed by McLatchie Miller in 1953. Like them, Crosby served for many years in other roles, including on the Board of Governors and Education Committee, but did not serve as president until 1963. As I explore further in the next chapter, the success of the organization was as much a product of the routine work of committees, copyediting, and correspondence as it was a matter of high-level decision-making.

Rationalizing expertise

As I will explore further in Chapter Five, the creation and growth of professional organizations for medical illustrators in the United Kingdom and Canada unfolded somewhat differently.²⁴ However, despite substantive differences in the social and political organization of medicine, particularly in the aftermath of the Second World War, the gendered dynamics and motivating forces were similar. Concerns about isolation, working conditions, and pay motivated efforts to organize and to develop standards for training and membership. Although there were disagreements about how this should be accomplished, organizers hoped that forming professional organizations would not only improve working conditions, job security, and compensation, but also ensure better quality and higher status overall.

With the support of these academic and professional institutions, medical illustrators began to codify their own expertise and to promote their field as a “profession.” For the first

²⁴ The Medical Artists Association of Great Britain (MAAGB) was founded in 1949 and the Canadian Academy of Medical Illustrators (CAMI) was founded in 1965.

decade, the AMI's major focus was the development of professional standards including a code of ethics and a *Standard for Teaching Departments of Medical Illustration*. Later, the educational standard would form the basis of a formal accreditation process for training programs, which in turn would underwrite certification and membership in the professional organization. The drive to systematize and standardize training was a way of substantiating the credibility of medical illustrators not only by documenting the knowledge and skill sets that a trained medical illustrator should possess, but also by establishing and solidifying links to established institutions such as medical schools.

Education and training

Early calls to action stressed the urgency of addressing the rapid expansion and changes taking place in the field. At the inaugural meeting of the AMI in 1946, president Tom Jones summarized what he saw as “the major interests, problems and aspirations of the Association” (Jones, 1947, p. 65). In particular, he identified training and education of medical illustrators as a “primary concern” (Jones, 1947, p. 64). Wartime expansion and post-war restructuring had created both a booming market for medical illustrators' skills and also a rapidly changing technological backdrop for their work. Demand was increasing, but supply was limited. Brödel's generation had raised the bar for quality, but the lack of suitable candidates threatened to lower that standard. Furthermore, changing media and technologies were changing the nature of the work. Some programs were already incorporating techniques like photography and moulage, but additional media from film to plastics meant that both novice practitioners and veterans needed to expand their skill sets if they were to remain relevant and competitive.

As new training programs emerged alongside expanding medical and visual technologies, many practitioners and program directors sensed that teaching methods would have to evolve in order to keep pace. Many of Brödel's former students had intentionally modeled their programs on the instruction they had received at Johns Hopkins as well as on medical student education. However, increased demand, coupled with the expansion of media and areas of practice, strained the capacity of that model on all sides. Even where it entailed certain standard elements and assignments, the Brödel model depended on a great deal of individually tailored instruction moving at the student's own pace. With increasing service demands and more rigid administrations, this degree of individual attention and fluid timelines could no longer be assured. Programs also needed a means to evaluate a candidate's existing skill set and potential before investing in training. New forms of media entailed specialized technical skills far beyond classical draftsmanship and emerging research areas demanded ever more detailed scientific acumen. Given the amount of time, energy, and resources required to train a new medical illustrator, as well as the unusual combination of skills required, they could not afford to waste time on bringing students up to speed.

Moreover, training needed to be a reliable indicator of the graduate's competence. It was clear that the individualized training of the past would not suffice to meet demand but rapid, unchecked growth threatened to flood the market, lowering the standard for everyone. If potential clients could no longer simply rely on Brödel's word to ensure quality, on what basis would they evaluate it? With so many new programs emerging, each with its own approach, priorities, and institutional context, how could AMI members be sure that the new generation of medical illustrators would possess the same skills and values as they did? Medical illustrators worried that a glut of sub-par workmanship would not only reflect badly on themselves, but also

that it would have a negative effect on medical education in general. In order to expand their domain without diluting their worth, medical illustrators needed to come to some kind of agreement as to what training should include and which skills were most fundamental to an illustrator's eventual success in the field.

Although most agreed that demand for trained medical illustrators was increasing, they were also concerned about what training would look like. Many looked to wartime methods such as the standardization and rationalization of medical education (to which their profession had already contributed) to scale up their own training methods. Advocates of this approach, like Tom Jones and Lewis Waters, cited the rapid expansion of medical education during the war as proof that rationalization was the best way to efficiently and systematically bring all pupils up to speed (Jones, 1947; Waters, 1946). However, articulating a single standard across geographic locations, media, and specializations, all within a rapidly evolving landscape of medicine and medical education, proved to be extremely difficult. On one hand, some kind of standardization and regulation seemed necessary to increase volume, establish consistency, and provide a means of evaluating quality. At the same time, it needed to encompass not only current practices, but also the variety of areas into which their field stood poised to expand. Furthermore, in order to be accepted by the membership, guidelines needed to incorporate existing programs and instructors (nearly all of whom were already members of the AMI) while limiting uncontrolled growth outside of their sphere of influence.

In 1946, the Board of Governors of the AMI had appointed the Committee on Education (later renamed Council on Education), composed of “directors of all the schools offering courses in medical illustration” at the time, whose aim would be to evaluate and “moderniz[e]” existing methods and to establish “minimum standards, entrance requirements, and a [...] curriculum”

(Jones, 1947, p. 64). Four additional programs had already emerged by 1949. By the time the educational standards were finalized in 1955, there were a total of ten different training programs across the continent, ranging from Ralph Sweet's Brödel-esque apprenticeship at the University of California in San Francisco to two graduate degree-granting programs.²⁵ The variety of approaches, institutions, and personalities involved meant that seemingly minor differences had the potential to substantially influence the direction of the field and impact the survival of any given program.

For these reasons, despite general agreement in principle, it would take nearly ten years and at least four major revisions for the committee to produce a *Standard for Teaching Departments of Medical Illustration* and have it approved by the Board and membership (Demarest, 1995, p. 32). The resulting guidelines sought to define both who was qualified to teach others the trade and what should be taught. In addition to defining requirements for a "qualified" medical illustrator in a teaching program, including formal training and experience in the field, the *Standard* also began to systematize the instruction those programs should provide as well as the institutional structures within which they would be built. Curriculum guidelines established recommendations for both medical subjects and artistic techniques that should be covered to constitute a comprehensive program. They also specified that required courses in areas such as anatomy, physiology, and pathology should be taught within a medical school and

²⁵ Lewis Waters' program at the University of Texas Southwestern Medical School was the first to succeed at implementing a masters-level degree program, in addition to a bachelor's degree in medical illustration, as early as 1945. At the time, Jones and McLatchie Miller's programs offered only a certificate and Wishart's a diploma. The program at the Medical College of Georgia (now Augusta University) was founded in 1948 by Jack Wilson, who was quickly succeeded in 1949 by Orville Parkes, who ran the program until 1972. The Georgia program began offering a two-year Master of Science degree in 1950. Two other programs were founded in 1948, one at Ohio State University, founded by Frederick Shepard, and the other at the University of Rochester, founded by Natt Jacobs. The last to launch prior to the finalized standard was Ralph Sweet's program at the University of California in San Francisco, begun in 1952 and run on an apprenticeship basis (no degree) well into the 1960s. Sweet's program eventually folded in the late 1980s.

that the curriculum should comprise at least 22 months of active study (Wilson-Pauwels, 1993b, p. 96). In the long run, these requirements would serve as a basis for implementing an accreditation process for schools of medical illustration (and later graduate schools).

In the end, those most involved with the committee were best positioned to influence the contents of the *Standard*. Although all active directors were members of the Committee on Education, not all contributed equally. McLatchie Miller was the AMI's second female president (in 1953) and served for many years as corresponding secretary but was less involved in drafting the educational standards. The committee was chaired by Ranice Crosby and Maria Wishart for most of the first ten years. Wishart in particular oversaw many of the major revisions of the *Standard* as chair of the committee from 1950 to the final approval in 1955. By taking an active role, Crosby and Wishart were able to shape the measures against which their own programs would be judged. Because of its historical stature in the field, Crosby's program provided a model of what a department ought to look like. However, the nearly unassailable position provided by the Walters endowment and the prestige of Johns Hopkins itself were almost impossible to replicate elsewhere. Despite Wishart's active role, some requirements also posed problems of translation across national borders. For many programs, insistence on specific forms of institutional affiliation proved to be one of the most significant obstacles to accreditation, as it required navigating, securing, and maintaining the cooperation of those institutions. For programs like McLatchie Miller's, which was based in a hospital rather than a university, the requirement for association with a medical school was insurmountable, leading to its eventual dissolution.

Accreditation

From the outset, it was clear that the force of the AMI's education standards would be “dependent to a large degree upon the cooperation and interest of medicine and its institutions” (Jones, 1947, pp. 64–65). Copies of the finalized *Standard for Teaching Departments* had been duly distributed to medical schools, but without the power to enforce them, they remained merely recommendations. In order to assert its regulatory power as an organization, the AMI needed a means of evaluating and acknowledging which programs met their standards. They also needed employers and professional groups to recognize and value those standards in their hiring and work practices. In order for standards to be taken seriously, they needed both internal and external mechanisms for enforcement.

As with training programs, the professional organization looked to existing institutions as models and support structures. In the lead-up to the Chicago organizing meeting in 1945, Ruth Coleman (later Wakerlin), then a student of Tom Jones, was recruited to draft a constitution.²⁶ Although she “pleaded complete ignorance,” she was able to procure a copy of the constitution and bylaws of Institute of Medicine of Chicago, of which her father was Secretary at the time (as cited in Wilson-Pauwels & Gralapp, 2010, p. E103). With her father's assistance, Coleman explains, she “used it as a model, drafting a document that Tom Jones presented to his fellow medical illustrators at the Chicago meeting” (as cited in Wilson-Pauwels & Gralapp, 2010, p. E103). Like the constitution, accreditation and certification processes were modeled after those

²⁶ Ruth Coleman Wakerlin (1917-2010) studied medical illustration with Tom Jones at the University of Illinois at Chicago until 1944 and continued teaching there until 1953. She is known for pioneering the use of plastics to produce large-scale transparent models for scientific exhibitions, including several large-scale projects for Chicago's Museum of Science and Industry. She returned to full time work in 1966 and in 1974 she took over as director of the training program in medical illustration at University of California at San Francisco, begun by Ralph Sweet in 1952. Under her leadership the program began offering a Master's degree in 1977 and was accredited by the AMI in 1979. However, it was shuttered in 1988 as a result of administrative restructuring and a new Dean of Medicine who rescinded funding for the program.

of larger medical professional organizations. Although their accreditation process would not formally affiliate with the American Medical Association (AMA) until 1985, the AMI's Council on Education met with the AMA's accrediting arm in 1958 (Demarest, 1995, p. 92).

Consultations with this and other professional groups sought to determine the forms of accountability and credibility that those organizations would recognize and respect. Organizers looked to the forms and functions of these groups to as models for their own structures and sought affiliation with them to lend institutional weight to their claims.

The push to begin enforcing the *Standard for Teaching Departments* was almost immediate, but like the *Standard* itself, a meaningful accreditation process was not fully implemented until more than ten years later. The push for accreditation gained momentum as the first founders of training programs began to retire. In 1962, Wishart retired from her position as head of the University of Toronto's Art as Applied to Medicine program, two years after McLatchie Miller's retirement from her own School of Medical Illustration. That same year, Melford Deidrich, the AMI's 1962-1963 president announced that he had "set as a primary goal the stemming of the proliferation of schools of medical illustration [and] discouraged the formation of two programs in the east" while "the Association's Committee on Education continued to strengthen the standards for becoming an AMI accredited school" (as cited in Demarest, 1995, p. 149). That year's chair of the Council on Education, Angela Bartenbach Mailer, "recommended that all training courses in medical illustration meet the accrediting policy of the AMI, and that those in the United States establish curricula by 1968 leading to a degree in medical illustration" (Demarest, 1995, p. 46). Revised minimum standards for schools of medical illustration were approved by the membership in 1965. A process of enforcing the standards

through accreditation would be implemented over the next few years, starting (perhaps unsurprisingly) with Johns Hopkins.

Accreditation requirements for schools and their students presented particular problems for Wishart's and McLatchie Miller's departments. McLatchie Miller had returned to Canada post-retirement but remained in contact with her illustrator colleagues, including Wishart's successor Nancy Joy. In their correspondence, Joy expressed misgivings about the potential effects of the AMI's proposed accreditation requirements (Joy, 1965). Her first concern was the requirement that candidates should be in possession of a bachelor's degree in order to be admitted to an accredited school. Although Joy considered Canadian art training superior to that available in the United States, Canadian art schools at the time did not offer such a degree. She worried that the new standards would penalize Canadian students financially and might even exclude them from entering the profession at all by essentially forcing them to complete art training in the United States. Secondly, the minimum standards approved by the membership in 1965 required the program to be affiliated with a degree-granting university medical school. Although Joy's program was already affiliated with the University of Toronto School of Medicine, it only granted a diploma, not a degree. If this became a basis for their exclusion from accreditation, it could result in second-class status for Canadians in the profession.

The new accreditation program would also affect American schools that did not fit the university-based model, like McLatchie Miller's, regardless of the curriculum or the quality of education provided. Unlike many training programs, McLatchie Miller's school was run in conjunction with the MGH's medical illustration service department and it was administered privately by McLatchie Miller herself. Because it was based in a hospital setting, rather than a university, medical training was furnished by hospital staff and practical experience through

supervised work on projects for the service department. Upon her retirement in 1960, “the Hospital administration agreed to officially accept her gift of the School as a Hospital responsibility” (Stebbins, 1963, p. 3). However, it was not an altogether desired one.

Tom Stebbins took over the running of the department, integrating the previously separate medical photography lab and moving some instruction out of the hospital to the Harvard Medical School (Stebbins, 1963, p. 3).²⁷ However, within a few years, hospital administration would cite the AMI accreditation requirements as a partial justification for discontinuing its support of the program altogether (Stebbins, 1965). Although the move was part of a larger decision to “‘dissolve’ support of all 21 of MGH teaching facilities including Nursing, Radiology Techs, etc” the hospital was particularly keen to offload responsibility for the small, resource-intensive medical illustration program (Stebbins, 1992). While pleading for more time, Stebbins reached out to several local institutions including Harvard, Tufts, and Boston University Medical School, but none was willing to take on the full cost and responsibility of sponsoring the school (Stebbins, 1965). The hospital was of little help. Stebbins described MGH as having already “moved our school and Service Dept to the old Winchell school building that we remodeled in that former boiler room (central heating) and my new office in the former coal bin” (Stebbins, 1992). Despite his early optimism and a brief working relationship with Harvard’s medical school, Stebbins’ efforts to establish a fiduciary relationship to an established, degree-granting medical school and achieve accreditation for the MGH program were ultimately unsuccessful.

Embedding accreditation within the United States university system not only codified and standardized training, it also enabled AMI members to leverage their relationship with more

²⁷ Stebbins had served as a Marine reservist during the Second World War. Having earned a degree in biology in 1942, after the war he pursued art training and graduated from John Hopkins AAM program in 1950 (*Stebbins CV*, n.d.).

established institutions as proof of their own credibility. However, adherence to that mold came at a price. Ironically, the AMI, which McLatchie Miller had dedicated so much effort to build, played a crucial part in the demise of her own training program, which shut its doors officially in 1967. Joy, on the other hand, was ultimately successful in her efforts to ensure her program's longevity at the University of Toronto and secure AMI accreditation. However, despite Wishart's critical involvement in developing the first educational standards, the Canadian program faced significant hurdles to achieve that result. In recognizing only credentials obtainable at an American university, the accreditation process not only failed to accommodate differences in educational systems, it also failed to recognize any other form of training as valid or equivalent, regardless of its content or outcomes. The structures into which they hoped to fit dictated the forms that "professionalization" could take.

The AMI push for accreditation was an attempt to make the training of medical illustrators legible within the increasing credentialization of American medical education. Externally verified markers of training and educational achievement would help to define and maintain the legitimate boundaries of the profession against incursions by "untrained" and "unqualified" competitors (CAMI Publicity Meeting, 1971). Formal accreditation of schools would also help to increase the profile and credibility of their graduates, while continuing to suture together schools and professional organizing. Thus, piece by piece, educational standards and membership requirements were yoked to each other and to larger credentialing bodies.²⁸ In

²⁸ A complete examination of debates around membership, certification, and jurisdictional disputes is unfortunately beyond the scope of this chapter but will be addressed in future work. In brief, early requirements for full membership included portfolio review by existing members as well as additional proof of training and/or work experience in the field. However, each new iteration of membership policy entailed a good deal of debate over how to document or measure an illustrator's qualifications and the quality of their work. These difficulties associated with documenting a unique knowledge base were further complicated by evolving practices, overlapping professional groups, and the bureaucratic exigencies of certification.

theory, the AMI's enforcement of education standards and accreditation would function as checks and balances which would grow the profession without diluting it. Would-be medical illustrators would have an incentive to pursue formal training, training programs would have both support and oversight in providing it, and the professional society would ensure a steady flow of new members who would perpetuate and expand the profession.

Accreditation of schools of medical illustration and later an individual certification process would come to serve as a primary means of gatekeeping both training programs and entry into the profession.²⁹ On one hand, these professional structures promised to bolster the credibility of medical illustrators by standardizing their training and rendering their skills and qualifications more transparent. This combination of institutionalization and standardization would ideally provide both an external validation of their skill set and reduced reliance on personal networks and subjective appraisals. In this sense, moving authority and credibility out of individual bodies and into institutions had the potential to level the playing field for women.

However, there were also clear disadvantages. The enforcement of standards based largely on American university medical schools would ensure that they remained most advantageous to those already included in them. The precarious position of many training programs within their institutions meant that, for many, meeting the standards – such as medical school affiliation and degree-granting status – would require substantial restructuring and resources. The differences between Canadian and American education systems also made clear the complexities of attempting to systematically correlate course content, competence, and credentials, especially across borders. Moreover, although they enabled a degree of access and

²⁹ An individual certification process, including examination and portfolio review, was introduced in the 1990s, at which point membership requirements were formally decoupled from both certification and schooling. However, this process is still overseen by an arms-length committee of the AMI.

stability for some white women, these standards were both modeled after and dependent on structures and institutions which had been designed to restrict access to white men. Much like the Flexner Report fifty years earlier, accreditation and credentialization of medical illustration was most likely to disadvantage those already most excluded from those structures.³⁰

Reproducing values

Women like Ranice Crosby, Maria Wishart, and Muriel McLatchie Miller each pursued different means to cement their own positions within the field, with varying degrees of success. However, their activities make clear that transforming medical illustration from an apprenticeship-based practice to a recognizable profession required more than simply founding a training program. Crosby's biographer and colleague John Cody, remarked later that

She [Ranice Crosby] held together what Max Brödel had begun. Sometimes I wonder if she hadn't taken over when she did if the whole profession would not have foundered. (2011)

The field required not only a founding father, but numerous mothers willing to take on the work of birthing new programs, nurturing professional societies, and (re)producing medical illustrators. Institutionalization and rationalization provided structural support, but the growth of medical illustration as a distinct profession also depended on the formation of a cohesive social group with shared values and history. This socialization built on existing social networks and values as well as a self-conscious emphasis on a shared disciplinary history epitomizing epistemic values.

³⁰ On the detrimental effects of the Flexner report on the gender and racial diversity of medical education, see Savitt (2006), Barkin et al. (2010), and Pannier (2016).

Mary Maciel

Mary Maciel presents an interesting, if partial, counter-narrative to Crosby, Wishart, and McLatchie Miller. Maciel founded and headed a medical illustration training program at the University of Cincinnati from 1947 to 1972. Like many others, the program was an outgrowth of Maciel's employment as head of a medical art service in the Department of Surgery of the University of Cincinnati's College of Medicine. However, there is little clarity surrounding the administrative basis for the training program within the university. One former student recalled receiving a "university certificate" while another reported having "paid his tuition directly to Maciel and never received any form of official recognition from the university to certify that he was a student" (Wilson-Pauwels, 1993b, p. 123). According to Linda Wilson-Pauwels' primarily oral history, Maciel seems to have "maintained a tight control on everything that was written about the program," but her record-keeping was relatively poor and accounts are piecemeal, making it difficult to trace the evolution of the program with any accuracy (1993b, p. 127). As the rest of the field moved towards professionalization, this resistance to administrative transparency and institutional oversight coupled with a profound social divide left her program adrift.

Although Maciel was one of the earliest to launch her own program, she did not develop strong social or professional relationships with female peers or other program directors and the graduates of her program were almost exclusively men. A 1940 biographical sketch in the *Cincinnati Enquirer* suggests that her early career aspirations to become a physician were derailed by a physician in the hospital laboratory where she worked as a teenager, who "became interested in her anatomical sketches made in anticipation of her medical education" and threatened to "discharge her" if she did not pursue medical art instead (Gorey, 1940, p. 54). She

did eventually abandon her aspirations to become a medical doctor and instead studied medical illustration with Brödel until 1930. During her time at Hopkins, Maciel studied and worked alongside Wishart, McLatchie, Brödel's daughter Elizabeth, and the well-known embryological illustrator Dorcas Hager Padget, all of whom continued to work in the field throughout their lives (Hill, 1965, p. 29).

Despite her own gender and that of many of her colleagues, Maciel was strongly averse to training women in medical illustration. According to one rejected candidate, Carol Donner, "Maciel refused to accept me in 1957 and she wrote a vicious, condescending dismissal letter stating the program did not accept women, as women upon graduation did not remain working in the field" (as cited in Wilson-Pauwels, 1993b, p. 126). Faced with clear evidence to the contrary, it is difficult to make sense of Maciel's position. It is possible that conflicts arose from differences of class or personality or that her own quashed medical ambitions led her to dissuade other women from the field. In any case, although some former students praised her exacting standards and single-minded commitment to medical illustration, her approach was rigid to the point of intransigence. Despite – or perhaps because of – this systematic exclusion and uncompromising discipline, many students failed to complete the program (Wilson-Pauwels, 1993b).

Unlike her peers, Maciel did not invest in developing networks or administrative frameworks for her training program nor was she an active participant in the AMI or other professional organizing. Although she did maintain ties with many of her former students and corresponded at least occasionally with Wishart's successor Nancy Joy, very little documentation of her program or her activities has been preserved aside from her artwork and reference materials. She seems to have pursued international contacts and travel to some degree, but she

remained at a significant social remove from her North American colleagues.³¹ Unlike many other program directors at the time, she did not participate in the AMI's efforts to develop standards for education and training during the 1950s and she did not publish on the matter of education for medical illustrators. According to Wilson-Pauwels' oral history, although Maciel was included as a charter member, she "was not a supporter of the AMI" and "did not attend her first meeting until 1952" (1993b, p. 126).³² Instead, Wilson-Pauwels asserts that Maciel was extremely protective of her program and "rejected criticism," to the point of sending her sole student away during an assessment visit from the AMI as part of curriculum evaluation and accreditation efforts in the late 1960s (1993b, pp. 125–126).

Although it is impossible to speculate as to Maciel's motives for gendered gate-keeping or the precise reasons for her lack of strong social networks, her trajectory makes clear the social and administrative labour required to ensure that tangible structures of professionalization, like training programs, survive their founders. Maciel's isolation from her peers not only precluded her from contributing to the formulation of educational standards but also from drawing on those connections to support her position within the University. All-or-nothing power struggles with both the AMI and university colleagues seem to have left her program administratively isolated and pedagogically "out-of-date" (Wilson-Pauwels, 1993b, p. 127). In addition to tensions with the AMI over accreditation in the 1960s, Maciel also found herself at odds with the director of the Department of Biomedical Communications at the University of Cincinnati, whose attempts

³¹ Some documents assert that she assisted with organizing training programs in Portugal and Lyon, France, but there is little evidence of what her contributions were or their long-term effect (J. Golden, 1950). She was also a Fulbright scholar at the University of Strasbourg (France) in 1956-57, but her exact activities during that period are unclear.

³² Demarest's *History of the Association of Medical Illustrators* places her at a meeting in 1951, where she "showed how to make half-tone drawings using crayon sauce on stipple board," but makes no other mention of her presence or involvement at any other meeting (1995, p. 28).

to incorporate her program she vehemently rejected (Wilson-Pauwels, 1993b). While Maciel did retain sole control of her program in the short term, the program was dropped from the AMI's listings in 1969 as it did not offer a degree. With no clear successor nor any plan for administrative continuity, the training program folded upon her retirement in 1972. Perhaps ironically, her position as staff illustrator was taken over by Jean Loos, one of the few female illustrators who had "studied under Maciel in the early 1960s, but who did not officially receive a certificate" (Wilson-Pauwels, 1993b, p. 127). Despite twenty-five years of teaching and practice, a lack of flexibility and aversion to bureaucratic oversight along with strained relationships with both her university colleagues and her professional peers resulted in little tangible legacy.

In order for medical illustration to construct itself as a legitimate and reproducible profession, practitioners needed to rationalize training and markers of medical authority while remaining flexible enough to adapt to changing circumstances and the social and economic realities of the field. Imposition of rigidly defined standards based on externally measurable attributes would result in professional marginalization, if not extinction, for any school which could not establish durable ties to existing institutions and to the emerging professional culture. However, in a protean and interdisciplinary field, excessively stringent requirements risked limiting their political and economic reach by excluding emergent practices over which they wished to exert dominion.

Federation

The proliferation of new technologies and techniques in medical and scientific visual practices was accompanied by a proliferation of competing professional organizations. In the United States, the largest and most powerful of these related groups were the Biological

Photographic Association (BPA), founded in 1931, and the Health and Science Communications Association (HeSCA), founded in 1959 (Gibson, 1981; *Hesca » History*, n.d.). Each of these organizations grew out of a distinct set of shared practices, priorities, and cultural norms. Most specialized medical photographers entered the field first as photographers, physicians, or radiographers. Although the BPA included women, the majority were men. HeSCA's members were mainly health administrators and medical personnel with an interest in visual and multimedia education, rather than specialist creatives. Despite an overarching shared interest in improving medical education and practice through audio-visual aids, in practice these differences in professional culture and competition for jurisdiction over the field led to ongoing tensions between them.

Medical photography and related media such as film and television developed alongside, but often in tension with, medical illustration. The relationship between medical illustration and medical photography had been fraught for many years. On one hand, increasingly sophisticated photographic technologies, particularly microscopic and ophthalmic photography, were replacing some areas of medical illustrators' work. On the other hand, this work was generally both difficult and tedious. As Swezey put it in an early essay,

Every trained medical artist will agree that whenever photography is adequate it should be used. Nothing is more irritating to an artist than to be asked to draw a specimen which could more easily be photographed. It is a waste of time and lacks interest. The artist's function is to select and interpret. (1943, p. 440)

Because medical illustration and medical photography occupied overlapping jurisdictions, the need to explicate the limits and strengths of each was (and indeed, remains) a constant refrain for medical illustrators. For medical illustrators, photography was construed as an aid or additional tool, but not an end in itself and certainly not a replacement for their specific form of expertise.

Nevertheless, changing technologies of medical practice and visual production would make occupational closure difficult.

In the face of post-war technological utopianism, it was increasingly difficult to counter assumptions of superior objectivity and scientific value attributed to new technologies. Furthermore, as expansion in both media and medical education continued post-war, men who had been trained up and begun working in medical photography and mass-media during the war were now competing for positions and assignments that might previously have been performed by medical illustrators. In fact, many medical art departments and training programs included medical photography and actively incorporated emerging media. However, they did not share the same history and were often treated as separate and even rival practices. In order to remain competitive, medical illustrators needed to assert dominion over the expanding field of “visual education” in medicine (Jones, 1947, p. 61).

Federation was one element of an uneven campaign to expand the purview of the AMI and to adapt to the changing landscapes of medicine and media. Faced with additional competition from other organizations and practitioners in the economically lean 1970s, the expense of both organizational and promotional activities of the AMI was increasing faster than its membership. However, attempts to join forces with allied groups were largely unsuccessful. Although there had been some discussion of a joint meeting with the BPA as early as 1955, the proposal had not been considered practical at the time. As the organizations continued to navigate their overlapping but distinctive practices in a competitive but specialized field, the concept of “federation” arose again. In 1972, discussion with allied groups was “spirited and divided” (Demarest, 1995, p. 63). Despite reservations, an alliance was indeed formed with HeSCA in 1974 and the first joint meeting of the AMI, HeSCA, and the BPA was held in 1976.

Nevertheless, although the combined meetings were generally deemed successful, gathering together nearly a thousand practitioners, after a few years the allied organizations determined that their loose confederation was “not working and should be allowed to die” at their final joint meeting in 1984 (Demarest, 1995, p. 82).³³ The failure of confederation made clear that overlapping practices and subject matter were insufficient to unite the different groups. The cohesiveness of medical illustration as a profession was also a matter of shared values and cultural norms.

In order for the AMI and training programs to serve as trustworthy arbiters of authority and credibility, some form of gatekeeping was required to ensure that new members could be trusted to meet and perpetuate “professional” standards of practice and comportment. Accreditation of training programs was one strategy to limit entry to those whose could be trusted to uphold and perpetuate them, but the expansion of professional practices meant that these shared values and standards could no longer be assured based on training and professional experience alone. In addition to explicit policies including codes of ethics, membership, and certification, emphasis on the founding father narrative would serve as a cultural touchstone distinguishing the field.

Reproducing medical illustrators

The social reproduction of shared professional values was ensured not only through formal regulatory mechanisms, but also through informal social and cultural norms, including the perpetuation of the Brödel narrative. At mid-century, the field of medical illustration was small

³³ The BPA later became the Biocommunication Association (BCA). Since 2000, the BCA and AMI jointly edit and publish the *Journal of Biocommunications*. HeSCA held its last meeting in 2014.

and relatively homogenous. Most of the AMI's founding members had trained under Brödel or Jones and thus shared a similar enculturation to the field. They were also almost exclusively white and upper class. Many had been recruited by family or friends in the medical field and were graduates of elite women's colleges. In Canada, key figures like Maria Wishart, Nancy Joy, and Eleanor Sweezey shared longstanding social ties within the relatively small circle of elite settler Canadian families. The commensurability of their training, their work experiences, and their values were almost universally assured. Those few who did not fit, like Mary Maciel, remained on the periphery or, like Canadian farmer's daughter Ranice Crosby, quickly assimilated. As the professional body expanded, inclusion was predicated not only upon the ability to meet the standards for validating expertise at each step, but also to both embody and enforce social norms. Emphasis on the Brödel origin story not only devalues the role of women in building the profession, it also obscures the ways in which gender, race, and class hierarchies were woven into the fabric of the field.

Through their teaching, organizing, and storytelling, women practitioners ensured the social reproduction of a shared history and value system. Even as their work expanded into new media and biomedical specialties, Crosby, Wishart, and McLatchie Miller continued to teach Brödel's techniques, often using the same exercises. Despite the acknowledged obsolescence of the carbon dust technique, the detailed tonal study of a hip bone remains one of the first assignments in the Johns Hopkins program today. In her later years, Crosby devoted much of her energy to preserving and documenting Brödel's legacy in the form of a substantial archive and a written biography. Contemporary students are often encouraged to seek out Brödel's work as a reference for their own. As I explored in Chapter Two, these histories and exercises are deployed in contemporary graduate training as a means of transmitting values like close observation,

judicious use of materials, and subservience to science. Although each department draws on its own unique history and culture, the shared figure of Brödel as founding father ties together these disparate approaches.

A powerful masculine origin story ensured that practitioners arriving from disparate backgrounds could be enculturated into a shared professional body. The creation of academic programs and professional organizations entailed decades of organizing, negotiations, and paperwork. This work was rarely glamorous and often invisible, but it was fundamental to the success of the professionalization project. Brödel's former students modeled their programs after their own training and joined together with the explicit goal to "raise the standards of medical illustration and expand its scope" (Jones, 1947, p. 59). As I explored in Chapter Three, as an idealized model of epistemic values and culture to which all medical illustrators are expected to aspire, "Papa" Brödel transforms whiteness and maleness into heritable qualities of expertise and professional comportment. However, this inheritance required the work of women like Crosby, Wishart, and McLatchie Miller, as well as Nancy Joy, Linda Wilson-Pauwels, and others who continue to tell those stories, often at the expense of their own.

Medical illustration had long been a scientific profession peculiarly open to women, but it was also a site of epistemic insecurity and economic precarity. Anchoring professional identity in shared values and a powerful founding figure deflects some of these anxieties, but in doing so, it obscures not only the labour required to construct medical illustration as a legible profession, but also what is at stake in doing so. Professional degrees and the backing of a professional organization promised increased status and economic security by enabling medical illustrators to validate their expertise and establish their credibility through external mechanisms. External validation was especially valuable to women because legible bureaucratic structures shifted the

locus of authority out of individual (gendered) bodies and into institutional norms and regulatory practices. Established institutions like medical schools and hospitals and recognizable bureaucratic forms like credentials and educational standards could act as a proxies for scientific authority and soothe epistemic anxieties aroused by representational practices and practitioners' gender. Greater institutional and collective power enabled them to advocate for better pay and working conditions, as well as defending and expanding their professional domain. However, as I explore in the next chapter, the profession remained both economically and epistemically precarious.

Chapter Five: Classification Challenges

Precarity, legibility, and gendering expert labour

In late December of 1966, Montreal-based medical illustrator Eleanor Sweezey wrote to the Canadian Academy of Medical Illustrators (CAMI), concerning the proposed classification of civil service jobs into administrative categories. She sought the CAMI's support to resist the potential devaluing of her qualifications:

... they are trying to put me in the Technical Category instead of the Scientific and Professional Category. The minimum qualification for the Technical category is Completion of Secondary School. I pointed out that that is not even enough to get you admitted to a school of medical illustration. (Sweezey, 1966).

Her concerns about the legibility and status of her qualifications were particularly relevant as the group worked to develop its own educational standards for Canadian schools of medical illustration.

Over the next few years, she discussed the matter at intervals with the CAMI and with the new head of the University of Toronto Art as Applied to Medicine program, Nancy Joy. As the sole medical illustrator in government service (at the Queen Mary Veterans Hospital), Sweezey acknowledged that she was “an anomaly,” who nevertheless needed to be fit into some category “for the purposes of collective bargaining” (1969). Although these distinctions might seem to be of little consequence for just one person, Sweezey was concerned that “the Government is setting a precedent which might be invoked by other hospitals and medical schools” (1969). The question of classifying Sweezey's labour within the civil service had broader implications for the prestige, pay, and working conditions of all Canadian medical illustrators.

In Sweezy's eyes, the future of the field depended on official recognition of the professional and scientific nature of their work. Sweezy's justification for classifying her position as skilled knowledge work hinged upon her superior level of scientific and medical education and the high-level professional judgement required to accomplish her craft. She was unsure of whether to recommend the category of "Technical" or "Scientific and Professional" for graph artists and assistants, but for her own position she was less equivocal:

The Civil Service insisted that I should fill in the specifications for my own job on a "Technical" category form (the Professional forms aren't out yet) but I refused and submitted it on plain paper with a covering note in the body of the description. I figured that they could throw away a covering letter. (Sweezy, 1967)

Sweezy's pointed defiance of bureaucratic constraints made clear the limits of the categories they sought to reify.

In spite of this determination, her attempts to have her work classified as "Scientific and Professional" were ultimately rebuffed (Sweezy, 1969). In a last-ditch effort to avoid the "Technical" label, Sweezy "rewrote [her] duties to emphasize the administrative aspects" and proposed the Administrative category as "a possible alternative to the Professional Category" (Sweezy, 1969). Reframing her work enabled her to gain access to higher pay grades, job security, and autonomy, but only by privileging a more legible (and less prestigious) category of already feminized labour over her scientific expertise and specialized training.

Sweezy's classification challenge is illustrative of the ways that economic anxieties and epistemic ambiguity informed medical illustrators' professionalization projects in the later part of the twentieth century. To achieve economic stability within a male-dominated medical field, female professionalizers like Sweezy aligned their expertise with existing gendered categories of labour by recasting themselves as administrators and intermediaries. Although this strategy enabled some medical illustrators to secure greater status and stability, it did not result in

recognition of their labour and expertise *as illustrators*. Despite some gains, working conditions and remuneration remained highly variable and positions themselves precarious, especially for women and practitioners working outside of the United States. Medical illustration remained “women’s work.”

Giving particular attention to the Canadian context, in this chapter I argue that the gendering of medical illustration is not a side effect but rather an integral aspect of the field. As I explored in Chapter Four, embedding credibility in established institutions and in bureaucratic structures enabled medical illustrators to secure greater status and stability.³⁴ However, articulating and enforcing professional boundaries required a good deal of ongoing administrative labour, which tended to fall disproportionately to women. Medical illustrators’ efforts to document and publicise their expert skills in the 1960s and 1970s provide a window into the ways the epistemic, economic, and gendered anxieties informed both the kinds of professional projects they pursued and their chances for success. By the end of the 1970s, emphasis shifted away from broader epistemic claims to a more modest construal of their role as administrators and “generalists.” The devaluing of both administrative labour and labour done primarily by women reinforced the devaluing of medical illustrators’ professional expertise and the continued classification of interpretive visualization practices as ancillary, rather than essential.

³⁴ For a general discussion of disciplinary formation, specialization, and organizational change in medicine in the twentieth century, including the overall restructuring of medical education and practice, see Starr (1982), Stevens (1998), Sturdy & Cooter (1998), and Kaiser (2005). On the dynamics of professionalization and specialization in particular sub-fields, see also Abbott (1988), Howell (1996), Linker (2011b), and Weisz (2006).

Gendering precarity

After the First World War, medical illustration had offered an unusual outlet for educated middle- and upper-class women with an interest in scientific and medical topics and who were not content to simply “return to the social life” of their pre-war days (Blackstock Thomson, 1981, p. 13). Although educational opportunities had expanded for upper-class women, many who pursued degrees in the sciences and math still found themselves with few career opportunities. For example, Eleanor Sweezey explained,

At the time I was studying math and philosophy at Queen’s and wondering what I could do with them when I had to earn a living. What I wanted to do with math was become a navigator on a ship but neither the navy nor the merchant marine was sympathetic to the idea of training a female. The government felt I should be helping the war effort and offered me a job measuring munitions gauges. Fortunately for me my mother was in Montreal and she met [Elizabeth Blackstock’s aunt] Hattie Blackstock Thompson [a medical illustrator] at a dinner party. (1995)

Connections to the medical field through friends or family enabled well-connected white women like Sweezey, Maria Wishart, and Harriet (Hattie) Blackstock (later Thompson) to envision an alternative path.³⁵ However, this path was still limited. Many were forced to leave or curtail their activities upon marriage or passed over for employment opportunities in favour of men.

Nevertheless, medical illustration was actively promoted as a career option for middle-class women. As early as 1929, Harriet Blackstock had been the subject of an article in *MacLean’s* magazine (a Canadian-focused news magazine aimed at a bourgeois readership) which framed medical illustration as “one of the most unusual professions open to women” (Muir, 1929, p. 55). In 1949, the corresponding secretary for the Association of Medical

³⁵ As discussed in Chapter Four, Maria Wishart was appointed as artist to the Faculty of Medicine of the University of Toronto in 1925 and established a training program in Art as Applied to Medicine (later known as BMC) in 1945. Elizabeth Blackstock, who had served as a part-time assistant to Wishart beginning around 1936, became one of its first graduates alongside Marguerite Drummond in 1946. Harriet Blackstock Thompson (1894-1990) studied with Max Brödel at Johns Hopkins from 1922 to 1924. She directed the Department of Medical Illustration at McGill University Faculty of Medicine and the Royal Victoria Hospital from 1925 to 1932.

Illustrators (AMI) reported that the inclusion of medical illustration as a “job idea” in *Glamour* magazine had triggered an onslaught of 155 inquiries (Demarest, 1995, p. 24). Throughout the 1960s, newspaper articles continued to appear under rubrics such as “Women’s section,” “For and about career girls,” and “feminine angle” (Matsumoto, 1969; “Meet the Girls with the Unusual Jobs,” 1968; Rex, 1961). Although medical illustrators rarely commented on the gendering of their occupation in their own self-promotional writing, the apparent disjuncture between subject matter and femininity was especially compelling to journalists. The author of the *MacLean’s* article was unusually blunt:

The greater majority of students who are doing anatomical art, I learned, are women, and Miss Blackstock considers women better suited to this work than men because they very often bring to the job more concentration and attention. They don't demand, although they should, such large salaries as men do, but on the other hand they are more likely to throw up their work for marriage or for some other vocation than are men, for a man makes his work his life work, in most instances. It is a sphere where women were accepted almost, if not quite, at the beginning, and one in which they do as well, if not better work than do men. (Muir, 1929, p. 56)

Most later authors were a bit more circumspect. Articles suggested that those who could “overcome the laymen's reactions to dismemberment of the human body” would find the “grim” field was not only open to women but even a “feminine forte” calling on practitioners’ “artistry” and “imagination” (Schrag, 1949, p. 15).

Despite being advertised as a feminized field, women also encountered barriers to entering and pursuing medical illustration. As discussed in Chapter Four, some instructors like Mary Maciel refused to take on female students at all. For example, in a 1972 newspaper interview, Buffalo, New York based medical illustrator Marion Ward Johnson described her early attempts to study medical illustration at the Rochester Medical School, in the 1940s: “They took three or four students a year but the director told me he just wouldn’t take a female student. He

said it was ‘nothing personal,’ just his policy” (as cited in Buyer, 1972, p. 16).³⁶ Frustrated but adventurous, Ward Johnson took a more circuitous route, eventually carving out a career in the field without formal training. Others agreed to train women but doubted and even thwarted their career potential. For example, in 1955, senior medical illustrator Ralph Sweet, of the University of California in San Francisco (UCSF) was reluctant to provide Laurel Schaubert a recommendation for a position in the university’s experimental surgery department. Schaubert had just completed her training with him and urgently needed to support herself and two children after a divorce, but Sweet “didn't really like the idea of women working” (McBride, 1980, p. 2132). He relented only when she agreed to his ongoing supervision of her work. Echoing decades-old assumptions, another department head assured reporters, “The girls are doing a fine job. Several of them are even continuing to work at it after marriage” (Waldron, 1966, p. 9).

Despite this resistance, most programs still took on more women than men. However, once trained, women often faced a higher degree of skepticism and reticence in the workplace as well. Although many practitioners were highly trained in the sciences, that training was frequently overlooked. In an interview, Helen, a retired medical illustrator, explained to me that doctors often struggled to take her medical acumen seriously:

I said where's the incision happening, how long is it? And he said oh, just put a line on the tummy. [laughs] And I said well, I can't do that. [laughs]. [...] they certainly didn't take well to being constrained to speak medical terminology to a woman sitting drawing things.

Another interviewee suggested that the detailed embryological studies of Dorcas Hager Padget had been misconstrued for decades in part due to a “sexist attitude” which led physicians

³⁶ The University of Rochester School of Medicine and Dentistry added a training program to their existing medical illustration service department around 1948, headed by Natt Jacobs. Jacobs was replaced by Melford Deidrich in 1959. The program began operating jointly with the Rochester Institute of Technology around 1976 but was not able to achieve accreditation from the AMI until 2022.

to “assume they understand what she drew, and then [...] impose their ideas on it” (Julie, faculty practitioner). Credit for innovative work in the field could similarly shift from women to their male peers. For example, while working with Tom Jones at the University of Chicago, Ruth Coleman Wakerlin’s background in chemistry enabled her to develop new techniques for creating three-dimensional models. However, some illustrators I spoke with attributed to Jones her well-known transparent model of a pregnant woman, first exhibited at the Museum of Science and Industry in 1947 (Hildebrand, 1951; Wilson-Pauwels & Gralapp, 2010). Despite illustrators’ efforts to explicate their qualifications and skill set, the work they performed continued to be interpreted through a gendered lens, recasting female illustrators as their male colleagues’ “right hand man” or “girl Friday” (Hildebrand, 1951; Lauricella, 1963). Indeed, the head of the service department of a large cancer treatment center in Buffalo, New York, praised a graduate’s ability to “work as well as a man” in various media, but notably did not mention her medical or scientific expertise (Lauricella, 1963, p. 3D). Assumptions about the kind of labour that women could perform continued to colour assumptions about the nature of the work they actually did.

Epistemic precarity

The invisibility and misconstrual of medical illustrators’ work is not accidental. As I explored in Chapter One of this dissertation, the history of medical illustration is marked by perennial anxieties around representational practices. One way of assuaging those anxieties was to assert the insignificance of the illustrator’s will and interpretive skill. For centuries, authors of illustrated anatomical and medical texts took pains to assure their readers in the preface that the author, not the illustrator, had ultimate control over the images they published. Although the criteria on which the image’s credibility rested changed over time, the compulsion to explain and

reassure the reader remained remarkably constant. Lorraine Daston and Peter Galison (2010) have traced these anxieties as part of a history of objectivity itself. For them, concerns about the qualities and qualifications of the properly scientific image reflect preoccupations with the nature of truth and truthfulness. In this sense, the gradual delineation of subjectivity and objectivity emerges as a strategy for managing epistemic doubts about representational enactments of knowledge. This analysis suggests that the rhetorical function of the preface is to assure the reader that the drawings were produced according to the reigning epistemic virtues of the time. Although the prefaces of atlases provide a great deal of insight into what the author *believes* to be the credentials of a trustworthy or accurate image, they explain very little about the vicissitudes of actually producing such an image.

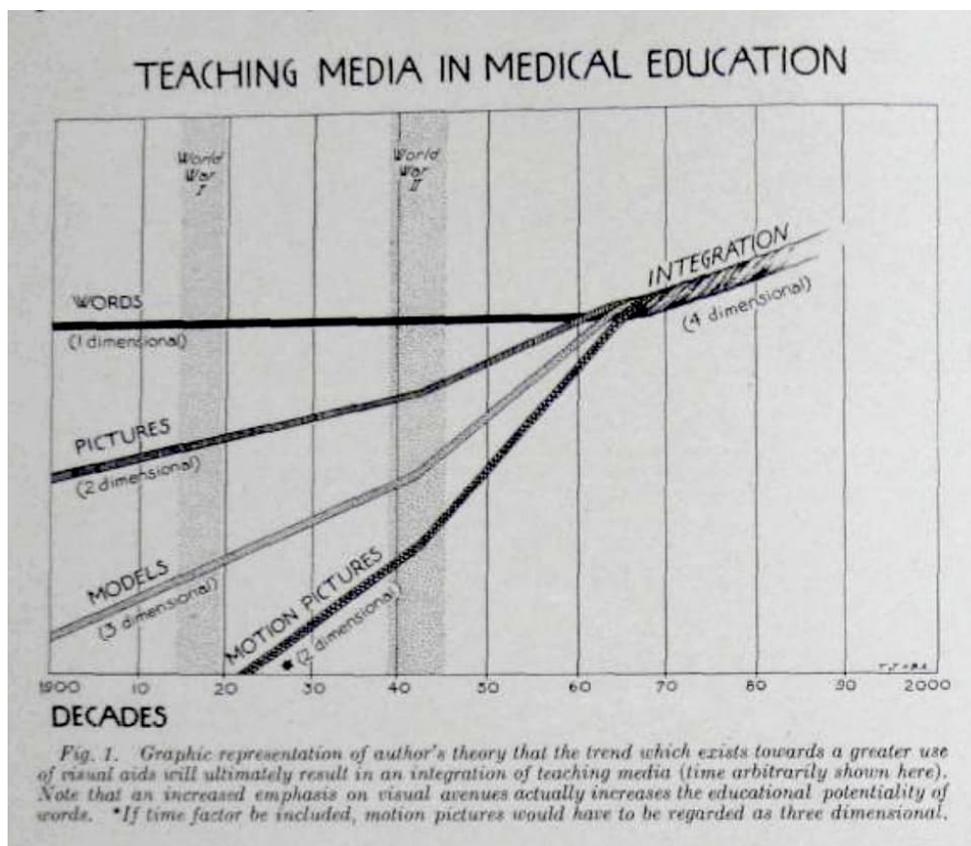
By the mid-twentieth century, illustrators were often credited and even praised by name, but emphasis on the mechanical processes and technologies by which the images were produced continued to misconstrue the work of the illustrator. Demand for original medical illustrations and related products increased steadily over the course of the twentieth century. In the early part of the century, the most popular and highly circulated anatomical atlases in North America were produced in Germany (Sawchuk et al., 2011). However, access to these texts became difficult as publishing and circulation dwindled during and after the First World War (Sawchuk et al., 2011). This material change was accompanied by shifts in the political economies of medical education, resulting in a greater emphasis on the production and publishing of medical texts within North America (Sawchuk et al., 2011).³⁷ Even as publishers emphasized the necessity of high-quality illustrations, the credibility of medical texts lay in the reassurance by authors and anatomists that illustrators were closely supervised and had not taken any liberties.

³⁷ On North American medical publishing in the twentieth century, see also Connor (2009).

It was in this climate that anatomist J.C.B. Grant at the University of Toronto directed the production of the first anatomical atlas produced entirely in North America, containing hundreds of original illustrations by Dorothy Foster Chubb and Nancy Joy.³⁸ The preface to *Grant's Atlas* provides a detailed description of the “preliminary steps” by which his dissections were positioned, photographed, enlarged, traced, and checked for accuracy. The tracing thus produced was “presented to the artist who transferred it to a suitable paper and having the original dissection beside her, proceeded to work up a plastic drawing in while the important features were brought out” (Grant, 1943, p. vii). The reassuring description ends just at the point when the illustrator enters the frame. However, despite the author’s emphasis on mechanical reproduction as a guarantee of accuracy, Joy later explained that images could not be traced “too literally” (as cited in Sawchuk, 2012, p. 141). On the contrary, in order to render an accurately proportioned and positioned specimen, illustrators Foster Chubb and Joy had to account and correct for distortions caused by the apparatus (Sawchuk, 2012, p. 141). Failure to compensate for the camera’s limitations generated frustration and criticism, but when the illustrator was successful, “accuracy was largely ascribed to the camera and not to the abilities of the illustrators who corrected the camera’s distortions” (Sawchuk, 2012, p. 141). As Sawchuk makes clear, photography enabled a degree of automation, but the “animation” of the image as a lively repository of reliable anatomical knowledge depends upon both the efforts and skill of the illustrator and upon her erasure.

³⁸ Dorothy Foster Chubb (1908-2005) began working as a technical assistant to Maria Wishart at the University of Toronto in 1928. She studied medical illustration with Max Brödel at Johns Hopkins from 1930-31 before returning to work with Wishart again until 1938. However, she returned to work on *Grant's Atlas* in 1941 and continued contributing until its sixth edition in 1972. Nancy Joy joined her on the project for the second volume of the first edition.

Image 10

Teaching media in medical education

By Thomas Jones, from Jones (1946a).

Throughout the mid-century, medical illustrators attempted to clarify their peculiar role. In a 1943 article for the *Canadian Medical Association Journal* promoting the use of trained medical illustrators, Sweezey explained bluntly “The artist’s function is to select and interpret” (1943, p. 440). Far from “copying naively specimens” placed in front of her, the value of a good medical illustrator lay precisely in her ability to accurately observe, understand, and render legible a complex array of visual and functional information (Sweezey, 1947, p. 51). Unlike a camera, she could omit extraneous information from “swabs and blood stains” to the particularities of a specific patient or operative setting (Sweezey, 1943, p. 441). Moreover, a

trained artist could produce a more comprehensive picture through extensive background research including x-rays and even physical palpation. She could incorporate a broader understanding of the scientific and medical context, convey underlying structures, and even “suggest the element of time” through visual devices such as arrows and shading (Sweezey, 1947, p. 51). In failing to acknowledge the importance of hiring trained professionals with this peculiar combination of technical skill and in-depth medical knowledge, she warned, publishers and teachers were wasting time and money on reproducing illustrations that were not only misleading but even blatantly incorrect. Nevertheless, despite the efforts of illustrators like Sweezey to explain their active contribution to scientific knowledge and to encourage authors to “regard the illustrator as an expert in his own field,” they remained all too often sidelined (Conrath, 1952, p. 694).

The Second World War had triggered additional expansion and rationalization of medical training, including use of visual materials. In conjunction with rapid technological change, emphasis on standardization drove demand for reproducible and mobile visual materials, resulting in both increased volume and an increased range of material practices for medical illustrators. Mid-century medical illustrators embraced these changes with the belief that the “awakened interest in visual instruction manifest in the whole field of medicine” would encourage medical schools to recognize and invest in medical illustrators to meet that need (Jones, 1946b, p. 9). Chicago department head and AMI president Tom Jones optimistically predicted that “a department of visual education fully integrated with the teaching, research and administrative machinery” would be “standard practice in medical schools in the not too distant future” (Jones & Foster, 1955, p. 1). However, like Jones’ post-war vision for a “National Institute of Visual Education in Medicine,” the dream of a “comprehensive” and “centralized”

service handling audio-visual media for medical education and research was rarely realized and always under threat (Jones, 1946b, p. 12; Jones & Foster, 1955, p. 1).³⁹

Economic precarity

The increased demand for visual materials of all kinds did not translate into a more central role for medical illustrators in the machineries of medical knowledge. The formation of the AMI in 1945 helped somewhat to publicise and grant credibility to the profession, but working conditions and remuneration remained unsatisfactory and positions themselves precarious. Despite efforts to rationalize and regulate the education of medical illustrators, their qualifications and credentials were often overlooked or ignored, as Sweezey's classification challenge shows. Rather than improving the prospects for medical illustrators, increasing demand resulted in tighter deadlines and budgets but not higher regard for the skills required to produce specialized work. Despite a growing emphasis on "profusely illustrated" texts throughout the mid-century, medical institutions and publishers evinced little understanding of the resources and skills required to produce accurate and effective illustrations and even less desire to pay for them (Sweezey, 1969, p. 51).

The working conditions of most medical illustrators failed to appreciate the material and physical requirements of the job, much less its intellectual demands. The time and effort required for a given image depend on both the complexity of the work and material constraints including media and its intended use. As Wishart pointed out, "twelve drawings altogether may only have taken one-third of the time spent on the single drawing" for a different brief (UofT Dean's

³⁹ In addition to describing existing facilities and organization, many illustrators and medical photographers put forth proposals and designs for an ideal department. See for example McLatchie Miller (1946), Hansell (1946), Hansell and Ollerenshaw (1947), and Doray (1968).

Report, 1937, p. 45). Medical schools and publishers alike balked at any accurate calculus of fair compensation and those responsible for hiring and commissioning illustrations often failed to include the cost of illustrators' time and expertise in their budgetary calculations. Although some practitioners were employed on a salaried basis within institutions, most were paid on an hourly basis or by project and the amounts could vary enormously. An hourly wage penalized expertise: a less experienced illustrator was apt to take more time, meaning that a more experienced illustrator would in effect be paid less for the same end product. At the same time, payment per drawing was difficult to negotiate, as it tended to undervalue the illustrator's time and specialized skill set. Neither approach accounted for the growing costs of acquiring and mastering new technologies and media.

Even in larger institutions such as universities and hospitals, medical illustrators were rarely equipped with sufficient space or resources for their work. Instead, they were often relegated to cramped, ad hoc spaces ill-suited to the work. In a 1946 article for *Modern Hospital*, Muriel McLatchie Miller noted that early in her tenure at the Massachusetts General Hospital (MGH), the combination of poor quarters (“a screened-off area in a hallway between a fire escape and an elevator”) and the novelty of an in-house medical illustrator meant that “I was peeped at by all who passed by somewhat in a manner of the traditional ‘bird in the gilded cage’” (1946, p. 63). Beyond the material necessity of essentials such as adequate space, proper lighting, and running water, the lack of privacy and constant interruptions were an active hindrance to the intense concentration required for detailed work. As Wishart's 1937 report to the University of Toronto's dean of medicine explained, poor conditions had direct consequences on the work:

Over and above the awkwardness of a crowded room the loss of privacy, necessary for concentration, is greater yet. An interruption for one has meant an interruption for all. The

result has been a poorer quality of work as well as the decreased output mentioned above.” (UofT Dean’s Report, 1937, p. 45)

Limited time and space affected not only quantity but also quality of output, meaning that underpaying and underappreciating medical illustrators also had epistemic consequences.

Issues of plagiarism and professional ethics help to illustrate the relationship between epistemic and economic concerns. Near the end of his life, Max Brödel penned an article on medical illustration, which opened by outlining its relationship to the production and dissemination of knowledge in medicine. Plagiarism was, he argued, not merely a matter of money or pride, but of truth:

[...] old pictures are apt to contain errors, sometimes glaring ones. A plagiarist who is too indolent to seek the truth through original investigation and copies old illustrations with ancient errors perpetuates them. For this reason alone there should be no plagiarism in medical pictures. (M. Brödel, 1941, p. 668)

Brödel explicitly construed the issue of plagiarism as a threat to epistemic values. He warned that an artist might be tempted to copy without credit rather than “choosing the honest road of original study from nature” (M. Brödel, 1941, p. 668). However, he also acknowledged that “economic factors, demanding speed” could result in reliance on existing images rather than “original investigation” (M. Brödel, 1941, p. 668). In fact, economic factors including ever-increasing volume, tight publishing timelines, and overall lack of space or resources rendered Brödel-style original investigation, much less full control over use and reproduction, almost impossible for all but the most successful medical illustrators.

Despite the considerable time and effort to produce novel illustrations, medical illustrators often had little power over their eventual publication and circulation, and very little legal recourse in cases of infringement or plagiarism. Once produced, images usually left their creators’ hands. To save time and money, authors and publishers might re-use or adapt illustrations from previous publications with no thought to contacting or compensating the

original artist. In addition to illustrations themselves, medical illustrators often handled planning and preparing images for publication – from determining the scale and style for best reproduction to lettering and layout (McLatchie Miller, 1952). Not only were these tasks time-consuming, but illustrators also often found their careful plans ignored by a publisher or printer more concerned with the cost than legibility. The difficulty of claiming or enforcing rights of authorship and reproduction reinforced the devaluing of medical illustrators' labour and impeded their claims to authority and autonomy.

Although early arguments against plagiarism were formulated as a moral or epistemic concern, the bulk of professional organizing around unauthorized reproduction hinges on its practical economic effects.⁴⁰ Within a few months of the organizing meeting of the AMI in 1945, its Ethics and Professional Relations committee received the first of many plagiarism complaints. The complaint came from Johns Hopkins urological illustrator and erstwhile head of the Department of Art as Applied to Medicine (AAM), James F. Didusch.⁴¹ Didusch's grievance arose in response to the unsanctioned reproduction of work done by himself and Brödel. With few formal protections in place at the time, the complainant had no official copyright on the images and could expect no monetary compensation. Like Brödel, Didusch pleaded on moral grounds: "We rely upon the decency and honesty of the copyist for deserved credit" (as cited in Demarest, 1995, p. 14). Because both Brödel and Didusch were Johns Hopkins employees, the

⁴⁰ While an in-depth exploration of these issues is beyond the scope of the present work, it is worth noting that plagiarism and unauthorized (uncompensated) re-use remain significant concerns. Indeed, members of the AMI were deeply involved in advocacy around United States copyright protections and related legislation in cooperation with other professional groups for visual artists and illustrators. This collaboration is possible in part because even arguments that hinge on the high degree of specialized knowledge and research involved are framed in economic rather than moral terms; contemporary copyright discussions emphasize the economic value of medical illustrators' skilled labour, but not the epistemic risk of perpetuating errors.

⁴¹ James F. Didusch succeeded Brödel as head of the program in 1941, but resigned the following year and was replaced by Ranice Birch (later Davis, Crosby). As discussed in Chapter Four, she remained head of the program for the next 40 years.

use of their work without compensation or acknowledgment was primarily an affront to gentlemanly behavioural norms (and perhaps ego). However, for more precariously employed medical illustrators, the economic impact of unauthorized reproduction could be far more damaging. Since a medical illustrator's work prospects tended to hinge on reputation, poor reproductions and copyright infringement could affect future income opportunities as well. Many medical illustrators simply could not afford to have their work reused without compensation and credit. With the expansion of medical publishing and visual media, this lack of ongoing control over the fruits of their labour became a growing concern for medical illustrators, regardless of their individual working conditions.

The relatively high cost of providing adequate infrastructure and up-to-date technologies, coupled with the time investment required to produce high-quality work, made medical illustration a hard sell. As I explored in Chapter Four, institutional approaches to budgeting and material support varied widely. Medical illustration departments – where they existed – tended to occupy an ambiguous and marginal position within organizational infrastructures. This meant that their sources of funding were often ad hoc or discretionary, subject to change from year to year on the whims of changing leadership. Although working conditions did improve somewhat in the 1950s and 1960s, they remained insecure and vulnerable to budgetary anxieties, especially as Wishart and Swezey's generation headed into retirement. Whether salaried, paid hourly, or per illustration, illustrators' compensation and working conditions did not always adequately reflect the time commitments and expertise involved in researching and rendering a high-quality product, much less the capital costs of space and keeping up with technological changes. As long as their employers failed to recognize the specialized knowledge and training, sustained

attention, and complex thinking required for their work, medical illustrators' requests for adequate space, time, and pay remained a low priority.

The highly gendered nature of the field also contributed to this precarious status. For example, when Grant recruited Foster Chubb in 1941 to produce "about 500" illustrations for his new *Atlas of Anatomy*, she was to be "paid monthly on an hourly basis" (Foster Chubb, n.d.). This arrangement was reached only after some negotiation with the Baltimore-based publisher Williams and Wilkins (Grant, 1941). On learning that Foster Chubb had not yet been paid for nearly two months of work, Grant pursued the issue with the publisher, arguing that remuneration per illustration was "not feasible" but "\$150 a month is a reasonable salary for a full day's work of eight hours each day and four on Saturday, i.e. \$44.00 a week," a rate of dollar an hour (Grant, 1941). Prorated to account for Foster Chubb's actual working hours (36 hours per week) and "domestic obligations," this would amount to about CA\$125 a month according to her calculations (Grant, 1941). In the end, Williams and Wilkins agreed to pay Foster Chubb CA\$125 for 150 hours of work (Grant, 1941). After two years of work and hundreds of original illustrations, Foster Chubb would earn about \$1500 for the first edition of the *Atlas*, published in 1943.

On the other hand, although he had trained and was employed as a medical doctor, Frank Netter took up medical illustration as a sideline during the American Great Depression, charging "about \$50 for a picture" (Netter, 2013, p. 129). A cheeky quote early in his career as an illustrator succeeded in securing \$1500 *each* for a series of five illustrations for a large pharmaceutical company (Netter, 2013). By 1934 he had discontinued practicing medicine entirely because illustration was more lucrative. Netter's relative renown stems in part from his prior medical training and to the high production values and wide circulation of images created

mainly for pharmaceutical marketing. However, even accounting for differences between commercial and academic budgets, it is difficult to justify this astronomical discrepancy based purely on the illustrator's ability or medical training.

The paradox of gendered precarity

Despite some masculine incursions into the field and efforts to establish medical illustration as a recognizable "profession," the field remained female-dominated precisely because this gendering enabled wages to remain depressed in relation to qualifications and training. On one hand, women practitioners tended to be "looked upon as amateurs, not really making a serious career for themselves and maybe doing it as voluntary work" (Archer, 1998, pp. 217–218). On the other, as Marguerite Drummond later put it in a phone interview, "salaries weren't high enough for men to support families" (as cited in Wilson-Pauwels, 1993a). The gendering of the profession continued to reinforce the devaluing of medical illustrators' expertise and vice-versa.

Men like Tom Jones were hopeful about the promise of post-war technological expansion, but it also posed a threat to women's opportunities. More men had entered the field of medical illustration during the Second World War as part of their military service, often bypassing the extensive training that women like Swezey had received.⁴² As the war ended,

⁴² Patricia Archer (1998) and Samuel Alberti (2018) have explored wartime medical illustration and its effect on post-war professional organizing in the British context, but this aspect is only obliquely documented in the North American context. Phillip Conrath (1952), Jones (1944b, 1944a), and Waters (1946) all refer to the advancement of visual education after the war as a result of wartime education or the military itself, but they offer no practical explanation for how these changes were accomplished, nor by whom. Similarly, Gerald Hodge mentions that

In 1918 an Art Section was established as a branch of the Chief Surgeon's Office, and during World War II every major theater had its department of medical illustration. The Veterans Administration, the U.S. Public Health Service, and the Armed Forces Institute of Pathology have well-staffed and well-equipped departments of medical illustration. (1955, p. 305)

many of those men were able to secure positions in medical illustration departments while others entered the field via more technical fields such as photography. Regardless of their technical knowledge, experienced female medical illustrators often found themselves either underpaid and under-appreciated or passed over in favour of men. Although medical illustration was actively promoted as a potentially viable career for women throughout the mid to late twentieth century, access to stable, well-paid employment remained limited, especially for women.

Despite inconsistency in both remuneration and respect for medical illustrators' expertise, medical illustrators' salaries were generally above the average wage. A 1961 news item promoting the field in a special section "for and about career girls" in Toronto's *The Globe and Mail* newspaper suggested that graduates of the University of Toronto program "should expect a starting salary of around \$5,000," an attractive rate compared to typical salaries for female office workers, but just barely competitive with rates for lower-seniority male office workers (Rex, 1961, p. 15).⁴³ However, while a few institutionally-employed medical illustrators were able to command salaries comparable to medical professionals with whom they worked, many were employed as technicians, not academics or researchers, and were paid hourly or by short-term contract (McLarty, 1962, p. 7). A 1971 survey of freelance charges in the Toronto area found that the "average rate is \$10.00 per hour but ranges from \$6.00 - \$15.00" (CAMI AGM Minutes,

Unfortunately, Hodge offers no specifics regarding how the military recruited or trained this staff nor their fate after the wars ended. Hodge himself trained at Johns Hopkins after completing his own military service during World War Two; Robert Blake (1916-2014) first began working in the Duke University Division of Medical Illustration as a conscientious objector. A few documents in the Johns Hopkins archives suggest that the military sought to recruit trained male illustrators, however relatively few were deemed to be of appropriate age and skill. Although national contexts differ in a number of important aspects, it is likely that the gendered aspects of recruitment and training of military medical illustrators in the United Kingdom, Canada, and the United States were at least comparable.

⁴³ According to Statistics Canada (2008), average salaries for female clerical workers in Toronto in 1965 ranged from \$58 a week for a junior typist to \$89 per week for a senior secretary. For men, salaries ranged from \$82 a week for an intermediate clerk to \$130 a week for a senior draughtsman. Only the position of intermediate clerk is duplicated across genders in the statistics, with women making \$69 per week in that position.

1971). Again, as compared to the minimum wage, ranging from as little as one Canadian dollar an hour (for women) in some provinces to CA\$1.50 in Quebec and CA\$1.65 per hour in Ontario, these were very competitive wages (Treasury Board of Canada Secretariat, 2016). However, they were less impressive when considering the amount of education most medical illustrators received.

Moreover, although wages overall were rising quickly, women's average wage was still about half that of men's (Rashid, 1993). Much as in the United Kingdom, "men's employment expanded most in areas that were generally higher paid, higher status, and full time, whereas women's employment continued to expand in lower-paid and part time employment" (Hicks, 2018, p. 215). The concentration of women's employment in lower-wage and part-time positions created a paradoxical situation in which, despite women's and men's wages rising at roughly comparable rates, women's "increased proportion among all wage-earners depressed overall the average wage" (Rashid, 1993). Medical illustrators faced a similar paradox. Despite the overall higher wages and status of medical illustration, the field continued to be defined by gendered expectations around pay and working patterns. In 1967, CAMI members agreed that a salary of CA\$6500 to CA\$8000 per year was reasonable for a recent graduate working under the supervision of a more experienced illustrator. However, there were few full-time medical illustration posts available in Canada. Salaries in both Canada and the United Kingdom remained below CA\$10,000 into the 1970s, even for positions demanding considerable autonomy and experience. For example, a position at Ottawa Civic Hospital advertised in the December 1973 CAMI newsletter with duties including "setting up a Medical Illustration section within the Audiovisual Department," offered a salary range of CA\$8,300 to CA\$9,500 ("Positions Available," 1973, p. 2). Although "a certificate from a Community College" was preferred, those

with “related experience” would be considered. These discrepancies made clear the incongruity of training, pay, and prestige in the field.

Rates were slightly higher in the United States. As early as 1972, Ruth Coleman Wakerlin struggled to recruit for her department as the “current crop of [U.S.] graduates had been gobbled up at figures varying from \$10,000 to almost \$14,000 right out of school” but her department at the University of Missouri, Columbia, Medical School had a “relatively limited budget” that topped out at 12,000 United States dollars (Coleman Wakerlin, 1972). With the two currencies hovering near parity throughout most of the 1960s and 1970s, the threat of losing Canadian illustrators to the United States was an ongoing concern. However, in addition to enacting new affirmative action policies, the United States Department of Labour had also tightened policies regarding cross-border employment. Canadian graduates interested in pursuing more lucrative opportunities in the United States would first need to navigate the “hassle of dealing with the Dept. of Labor and the Canadian-U.S. Consulate” (Coleman Wakerlin, 1972).

Although their rates of pay were demonstrably higher than average, medical illustrators remained dissatisfied. The AMI’s first salary questionnaire in 1960 found that of fifty-five respondents, “When asked if medical illustration was a ‘good paying profession,’ 39 responded ‘no,’ eight said ‘yes,’ and three said ‘yes and no’” (Demarest, 1995, p. 43). Although rates increased over the next ten years, remuneration remained extremely uneven, ranging anywhere from US\$4.50 to US\$15 hourly and as low as US\$8,500 for salaried practitioners (“Untitled Clipping,” 1971, p. 39). At the high end, promotional materials suggested that experienced illustrators could earn over US\$21,000, especially when supplementing salary with additional freelance and commercial work (*AMI Brochure*, 1972). As in Canada, these rates were well

above the median income in the country, yet medical illustrators remained concerned about the future.⁴⁴

Medical illustrators' anxieties around compensation reflected deeper anxieties around expertise, prestige, and job security. Although their salaries were higher than the national average and were comparable to other feminized, mostly white middle-class occupations like nurses and office workers, medical illustrators were comparing themselves to scientists and academics, not secretaries. As Swezey's concerns around civil service classification make clear, medical illustrators considered their work to be "professional and scientific," not technical or clerical. Moreover, the majority came from white upper- and middle-class families, with salary expectations on par with their class background. Despite known gender disparities, they expected their education, specialized skills, and contributions to knowledge to be reflected in their working conditions and compensation.

Despite overall growth in both medical and university sectors, a pervasive sense of scarcity and precarity continued to animate professional publications, personal communications, and professionalization projects. Although early professional organizing resulted in incremental gains, these concerns remained pressing well into the 1980s. While illustrators like Tom Jones extolled the virtues of "visual aids" in rationalizing education, cash strapped medical schools, publishers, and even authors still tended to treat illustrations as supplementary embellishments to attract attention and increase revenues, not as an integral aspect of research and teaching (Jones, 1946a, p. 3). Medical professionals and publishers agreed that images were a necessary element of medical education, but the resources, time, and skill required to produce useful and up-to-date

⁴⁴ In the United States median earnings in 1969 (all occupations) was US\$8,455 for men and US\$4,977 for women. These numbers were higher for professional and technical workers (US\$11,750 for men and US\$7,308 for women) and clerical workers (US\$7,942 for men and US\$5,161 for women)(U.S Bureau of the Census, 1970, p. 4). The median family income was US\$9,400 (U.S Bureau of the Census, 1970, p. 19).

illustrations were still considered a non-essential “luxury” (Swezey, 1943, p. 441).

Compensation and working conditions varied widely and often fell far short of the standard required to produce highly detailed and innovative work, much less to do the kind of independent research Brödel had once advocated.

Gendering expertise

The gendered construction of both agency and bureaucratic labour in the professions complicated attempts to establish medical illustrators as epistemically essential knowledge producers, rather than subservient or expendable luxuries. Like many other historically gendered professions such as nursing and social work, medical illustrators responded to growing social and economic concerns with professional organizing. As I explored in Chapter Four, the institutionalization of training structures, standards, and regulatory mechanisms had the potential to enhance medical illustrators’ legitimacy and authority. However, the gendered assumptions and hierarchies built into the professions themselves complicated their efforts, particularly those that sought greater recognition of medical illustrators’ agency and autonomy. Moreover, the increase in clerical and administrative work upon which bureaucratic expansion, institutionalization, and professional regulation depended tended to fall disproportionately to women, further entrenching gendered dynamics. This pattern also played out within the profession, as the administrative labour of professionalization itself continued to be “womens’ work.” As I explored earlier in this dissertation, many credited Max Brödel with raising the profile of medical illustration in the earlier part of the century, but the field remained small, under-resourced, and predominantly female.

Women's work

Throughout the twentieth century, raising the profile of medical illustrators as trained, expert labour remained a concern for both men and women, but for different reasons. The predominance of women in the field reinforced the tendency to construe medical illustration as a specialized form of clerical or support work, which limited the autonomy and prestige accorded to the illustrator. As Ruth Coleman Wakerlin wrote to Gerald Hodge, “The amateur effort of a wife or cousin who loves to draw or a secretary who hadn't enough to do to keep her busy, is frequently deemed adequate”(1981). Although medical illustrators could command significant sums in theory, potential employers were often reluctant to pay those rates when “quick and dirty” would suffice (Coleman Wakerlin, 1981). Furthermore, these lowered expectations not only devalued their work, knowledgeable and competent illustrators ran the risk of alienating their clientele precisely because “they are something of a threat and have ideas of their own” (Coleman Wakerlin, 1981). Male candidates might encounter less resistance to their credibility and autonomy, but the feminization of the field also impaired their own salary expectations and threatened the future of the field. While a high degree of autonomy and discernment is unquestioned in the realm of the traditional professions like medicine, the historical feminization of medical illustration continued to thwart attempts to assert professional autonomy and responsibility.

The malleability of gender as a social construct enables work to be categorized as feminine or masculine by a variety of actors and for a variety of purposes, regardless of the skills or autonomy the work actually entails. Although the war and post-war period expanded the locations of women's participation in paid labour, their roles remained overwhelmingly subordinate and even specifically barred them from supervising men (Adams, 2010; Light, 1999;

Rossiter, 1982). Boundaries around women's labour shifted to meet changing labour force demands by reframing and naturalizing forms of work as "feminine" and subordinate, even work formerly carried out by men (Hinze, 1999; Light, 1999; Linker, 2011b). Conversely, as certain occupations such as computer work took on greater status, women were driven out and work formerly construed as menial and repetitive began to be seen as professional or executive (Hicks, 2018; Light, 1999). While sex-typing of occupations as "suitable" or "unsuitable" for women became less explicit by the 1970s, it lived on in organizational and hiring practices, as well as in the gendering of entire categories of labour such as clerical and care work.

Feminist sociologists have argued that the construal of the traditional professions (such as medicine, law, and engineering) as autonomous, rational, and inherently masculine depends on the subordination of work done by women (C. Davies, 1996; Trotter, 2017). Anne Witz (1990) argues that male-dominated occupations restrict competition by enforcing a gendered and hierarchical division of labour which excludes women and female-dominated occupations from specific skills and areas of practice. Although some female-dominated occupations such as nursing and dental hygiene have been moderately successful in achieving legal recognition as professionals, they are often hampered by continued efforts on the part of male-dominated fields to limit their autonomy and to "define women's professional work as subordinate to their own" (Adams, 2003, p. 272). In this sense, men's professional standing is reinforced by drawing "on gender ideology and gender relations to legitimate their claims to professional authority, expertise and status" (Adams, 2003, p. 271). This exclusion through subordination is an important strategy for enabling professional closure and preserving wider social and economic hierarchies.

Moreover, traditionally male-dominated professions maintain the fiction of their own autonomy and agency by denying it to the women and female-dominated occupations that they rely on. Celia Davies argues that the autonomy and discretion that characterize traditional ideals of professionalism require “considerable additional work,” from record-keeping to emotional management, much of which is performed by women (1996, p. 670). The “fleeting encounter” of the busy professional is made possible through “bureaucratic recording systems,” preparatory work, and follow up, all of which are outsourced to others, usually women in subordinate roles, such as paralegals, dental assistants, or nursing staff (C. Davies, 1996, p. 670). This technical, specialized, and often ongoing labour has typically been construed as de-facto non-professional precisely because it enables the complex actions and judgments of the “professional” to appear autonomous. Davies concludes, “It is only through this activity that the work can take on its active, agentic and distant and controlling character” (1996, p. 670). In other words, women’s inclusion (in subordinate roles) not only enables their exclusion (from “professional” occupations), the invisibility of feminized labour is what makes professional autonomy possible.

Gendered strategies are unreliable allies in women’s professional projects precisely because they make clear the durability of underlying hierarchies. Female-dominated occupations such as nurses, teachers, physiotherapists, and dental hygienists have also attempted to mobilize gendered ideals in their own professional projects, ranging from white middle-class feminine virtues of gentility and discretion to emphasis on the social value of emotional labour and care work (Adams, 2010; Adams & Bourgeault, 2004; Cavanagh, 2003; Linker, 2011b; Schneider, 2016). However, attempts to redefine the “masculine” ideals of professionalism to include historically feminized values, activities, and career trajectories have had mixed results and run the risk of re-entrenching gendered norms (Adams & Bourgeault, 2004; Cavanagh, 2003;

Schneider, 2016; Trotter, 2017). As the newspaper profiles of medical illustrators I discussed earlier in this chapter make clear, assertions that women are well-suited to particular types of work reify gender as a meaningful category, whether or not the work itself is seen as valuable. For historically feminized occupations, professionalization projects such as increasing credentialization and rationalization do not necessarily result in increased security or autonomy, even for those at the highest echelons (Schneider, 2016). Female-dominated fields whose professional projects have been successful, such as dental hygienists, radiographers, and physiotherapists, remain construed as “paramedical” or implicitly subservient to male-dominated fields.

Professionalization strategies grounded in white, middle-class ideals tend to reinforce racial and class hierarchies (Adams, 2010; Beagan, 2000; Cavanagh, 2003; Trotter, 2017). Like the relationships of subservience between male- and female-dominated occupations, claims to autonomy and discretion in feminized professional groups are often expressed through the exclusion or exercise of power and dominance over other groups (Ashcraft et al., 2012). For example, nursing professions emphasize decision-making capacity and managerial roles in relation to other health care workers such as personal support workers and hospital staff, groups that are often highly racialized and precarious (Schneider, 2016). The costs and logistics of pursuing additional education and credentialing create new forms of inequality and exclusion (Schneider, 2016; Trotter, 2017). While they may enable greater autonomy and security for some, professionalization projects organized around demarcation and credentialization also create an underclass of workers onto whom tasks construed as menial or low status may be shifted. While these professional projects may enable certain practitioners access to greater professional autonomy and security, they do so by maintaining hierarchies, not undoing them.

More work for mother

Increasingly bureaucratic work environments in the 1960s reinforced the gendering of medical illustration by enabling their work to be construed as clerical and routine. Moreover, rather than simplifying their task, the expansion of media and the rationalization of medical education and practice also resulted in “more work for mother” (Cowan, 1983, p. 193). As managerialism and early forms of datafication spread throughout medicine and education, demand for data visualizations like graphs and charts was rising. This work often fell to medical illustrators. However, as Sweezey pointed out, such work was relatively tedious and rarely made use of medical illustrators’ specialized skills and experience with rendering organic forms and biological complexity. Departmental budgets were often too tight to hire clerical assistance, meaning that too fell to illustrators. Although medical illustrators made efforts to explicate and promote their expertise in an expanding array of new media, the everyday work of institutional positions became “duller and duller and yet more and more of it” (Treadgold, 1963). Despite their credentials, the devaluing of illustrators’ specialized knowledge continued to force them into feminized and low prestige roles with little intellectual challenge or professional autonomy.

Like Sweezey, medical illustrators often found that career advancement could only be achieved by taking on more administrative work. Practitioners who wished to focus on the work of illustrating, rather than teaching or administration, had few options. In 1962 medical illustrator Marguerite Drummond left Hospital for Sick Children in Toronto, where she had worked for 15 years, in an effort to “stop being more of an administrator” and return to illustration work

(Wilson-Pauwels, 1993a).⁴⁵ Her new position – assistant medical illustrator in the Department of Biomedical Communications at the University of British Columbia – suited her, but it required a cross-country move to Vancouver to work under her own former student, Victor Doray (Wilson-Pauwels, 1993a). For female practitioners with families, the relative flexibility of freelancing could be “more convenient,” but sacrificing the stability of salaried institutional employment also left them more isolated (“Woman Chose Art,” 1970, p. 11). As in other predominantly female fields, flexibility in credentialing and working conditions produced “flexible women who were pressed into making it work despite significant tradeoffs” (Trotter, 2017, p. 504). In either case, many still struggled to find “a successful way to balance housework and career to everyone's satisfaction” (Bosomworth, 1972). Medical illustrators were faced with a choice between stable but uninteresting and often largely administrative positions or the unpredictability and capital costs of freelance work.

Freelancing promised to reduce the administrative burden and increase variety, but at the cost of stability and institutional power to entrench the profession in the fabric of medical education and practice. In an already scattered and unstable field, increasing volumes of routine and administrative work made the few salaried and full time positions a hard sell. Yet these were also the positions from which illustrators had the greatest power to build up the profession. As I explored in Chapter Four, the survival of many departments, especially in the 1960s, hinged on the administrative acumen of those who ran them. In addition to managing limited budgets and insecure, inadequate working conditions, heads of training programs developed new curricula and teaching standards, acquired degree-granting status and accreditation for their programs, and

⁴⁵ Barbara Marguerite Drummond worked as “pupil assistant” to Maria Wishart at the University of Toronto after graduating from the Ontario College of Art in 1941. She became head medical artist for the Department of Visual Education at the Hospital for Sick Children in Toronto where she worked from 1947 to 1962. She also taught anatomical illustration and departmental organization at the University of Toronto from 1950 to 1958.

dedicated considerable energy to professional organizing – all while continuing to produce work as medical illustrators. Those who succeeded could leverage that security to publicize and advocate for the profession as a whole. Those who failed to entrench their positions within existing bureaucracies found their positions and their departments dissolved or absorbed. In a 1962 letter to British colleague Sylvia Treadgold, Nancy Joy pointed out “when you mentioned that you are looking around at other prospects I had a sharp sense of regret because none of us have positions that are stable enough to carry on, on their own momentum if we leave” (Joy, 1962). The continued existence of stable institutional positions depended upon the ongoing administrative work of the post-holders themselves.

Professional organizing also demanded a good deal of unwaged administrative and clerical labour, again performed mainly by female practitioners. Tasks such as recording and preparing minutes, handling correspondence, planning meetings, committee work, and managing budgets were vital to the success or failure of professional organizations like the AMI and the CAMI. However, the importance of these roles in promoting the profession, managing external relationships, and maintaining the bureaucratic infrastructures that many socio-legal professionalization projects (such as credentialization and self-regulation) require tends to be overlooked. Within the AMI, tasks like bookkeeping, organizing meetings, editing publications and handling correspondence tended to fall to women, while men held prestigious executive roles. Indeed, although women have consistently outnumbered men two to one, only a third of all AMI presidents to date have been women. Medical illustrator Robert Demarest’s (1995) *History of the AMI*, commissioned on the occasion of the association’s fiftieth anniversary, includes a complete list of past presidents, vice-presidents, and chairs of the Board of Governors, but in most years it omits the names of Corresponding Secretary, Recording Secretary, and Treasurer.

Despite their demographic dominance, professional histories often omit women's contributions precisely because they typically performed administrative roles.

Meanwhile, as the AMI grew, so did the administrative labour of managing it. In 1954, corresponding secretary Evelyn Erickson, "reported that the acquisition by the Association of a typewriter and an addressograph system had greatly simplified the year's correspondence" (Demarest, 1995, p. 32). In 1963, the recording secretary (unnamed) reported to the annual meeting that "over 1,000 requests had been received" for copies of an informational brochure on Medical Illustration (Demarest, 1995, p. 46). When Margaret Croup Brudon became president in 1969, one of her main concerns was to hire a dedicated administrator to oversee areas including "staff representation, member services, meeting planning and financial management" (Demarest, 1995, p. 109). Prior to being elected president, Brudon had served in the role of recording secretary for three years. She argued that the volume of administrative labour required to develop and sustain a viable organization "had become too demanding for volunteer time and effort" (as cited in Demarest, 1995, p. 161). Having been "asked [...] to accept the position of recording secretary," Brudon was well aware that much of this work fell on female illustrators, on top of both their professional practice and, for some, caring for their families as well (as cited in Demarest, 1995, p. 161). However, due in large part to the cost of actually paying someone for this labour, Brudon's goal of hiring an executive director was not achieved until 1972.

The Canadian challenge

In their work on the role of classification, standards, and maintenance in technological infrastructures, Geoffrey Bowker and Susan Leigh Star remind us that "there is a lot of hard labour in effortless ease" (1999, p. 9). This "missing work" is not merely frequently overlooked

or underpaid, its invisibility is a vital part of the process of stabilizing and normalizing those infrastructures. The rise and fall of the Canadian Academy of Medical Illustrators (CAMI) provides a useful case study of this dilemma. As the history of the CAMI illustrates, much like the effects of work to rule in a unionized workplace, the importance of “invisible work and the invisible memberships that have anchored them in place” becomes clear when the work *is not* being done (Star, 2015, p. 277).

As I explored in Chapter Four, professionalization projects, such as the creation of new training programs and the founding of the Association of Medical Illustrators (AMI) in the late 1940s and 1950s helped to publicize and grant credibility to the profession by strengthening social ties and institutionalizing claims to scientific authority. However, these efforts were slow to bear fruit and did so unevenly. Concerns about financial security in the 1960s and 1970s were not new. In a 1943 article, Sweezey pointed out that “because the medical profession does not recognize the necessity for trained artists and is not willing to pay them a reasonable salary,” many Canadian practitioners were “forced to give up either their profession or their country” to earn a living (1943, p. 441). Although the situation was marginally better in the United States, American illustrators faced similar issues. Despite increasing demand and technological progress, medical illustrators still struggled to secure satisfactory pay and working conditions.

Although Canadians had been included in the AMI from its inception and most were members, their concerns were not always addressed by organizing efforts in the United States. Prior to the Second World War, traffic between the two countries was relatively easy, at least for white people. Many of Brödel’s students, including Wishart, Sweezey, McLatchie Miller, and Crosby were Canadian, whilst the Brödel family maintained a cottage on Ahemic Lake in Ontario. However, the border between the two countries became less porous during and after the

Second World War. Although the two countries shared many commonalities, diverging political and economic systems resulted in increasing differences in policy and governance. These differences were borne out in the working lives of medical illustrators and in their attempts to professionalize, which tended to reflect the political and economic organization of health care provision in that country. Moreover, AMI affiliation did not confer any official status in Canada.

In addition to practical differences of population and scale, the provision of health care in the two countries was also changing. The employer-based model initiated in the United States during the war proved remarkably resistant to attempts at nationalization and formed the basis for the ongoing marketization of health care. In some ways, the market-based organizing principles of American medicine were more amenable to the idiosyncratic nature of medical illustration but they tended to favour those with ready access to capital and social mobility. In Canada, the move towards publicly administered care allowed a greater sense of stability at the institutional level, but smaller, less established professions like medical illustration struggled to be taken seriously in policy discussions and were not easily incorporated into large-scale bureaucratic structures of nationalized health care.

Although it is largely beyond the scope of this dissertation, it is worth noting that British medical illustrators and photographers faced similar problems in the National Health Service (NHS), resulting in a very different professional landscape (Archer, 1998; Hansell & Ollerenshaw, 1947; McFall, 2000; F. Roberts, 1948). A professional organization also took shape in Great Britain after the Second World War, spearheaded by illustrator Dorothy Davison (Archer, 1998). In her history of the Medical Artists Association of Great Britain (MAAGB), medical illustrator Patricia Archer suggests that “If Davison had not founded the M.A.A. in 1949 it probably would not have been too long before one of the men, among the members, who had

come into the profession after the war, would have done so” (1998, p. 217). However, she goes on to point out that the entry of more men into the field was stymied by the predominance of women, who were “not treated with the same seriousness with regard to pay, status and conditions of employment” (Archer, 1998, pp. 217–218). While some freelancers and men who had been working since before the war were content with the conditions of their trade, women and younger men working within institutions were particularly interested in a “negotiating body to cope with conditions of employment and salary scales” (Archer, 1998, pp. 153–154). Although the group was aware of and even inspired by the American organization, they wished to remain separate.

Over the course of the 1950s and 1960s it became clear that the American based AMI could not meet the unique needs of Canadian medical illustrators. Even more than their American counterparts, Canadian medical illustrators lacked clear external markers of their credibility, training, and social position. In 1960, Canadian-born Muriel McLatchie Miller retired from her position as head of the medical illustration service and Director of the School of Medical Illustration at the MGH and returned to Alberta, Canada. Although she wished to continue working part time in her retirement, she turned down a full-time offer at the University Hospital in Edmonton, “mainly because it is a time clock position” (McLatchie Miller, 1962). An hourly wage would substantially undervalue her experience and skill, but she had few resources with which to explain or justify her position. In response to this “disappointment,” McLatchie Miller requested that Nancy Joy forward as much information as she could, including the University of Toronto program curriculum and entrance requirements, typical Canadian salary range, and Joy’s employment status (McLatchie Miller, 1962). She hoped to provide this information to the Edmonton hospital’s Chief of photography and art in the X-ray Department,

who was responsible for the position. She explained diplomatically that he “needs our help to gauge the status of the illustrator” (McLatchie Miller, 1962). Without a recognizable and organized professional structure in Canada, both medical illustrators and their would-be employers lacked a frame of reference from which to establish qualifications, expertise, or pay scales. Twenty years after Chubb’s hourly rate for *Grant’s Atlas* and McLatchie Miller’s efforts to launch the AMI, the medical illustrator was still not treated as an integral part of medicine’s infrastructure.

Crafting the CAMI

In September of 1963, Eleanor Sweezey met with a small group of Canadian medical illustrators, chaired by recently retired Maria Wishart, to organize the Canadian Academy of Medical Illustrators (CAMI). Having met and befriended Maria Wishart during her brief employment in Wishart’s service department in 1942, Sweezey maintained an active interest in the education and professional development of medical illustrators in Canada throughout her career (Sweezey, 1995). As early as 1958, Sweezey noted that “[w]ithout a [Canadian] organization behind the profession,” they would continue to be treated as “amateurs whose proteges were scarcely eligible” for funding (Sweezey, 1963). As other paramedical professions were organizing and gaining recognition, the lack of legal status or “official mouthpiece of the profession” also limited the Canadians’ ability to advocate effectively for themselves in legal and administrative matters from hospital insurance to salary negotiations (Sweezey, 1963). She believed that an organized Canadian group would enable them to access funding such as “scholarships for medical art students,” opportunities for advancement, and greater job security (Sweezey, 1963). It seemed clear that Canadian medical illustrators needed their own professional body. Members of the fledgeling group hoped that the existence of a Canadian

professional organization and clear standards for training would provide legitimacy to their field and material support in employment negotiations, as well as improving communication between geographically and socially isolated practitioners. However, progress was slow and faced a number of practical limitations.

Maintaining an active membership was a constant problem. Canadian medical illustrators were relatively few and geographically dispersed, making communication and organizing difficult. In practice, most organizing revolved around a core group of practitioners based in Toronto, Montreal, and Vancouver. Many illustrators working in other parts of the country could not afford the time and expense of travelling to meetings – which usually took place in Toronto – on a regular basis. Like the AMI, the group's activities during its first few years revolved around the creation of a standard for teaching departments, largely overseen by Wishart. In later years, the group's activities also included publicity campaigns, salary questionnaires, meetings and workshops, and a newsletter. However, these activities tended to take place in a piecemeal fashion, largely dependent on the time and interest of those members willing to take on executive and committee roles. Despite ongoing attempts to balance stringent membership requirements with the need to attract and retain new members (especially students and recent graduates), membership grew slowly and active participation remained limited.

Many members struggled to balance the work of building an organization with the demands of their employment, as well as the logistical difficulties of communicating with practitioners across the country. For example, despite having actively corresponded with Sweezey from the organization's inception, Joy had felt "unable to accept" charter membership in the CAMI at the time (Sweezey, 1965). Having just taken over as head of the department, it seems likely that Joy's early reluctance to join was primarily a matter of time and energy. In a

letter to Joy in 1964 regarding her plans for an exhibition of medical illustrations in Calgary, McLatchie Miller expressed dismay “to hear that you had not joined the CAMI [...] for this to me [is] most important in our profession” (McLatchie Miller, 1964). As the only training program in the country, McLatchie Miller believed that participation in organizing the CAMI was vitally connected to Joy’s role as department head. She positioned both the CAMI and the exhibition as opportunities to promote the profession and support student recruitment. Joy eventually acquiesced and was approved for a “retroactive charter membership” in 1965. She went on to be an active participant in the group (Sweezey, 1965).

With only a few exceptions, the majority of working illustrators and heads of departments in Canada were trained women, but for the next generation the means of entry into such positions were fast being eroded. In a recruitment meeting with medical illustration students in 1971, Wishart explained that “a small society with good standing which could carry more weight as the profession grew than an indiscriminate group [...] would be in a position to help the status of the profession” (CAMI Publicity Meeting, 1971). However, the group struggled to assert that status. In the same recruitment meeting, students expressed concern that the organization was not doing enough to advocate on their behalf. They suggested that CAMI should have protested more strenuously when a position at a Toronto hospital “was given to an untrained man” (CAMI Publicity Meeting, 1971).

Over the next few decades, lack of prestige and critical mass would leave Canadian medical illustrators ill-equipped to assert their status and to fend off incursions into their occupational territory. Although the CAMI representatives vowed to look into the problems and to find meaningful ways to support younger practitioners, new threats continued to emerge. In 1975, Joy’s program came under threat of closure. The university’s justification was primarily

financial: although a medical illustrator cost nearly as much to train as a medical student, government funding was only .01% higher than funding for general art students, a quarter of the amount available for medical students (CAMI SMM Minutes, 1975). At a special meeting to address the issue, members agreed that it was “deplorable that a unique Canadian training programme will be closed down” and resolved that CAMI should “explore diplomatically the reasons for the proposal” and take whatever action it could to save the program (CAMI SMM Minutes, 1975). Without the size and influence of a larger organization, CAMI members were forced to resort to a diplomatic approach, making use of members’ social and family connections to advocate for the program. However, in the increasingly managerial landscape of both health care and academia, this kind of informal social mediation was becoming less effective. Although the program was indeed saved, it was becoming clear that despite their efforts, CAMI was failing to deliver on the promise of building up the profession.

The CAMI struggled to be taken seriously as a lobbying group and attempts at defining and regulating the field, from educational standards to recommended salary scales, were largely ignored by major hospitals and universities. Overall lack of correspondence also signalled that “contacts with the outside world have diminished” and lack of tangible results made recruitment difficult (Hough, 1974a). Due to its small size, the CAMI faced an exceptionally small pool of illustrators to carry out the work of running the organization. At their 1974 Annual Meeting, the incoming president Gary Cousins lamented

If we were a dynamic, powerful group, finding jobs for people, dictating salaries, providing educational opportunities, there would be a much greater attraction for people seeking membership. These things we are not. We are little more than a social club, whether we admit it or not. (1974)

Cousins presented a bold programme to expand the group, including relaxing “too pretentious” standards for admission and integrating more allied fields such as medical photographers and television producers (Cousins, 1974).

Image 11

“Get CAMI newsletter out on time!”



Illustration by Margot Mackay, from CAMI newsletter (Dec 1974).

However, this was easier said than done. Few members were prepared to invest the time and effort necessary to navigate the “administrative and legal hassles involved to change our

constitution” to reflect the more inclusive set of practices and experiences Cousins advocated (Hough, 1974b). The everyday administrative work of organizing the profession tended to fall on already overworked and underpaid women. Taking on additional professional projects would leave even less time to invest in their own career development. Those who were not yet retired were typically too busy managing their own careers to dedicate significant time to the cause. As Cousins noted, “We don't have enough people to share the work” (1974). Newsletters and correspondence often included some *mea culpa* detailing the volume of obligations that interfered with timely response. Moreover, many of these allied groups were male dominated. As media and technologies expanded, women who had carved out a niche for their specialized skills were wary of redefining the field in ways that would marginalize those very skills while privileging men. With limited resources and few active members, attempts to revive the “moribund” organization, including workshops, newsletters, and a salary survey, ultimately fell flat (Hough, 1974b). In 1975, the group held their annual meeting in conjunction with the AMI meeting in Vancouver, which CAMI members including Victor Doray were involved in planning. However, it seems to have been their last annual meeting. The scarce available documentation suggests that the CAMI was essentially defunct by the end of the decade.

Gendered generalists

Professional groups and academic standards were explicitly designed to improve the status of practitioners, but they could only do so if they succeeded in reshaping the broader social and economic structures within which medical illustrators practiced. Female-dominated occupations were at a disadvantage precisely because of gendered assumptions about the nature of their labour and their capacity for autonomy. Although credentials and regulatory frameworks

could ostensibly serve as external validation, the pursuit of professional status and academic standards was predicated upon the assumption that training and qualifications would be recognized in hiring and career progression. Without that recognition, women remained at a particular disadvantage. Moreover, both medicine and academia were increasingly bureaucratically structured. Groups that were successful in establishing their own authority would have a say in what those structures looked like and who could be included. Those who were not able to establish a foothold (or were actively excluded) risked losing even more.

The gendering of the field continued to reinforce the construal of medical illustrators as passive and their work as ancillary or primarily clerical rather than central to knowledge production. Paradoxically, medical illustrators' ability to adapt to technological changes was both their strength and a hindrance to clearly defining and seizing control of any specific professional domain. In addition to ongoing debates concerning the regulations of training, membership, and credentialing exams, periodic attempts to catalogue "competencies" demonstrate the difficulty of disambiguating illustrators' technical and conceptual practices.⁴⁶ However, emphasis on the more concrete (and masculine-coded) elements of technological mastery tended only to further obscure practitioners' agency, rather than supporting claims to autonomy. As I explored in Chapter One of this dissertation, even as medical illustrators' skills expanded into areas like computer programming, credit for the work produced using new technologies tended to shift to the devices themselves, obscuring the effort that "goes into making things work like magic"

⁴⁶ The changing criteria and processes for obtaining membership in the AMI reflect not only the evolution of medical illustrators' practices over time, but also existential anxieties about which skills and practices are "essential" to professional identity and belonging. For example, attempts to create a certification examination took more than two decades to come to fruition. This incredible delay was largely the result of heated debates about what the examination should (or could) cover and fears that the introduction of such an exam would push out long-standing members. On competencies in medical illustration, see, for example, Katz (1996); Ostergren (2013); Pecoraro (2007). On attempts to catalogue tasks and competencies in the context of nursing, see Bowker and Star (1999).

(Bowker & Star, 1999, p. 9). Unlike specialties like radiology, medical illustrators' jurisdictional claims could not be effectively oriented around their use of specific technologies (Burri, 2008; Howell, 1996). Despite their willingness to adopt new media, medical illustrators were unable to mobilize technology as a proxy for expertise.

The material and organizational problem of medical illustrators' meaningful integration into medical teaching and practice was an ongoing one throughout the later part of the twentieth century. As Ruth Cowan (1983) has argued in regards to household technologies, changing technologies of visualization and reproduction reorganized but did not reduce the amount of labour required to produce medical visuals. Just as photography had taken over detailed and time-consuming areas such as ophthalmic illustration, new forms of computerization and imaging presented exciting possibilities for recording and manipulating visual data. Although computing promised to relieve medical illustrators of tedious tasks like charts, graphs, billing, and record-keeping, what was gained in efficiency of certain parts of the job was often lost in the race to adapt to ever-changing work-flows, skills, and infrastructure (Atkinson, 1983). New technologies were attractive to illustrators as new tools for rendering and for streamlining some of the more onerous steps in the publication process. However, new technologies also bred new demands and were often time- and labour-intensive in their own ways. The cost of acquiring and mastering new technologies, not to mention adapting them to the specialized needs of medical illustration, was often extremely high. Computer graphics capabilities remained basic into the 1980s, while film and other new media still required even more material investment and time to produce. Constantly changing technology required an increasing portion of departmental and freelance budgets as well as time and energy to master its use.

Although the expanding array of media technologies and visual outputs required additional training and equipment, potential employers remained both unaware of the skills involved and unwilling to invest long term. In 1974, Mark Eppinger, illustrator and assistant professor of Biocommunication Arts the University of Illinois College of Medicine conducted a pilot study of local hospitals to determine future needs for both training and growing the profession. The study found that limited and often antiquated perceptions of medical illustrators' role and expertise justified continued lack of dedicated resources, which in turn maintained the position of illustrators as ancillary services.

Of the sixteen hospitals visited, none employed a medical artist, although ten had used the services of a free lance medical artist working in the area. Many of the administrators felt that the medical artists' skills were too specific to be in constant demand and therefore a luxury item. (Eppinger, 1978)

Moreover, the study made clear the disconnection between employers' expectations, illustrators' training, and the resources available to them. In the five urban hospitals studied,

“two employed a medical artist, but only one artist was utilized as trained for the profession. The hospital administrators were favorable in employing a medical artist but were uncertain of the capabilities of such a person and unclear of the scope of the medical art profession. Four of the five hospitals had adequate audiovisual and production hardware, but little or no space for a medical artist. Without understanding the full benefits of hiring a medical artist, the administrators were reluctant to budget the necessary money or allocate space. (Eppinger, 1978)

Eppinger argued that the study demonstrated a “demand for a baccalaureate biomedical communication graduate (a generalist)” with “sufficient job mobility” to meet “existing and expanding job opportunities” (1978, p. 2). Nevertheless, it also made clear that 30 years of attempts to demonstrate the value of medical illustrators as knowledge workers and scientific experts seemed to be a losing battle; medical illustration remained a “luxury” (Sweezey, 1943, p. 441).

By the end of the decade, medical illustrators' claims to autonomy and agency were all but abandoned in favour of defining their work in ways that were more congruent with existing gendered norms. Reba Benschoter, associate editor of the AMI's *Journal of Biocommunications*, lamented in 1979 that despite some progress, the expansion of medical illustration into the more "comprehensive" service that Tom Jones had confidently predicted in his 1948 retirement speech remained perpetually "just around the corner" (1979, p. 2). The battle to be viewed as an integral part of a robust research infrastructure seemed definitively lost. Instead, they began to embrace their ambiguous role. Echoing Eppinger's report, University of Toronto department head Nancy Joy explained in a 1978 interview that because her graduates emerged as "generalists, all rounders," many would "go on to fill administrative or coordinating roles in medical communications" (D. Woods, 1978, p. 1115). As Joy's interview makes clear, "generalist" continued to signify administrator. However, her adoption of these terms marks a shift in strategies for branding medical illustration as professional, expert labour that emphasizes illustrators' uncategorizability and adaptability *as* professional expertise.

Faced with a protean jurisdictional and technological landscape, medical illustrators' professionalization projects in the late twentieth century were functionally limited by the ongoing gendering of the field. They responded to this predicament by relinquishing stronger claims to autonomy and epistemic authority and reframing their expertise as the ability to move between worlds whilst remaining subservient to their employers. This approach remains evident in the contemporary branding of medical illustrators as communicators and storytellers that I explored in Chapter Two. As Swezey's classification challenge suggests, the administrative side of medical illustration was often more easily recognizable as skilled labour, precisely because it was already more feminized and less prestigious than "scientific" work. However, although

acquiescing to this categorization enabled medical illustrators to access some of the benefits of being included in a more prestigious echelon than “Technical,” it also meant giving up on broader claims to expertise, agency, and autonomy embodied in the category of “Professional and Scientific.” In other words, the most successful attempts to make their work legible as skilled labour were those that obscured their agency and misconstrued its fundamental nature.

Chapter Six: Crafting Bodies

Colonialism, conventions, and the problem of accuracy

In December of 2021, Nigerian medical student and illustrator Chidiebere Ibe posted a recently completed medical illustration of a foetus in utero to his social media account. The image prompted a brief but significant flurry of online activity, summed up by one user's comment, "I've literally never seen a Black foetus illustrated, ever" (Fearn, 2021).

The image and the online response to it reminded me of an interview I conducted with a retired medical illustrator in the attic of her Toronto home. We had begun chatting over tea and zucchini bread before the recorder was turned on. She pulled drawings out of folders and cupboards as we meandered through recollections of her career. Having spent her childhood in Egypt and Ghana as the child of British nationals, she had returned to work in Tanzania after completing her training in medical illustration at the University of Toronto in the late 1950s. Upon returning to Canada in 1974, she took a position as chief medical artist in a medical center.

When I first came back from Africa, I fell into this job at [a major Canadian Hospital] and one of the first jobs I did was an illustration for a neurologist for a lecture he was giving to the medical students.

And he said "Just make a profile and show the main communicating branches between the carotid arteries and the vertebral arteries."

"No problem, I can do that," I said.

He said, "Just have a guy's face and profile."

I said, "What would happen if it were a woman?"

And he was a good, progressive sort, and he said, "No, a woman would be fine."

And I said, "Well, what if she was black?"

And he said, "Yes, black is fine." [laughs]

He knew better than to say anything else. At that point, I suppose everybody knew I was just back from Africa. So I did this illustration, which became sort of famous [laughs] because it was so pretty. This dark brown woman's face, her braids in the back and everything. And the bright red arteries. It became one of my favourites of my illustrations. (Helen)

She did not have the original image on hand, but she kindly sent me a copy later. It is in many ways quite conventional, with a head in profile (as requested) and arteries mapped over the landscape of the skull. Although it is indeed aesthetically beautiful, what was most striking is simply that, like the user reflecting on Ibe's illustration, I had never before seen an illustration of normal anatomy that was not white and male.

The neurologist in Helen's story requested a standard type of image: "a guy's face and profile." Helen's response suggested that things could be otherwise. But why, nearly 50 years after Helen's illustration, is this still so unusual? How can we account for the incredible staying power of these conventions? What will it take to change them? These questions have haunted my doctoral work.

To understand the continued lack of bodily diversity in medical illustrations, this dissertation explores the material and social contexts within which medical illustrators construct their own expertise. In this chapter, I consider the history of medical illustration as a standardizing and normative practice anchored in colonial conventions that posit an athletic, white, male body as the normative ideal. I argue that despite shifts in material practices and socio-economic organization, these conventions haunt the professional practices of contemporary medical illustration. However, although illustrators remain constrained by the social and economic structures within which they operate, the very nature of their work also presents possibilities for generating visual repertoires that reflect the full range of human embodiment and experience. I examine the social and material construction of "accuracy" not as a fixed, measurable attribute of images, but as a quality of human labour, enacted in and through social

and material relations. I suggest that these relational practices of accuracy in medical illustration be cultivated as what Maria Puig de la Bellacasa has termed “matters of care,” turning attention to the “necessary yet mostly dismissed labours of everyday maintenance of life, an ethico-political commitment to neglected things, and the affective remaking of relationships with our objects” (2011, p. 100). Treating accuracy in medical education as a matter of care may enable both medical illustrators and scholars to more substantively intervene in normative ways of seeing and understanding bodies.

Figure 12

“I’ve literally never seen a Black foetus illustrated, ever”



Social media post by user @Liyahsworld_xo with illustration by Chidiebere Ibe.

Colonialism's ghosts

We're all standing on our parent's shoulders.
 The boats across the ocean.
 And they stand on their parent's shoulders.
 Missionaries that never went home.

And they stand on their parent's shoulders.
 Wagons in a row.
 And they stand on their parent's shoulders.
 Churches built from bones.

...

Ask the colonial ghosts if they live in your bones.
 Ask the colonial ghosts if they live in your bones.
 Ask the colonial ghosts what they took⁴⁷

In the basement of the Medical Sciences building of the University of Toronto, intrepid explorers and those in the know find a darkened cabinet of curiosities known as the J.C.B. Grant Museum. The museum houses a variety of anatomical materials including many of the original dissections that form the basis of Grant's *An Atlas of Anatomy*. First published in 1943, *Grant's Atlas* includes hundreds of original illustrations produced primarily by illustrators Dorothy Chubb and Nancy Joy, based on dissections prepared by Grant and his assistant Charles Storton (Grant, 1943; Polk & Wall, 2009; Robinson, 1993). Many of the resulting dissections were preserved and added to the university's anatomical museum, along with reproductions of labeled illustrations, so that, as Grant expressed, medical students "seated and with textbook or notes beside [them], could study in comfort" (as cited in Robinson, 1993, p. 89). The museum continues to be used in the same manner today.

⁴⁷ Rae Spoon (2008).

Grant's Atlas is still produced and used in anatomy teaching at the University of Toronto, alongside its accompanying *Dissector*, first published in 1940. Now in its fifteenth edition, *Grant's Atlas* remains one of the most commonly used anatomy teaching texts in North America (Polk & Wall, 2009). Current editions have been updated in both content and style. Although colour was added to most of the historical illustrations, faculty members at the University of Toronto Biomedical Communications Department (BMC) also created new illustrations by copying the style and techniques of the early editions. In addition to those on display in the museum, many of the original illustrations are housed in the BMC archives where they are used in teaching medical illustration students. The history of *Grant's Atlas* is a part of departmental lore. Indeed, in addition to many framed pieces in the halls, one of Chubb's illustrations is reproduced on a grand scale at the main entrance to the department.

Before arriving at the University of Toronto, Grant had studied at the University of Edinburgh and served as chair of Anatomy at the University of Manitoba from 1919 to 1930. It was during this period that he pursued the "hobby" of anthropometry (Breslin, 1956, p. 8). In a journal, Grant explained why he began this work shortly after his arrival in Manitoba:

On finding out that almost no work had been done on the anthropometry (physical anthropology) of the North American Indians of Canada, it seemed obvious that without further delay data on the Indians should be collected before further intermixture with other races took place. (as cited in Robinson, 1993, p. 67)

In 1920 Grant accompanied an "Indian treaty party" led by anthropologist Diamond Jenness, the first of many excursions throughout the 1920s. Anthropologist John Albanese points out, "it is impossible to separate the anatomy from the anthropology in the first half of the 20th century" (2018, p. 35). Most forensic anthropologists were trained as anatomists and many anatomists treated forensic osteology and anthropometry as logical extensions of their own work. Often joined by "a Roman Catholic priest [...] as interpreter and companion to help with the camping

chores” (Robinson, 1993, p. 117), Grant’s excursions entailed “two dozen measurements on each subject studied,” ranging from height and blood type to

“[t]he condition of the teeth, eye colour, the condition and quality of the hair (baldness was only present in Indians with some European blood), the length and shape of the nose, the upper lip, mouth and ear, and the state of the beard” (Robinson, 1993, p. 118).

Unsurprisingly, the communities Grant visited were often unwilling to submit to this study, particularly to more invasive requests, but this did not dissuade Grant’s team. Additional trips included the study of “[c]hildren at a Chipewyan orphanage,” collection of blood samples, and removal of skeletal remains (Robinson, 1993, p. 119).⁴⁸ In most cases, the circumstances of collection, much less consent, are murky at best.

A thorough discussion of the role of scientific cataloguing of Indigenous peoples and religious missions in the expansion of the colonial state is well beyond the scope of this dissertation. However, Grant’s adventures provide a snapshot of how the goals of religion, government, and science were both ideologically compatible and mutually sustaining. The composition of Grant’s expedition party was not unusual. From the late nineteenth century through the mid-twentieth century, treaty parties typically included doctors, missionaries, police, and civil servants (Albanese, 2018; Bean, 1989; Lux, 2016). While the party’s “Indian agent” might be tasked with negotiating or fulfilling treaty obligations, these expeditions were also occasions for the surveillance and disciplining of Indigenous bodies and cultures.

⁴⁸ In addition to at least one skeleton “obtained” from “the west coast of Hudson Bay,” Grant also participated in the excavation and removal of Iroquois bodies from a burial site in Ontario in 1935 (Robinson, 1993, p. 125). According to archeologists Grant Mullen and Robert Hoppa, the disinterred remains were kept in the University of Toronto Department of Anatomy but there was very little record of the excavation, the bones, and even the location from which they had been taken (1992, p. 32). They were not catalogued until the 1960s, when they became known as the “Brantford Indian Collecction.” In the early 1970s, the bones were moved to the Department of Anthropology at the University of Toronto’s Erindale College but received very little attention until the Mullen and Hoppa study, which found a number of bones including “ribs, hand bones, metatarsals, and pedal phalanges” missing without clear explanation (1992, p. 32).

The “civilizing” of Indigenous peoples was a project of both cultural and political assimilation.⁴⁹ Since the early nineteenth century, missionaries had been an integral part of British colonizers’ “policy of civilizing the Indian” (Tobias, 1983, p. 40). The role of religious sects in Canada’s residential school system is well documented. However, the involvement of religious missionaries in colonial expansion entailed not only intervention into the cultural values and practices of Indigenous groups, but also the reshaping of leadership structures. By the twentieth century, the long history of missionary involvement in Indigenous people’s lives meant that they often served not only as translators or go-betweens, but as agents of the state whose influence allowed government officials to define and impose “the very categories of aboriginal society,” including who could “speak and make decisions for other native people” (Bean, 1989, p. 22). This reshaping of cultural and political values was a necessary component in colonial expansion.

The ideological basis for colonial expansion rested upon the construal of the land as uninhabited and free for the taking, so the continued presence of human groups presented a problem. Throughout the first half of the twentieth century, the relationship between the Canadian state and the land’s earliest inhabitants was characterized by “an array of structures that served to define, confine, and ultimately remove what it had constructed as its ‘Native problem’” (Kulchyski, 1993, p. 24). Previously disparate (though more or less ideologically congruent) policies were consolidated with the Indian Act of 1876, which provided “the foundation for all Canada’s future Indian legislation” (Tobias, 1983, p. 44). Earlier legislation paradoxically purported to remove distinctions between Indigenous and settler people by “defin[ing] who was

⁴⁹ On the relationship between science and the “civilizing mission” as colonial project, see Adas (2015). On “civilization” as an anthropological and historical concept in the Canadian colonial context, see Francis (1998).

an Indian” and establishing the criteria of “civilization” under which such a person could be assimilated and “accorded the rights and privileges accorded to European Canadians” (Tobias, 1983, p. 42). With the Indian Act, the Canadian government built on previous policies to develop legal mechanisms of assimilation through which “Indians” could become “enfranchised,” ideally resulting in the gradual eradication of the category of “Indian” and the lands that were defined by it. In short, the category of “Indian” was created so that it could be eliminated.

The process of (re)defining “the Indian” as a political category and as an object of knowledge enabled the imposition of colonial legislative and cultural frameworks. Peter Kulchyski argues that Jenness’ anthropological work acted as a “strategy of containment” which enabled Indigenous peoples to become “an object of knowledge rather than its constituent” and “provided an ideological support for the State’s activities” (1993, pp. 32–33). As a member of Jenness’ expedition team, Grant’s drive to conduct anthropometric studies “without further delay” depended on the longstanding construal of Indigenous groups as “vanishing.”⁵⁰ In both his policy work and in his anthropological work, Jenness constructs Indigenous cultures as “defined by a series of absences” – lacking material and cultural accoutrements of Europeans – and Indigenous peoples as “simple and childlike” and already on the verge of extinction (Kulchyski, 1993, p. 35). In keeping with the recuperative premise of such “salvage” anthropology, Grant’s appraisals of genetic “purity” present intermixture with white settlers and eventual extinction of Indigenous groups as a foregone conclusion. As Jenny Reardon and Kim TallBear (2012) have argued, the inevitability of cultural disappearance was coupled with a drive to preserve certain aspects as a legacy for white settlers in North America. Coupled with the

⁵⁰ For example, Daniel Francis (1992) traces the mythology of the “vanishing Indian” trope in Canada from at least the mid-nineteenth century.

eugenics-inflected construal of Indigenous groups as “breeds” and “stock,” anthropometric studies like Grant’s reinforce the construction of Indigenous groups as scientific objects and, importantly, the property of white settlers (along with the lands they inhabit). Although Jenness was critical of the Canadian State’s approach to administration of “our Indians,” the policies he advocated were founded in the same possessive and assimilationist agenda which contributed to the government’s approach to its “Native problem” (as cited in Kulchyski, 1993, p. 28). The cultural and scientific construction of Indigenous peoples as endangered objects of knowledge served as both justification and excuse for their dispossession and extermination.

Anatomists and anthropologists travelling with representatives of colonial government and religious interests were not merely a matter of expediency or chance. Rather, the goals of cataloguing, conversion, and coercion were intimately entwined. For government officials, the cataloguing and assimilation of Indigenous peoples were tools for colonial dispossession and domination. Close association with both state and scientific authority enabled missionaries to frame cultural genocide as a civilizing mission. For anthropologists and anatomists like Grant, the construction of Indigenous peoples both as representative of an earlier evolutionary history and as doomed to disappear enabled the production of “Native cultures and their biologies as part of the proper inheritance of whites and thus that which scientists had the right to control and study” (Reardon & TallBear, 2012, p. S235). The assumption that Indigenous groups were both less than fully human and destined to disappear (either through extinction or assimilation) justified the taking of lands, children, and bones with equal impunity.

The example of Grant’s expeditions is not intended as a specific indictment of one person. On the contrary, Grant’s involvement in anthropometry in Canada is only one instantiation of the interrelationship between colonialism and medical and anatomical

knowledge; it is fundamentally unexceptional. The unnamed Indigenous people who submitted to Grant's studies – many of whose bodies remain unburied, far from home – are only some of the many colonial ghosts that haunt contemporary visual practices in medicine.⁵¹ As Banu Subramaniam suggests,

The ghosts live on in almost all aspects of current biological practice. Learning to see them is not just about seeing the ghosts, seeing the history, the political and cultural legacy of the field, but about laying bare the epistemological and methodological apparatuses that have framed our seeing for more than a century. (2014, p. 22)

Like Subramaniam, I explore these histories as not only a problem of lingering cultural biases in the field but as profoundly constitutive of its current material and social configurations. In the rest of this chapter, I provide a contextual account of these material and social structures as one way of learning to see how, where, and in what forms these ghosts continue to haunt medical and anatomical visual practices.

“The anatomy problem”

Anthropometric projects were a logical extension of Grant's work as an anatomist precisely because they were but one part of a larger historical pattern of medical and scientific approaches to understanding and classifying human bodies. Colonial expansion exposed early modern Europeans to an overwhelming diversity of life which seemed to demand cataloguing, classification, and interpretation (Findlen, 1994; Sawday, 1995). However, by the seventeenth century, the presence of such diversity presented an ontological challenge to the universality of the individual (European, male) subject of emerging political and moral philosophy (Leys Stepan, 1998). Thus, as historian Londa Schiebinger argues, “the Enlightenment challenge that

⁵¹ On some of the many ghosts of anatomical practice and medical illustration, including the dissection (both legal and extra-legal) of the bodies of marginalized, impoverished, and incarcerated people, see Humphrey (1973), Richardson (2001), Sappol (2004), Halperin (2007), and Hildebrandt (2008).

people are by nature equal was met in conservative quarters with the search for natural differences” (1993, p. 9). Europeans responded by focusing on the cataloguing of difference as a strategy for not only ordering but ranking bodies.

In conjunction with liberal individualism, the process of demarcation and categorization of difference could take on political and moral dimensions as well, resulting in “the construction of races and genders as natural, biologically grounded entities, entities which render its [sic] members lesser or even non-individuals” (Leys Stepan, 1998, p. 29). By the nineteenth and twentieth centuries, the co-development of anthropology and anatomy, alongside evolutionary theories and their eugenic corollaries, enabled this ordering to be cast and recast as a natural one in which human groups could be not only sorted according to quantifiable physical differences but also arranged along a continuum of “civilization” and humanity.⁵² Scientific construal of difference as deficiency enabled a retrenchment of the social and political order, providing justification for continued colonial expansion, enslavement, and eugenics while also intensifying gendered social relations.

As part of these entwined histories of classification and colonization, medical and anatomical illustration has been one of the most convincing vehicles for cementing and transmitting the European male body as a universal norm. Lorraine Daston and Peter Galison (2010) have argued persuasively that medical image-making serves as a form of training the perceptual apparatus. Katherine Cober argues that the “cumulative nature of anatomical science meant that each successive generation of anatomical scientists built upon the conventions and established knowledge of the previous generation” (2015, p. 12). As successive generations of

⁵² The literature on these topics is rich and varied, but well beyond the scope of this dissertation. For an overview of post-colonial science studies, see Seth (2009, 2017). For more on connections between anthropology, anatomy, colonial medicine, and eugenics, see Ben-zvi (2007); Blakey (1987); Levine (2012); O’Sullivan and Jones (2015); Schiebinger (1990, 1993); Wallis (1995).

anatomists developed, entrenched, and systematized the teaching of a “normative human anatomy,” this accumulated knowledge was further “refined and reinforced” through illustrations (Cober, 2015, p. 12). Echoing Steven Shapin’s “modest witness,” Cober argues that anatomical illustrations become “witnessable objects” that concretize and codify the anatomist’s perspective as scientific fact, thereby shaping “the perception of the student by influencing what was observed and how it was observed” (2015, p. 12). Furthermore, the portability of anatomical illustrations enabled this codification and systematization to travel and function as an organizing principle for medical education and medicine as a disciplinary practice. Thus, she argues, “... in anatomical illustration the European male body becomes the universal form, the working object, and the silent messenger that was used to carry knowledge about and speak on behalf of all bodies, not just European male ones” (Cober, 2015, p. 28). Although in practice anatomical illustrations draw on the accumulated knowledge and observation of many different bodies, the visual exemplar of anatomical normalcy from which all other bodies could be construed as deviations remains European and male. The production of a recognizable “universal standard body” against which all others could be measured relied upon the ability to concretize and mobilize expert vision as scientific fact (L. J. Moore & Clarke, 2001, p. 61).

The representation of bodies in anatomy was taken up as a matter of particular concern by feminists in the 1990s. Lisa Jean Moore and Adele Clarke identified anatomy as “an institutionalized discourse rife with vivid representations which claim the body for medicine and then insist on simplification and universalization” (1995, p. 255). Throughout the late 1980s and 1990s, researchers sought to document and understand the ways in which (cisgender) women’s bodies appear (or do not appear) in mainstream anatomy and medical textbooks (Alexanderson et al., 1998; Giacomini et al., 1986; Lawrence & Bendixen, 1992; Mendelsohn et al., 1994; L. J.

Moore & Clarke, 1995). The consensus across these studies was that women are considerably underrepresented in “normal” anatomy, but overrepresented in illustrations of reproductive anatomy. Those that attended to additional axes such as race, age, and size found that both women and men were typically depicted as young, thin or lightly muscular, and white. Texts typically presented gender as strictly dimorphic, with female bodies typically described in relation to or as a variation on the male (never vice-versa). Representation of disabled or intersex bodies was virtually non-existent outside the context of pathology. By the turn of the century, the “anatomy problem” was well defined: illustrations and descriptions in medical and anatomy textbooks depict a singular (young, white, athletic) male body as normative and a singular (young, white, athletic) female body as not only its binary and adulterated other but also as primarily a reproductive body.

Despite identification of “the anatomy problem” in the 1990s, little has changed (L. J. Moore & Clarke, 1995, p. 255). The historical construction of whiteness and maleness as an anatomical baseline continues to inform medical education and practice.⁵³ When Moore and Clarke (2001) returned to the question in the early part of the current century, they found that the general trends identified by previous studies persisted in new digital media. In a 2016 study of representation in anatomical and medical texts, Rhiannon Parker found that the vast majority of images remained white, male, muscular and not visibly disabled. Where variations in apparent race, gender, size, or ability were present, they were “more likely to be diverse either in terms of gender or ethnicity or body type than they are to be in any combination of these characteristics”

⁵³ Although shifts in classificatory practices over the last century have ostensibly aimed at disambiguating racial categories from biological ones, these shifts have often resulted in a retrenchment of old norms under new names. See Fitzgerald (2014); Gissis (2008); Morning (2008, 2011); Reardon and TallBear (2012). On the persistence of standard bodies in medical education and associated fields such as forensic pathology, see also E. Johnson (2005); Pugliese (2005).

(Parker, 2016, p. 138).⁵⁴ In other words, the “universal standard body” remains the anatomical baseline against which variation is measured; the diversity of human bodies is representable only as a series of discrete deviations from the norm (L. J. Moore & Clarke, 2001, p. 61).

The distribution of the conventional

As I explored in Chapter Two, biomedical illustrators are trained to create images that are self-evident: intuitive and correctly interpretable by every viewer, at least within the intended audience. For the medical illustrator, a successful visualization is one that conveys the intended information without calling attention to the medium itself nor the effort involved in creating it. In short, a well-constructed image should speak for itself. Moore and Clarke contend, “[a] standard human body can also become discursively hegemonic and global in that anatomical representations can create the universal standard body while erasing both the range of variation of human bodies and making invisible the very work of standardizing bodies” (2001, p. 61). To maintain the self-actualizing fiction that standards faithfully and disinterestedly represent the world – even as they re-make it in their own image – the work of standardizing is necessarily invisible.

The material and economic contexts that continue to hold these standards in place, in spite of critiques, comprise what Susan Leigh Star calls “the distribution of the conventional”

⁵⁴ Kimberlé Crenshaw’s canonical work on intersectionality suggests that the “single-axis” framing of difference treats each category as separate, “[limiting] inquiry to the experiences of otherwise-privileged members of the group” (1989, p. 140). “Women” are assumed to be white, unless otherwise stated; “Blacks” or “African Americans” are assumed to be male, unless otherwise stated; and so on. Crenshaw argues that this approach ignores the distinctiveness of Black women’s experiences. The combined effects of gender, race, age, disability, and class can neither be extracted from each other nor extrapolated arithmetically through the multiplication of singular categories. In the context of anatomical texts and medical practice, the treatment of white and male as the norm from which all others deviate is not just an epistemological or theoretical problem; those who are left out face often life-threatening consequences when seeking medical attention. See, for example, Schiebinger (1990), Bauer et al. (2009), Parker (2016), and Massie et al. (2019).

(2015, p. 277). Moore and Clarke suggest that “[a]natomies are ruled by conventions” (2001, p. 59). Drawing on both art history and sociology, they argue that “conventions are products of pragmatic situations, aesthetics and interactional networks” (L. J. Moore & Clarke, 2001, p. 59). Over time, the accretion of assumptions, practices, and pragmatic decisions produced within a cultural context solidifies into conventions and heuristics which, while often unstated (much less dogmatically enforced), inform and constrain future decision-making and practice. However, the durability of conventions is not simply a matter of habitus or unquestioned assumptions, but also a product of the material, social, and economic contexts within which medical illustrators operate.

Representational conventions arise not only from a shared visual language or knowledge base, but also from a sedimented set of institutional arrangements that act as standards of practice. The social and economic arrangements in which medical illustrators work limit access to more inclusive reference materials and resources, the time available for developing novel representations, as well as their autonomy in creating unconventional depictions. Furthermore, the historical and social conventions of representation, such as the pathologization of non-normative bodies and the sexualization of female bodies, continue to inform the interpretation of new images. As the case of Ibe’s illustration demonstrates, even when individual illustrators wish to contest the norms of biomedical representations, they remain beholden to the expectations of their clients and the cultural contexts in which the images circulate. Representing a variety of human bodies in medical imagery is not merely an ethical dilemma. It is also a practical problem of negotiating meanings, materials, and contexts.

Image 13

Student workstation with plastinated head

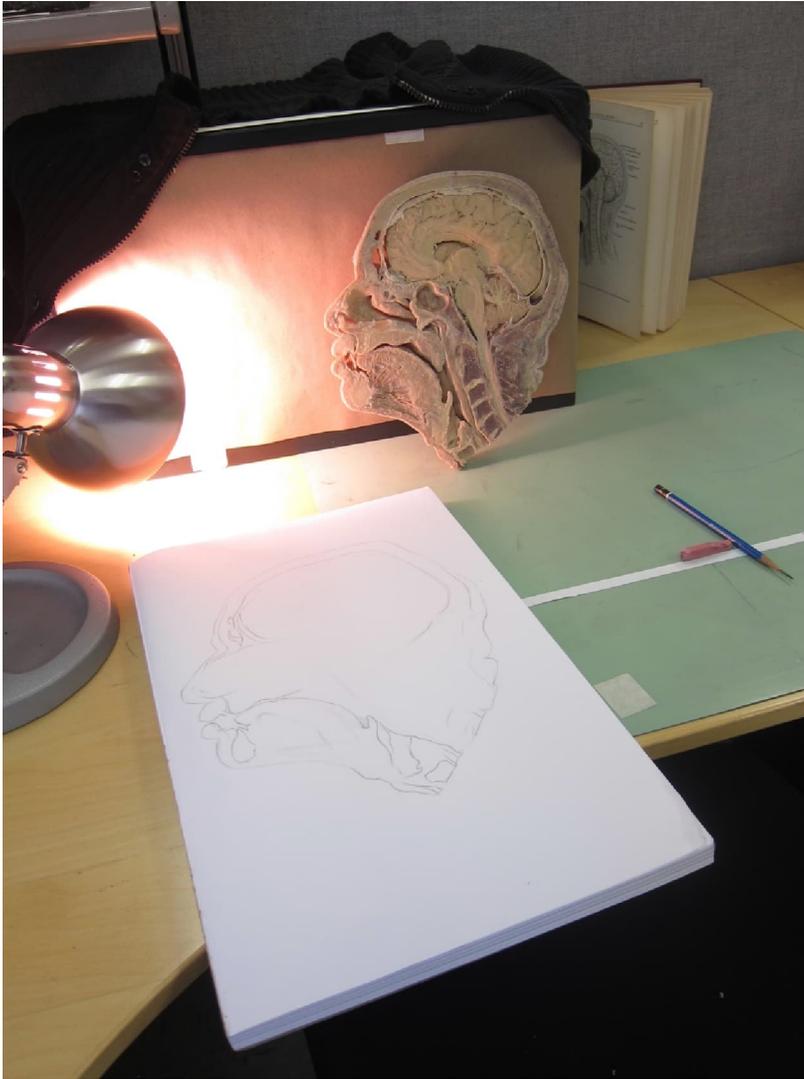


Photo by the author.

“Light from the upper left”

During the first few months of their two-year program, graduate students in medical illustration are introduced to the conventions and heuristics of visual depiction and graphic design which will enable them to succinctly convey information about form as well as temporal

and spatial orientation. Brian, an instructor in the Canadian graduate program, begins one early lesson by explaining that scientific convention is to use a single light source in the upper left. Most students have prior artistic training and are already aware, at least intuitively, that artists rely on the effects of light to enable two-dimensional drawings to convey three-dimensional forms. However, light and shade can be deceptive without other contextual references. Without knowing where the light source is, Brian explains, one can enter the realm of optical illusions. For example, an image can appear convex or concave depending on where one assumes the light source is located. Lack of orienting context is of particular concern to medical illustrators because their work often depicts only a narrow section or a limited view of specific areas or parts within a body. Spatial orientation in these images is key to interpreting them, but also difficult to achieve. Consistent positioning of the light source, as well as visual effects suggesting transparency and translucency, texture, and contrast, can be used to orient the viewer to the image and its depth while omitting contextual and spatial references that are not considered otherwise salient. He concludes, “All those things are giving us the clues we need to understand that form.”

A few months later, I accompanied the same students to Chicago to attend a series of lectures in honour of recently deceased artist Frank Armitage. In her keynote address, his widow Karen Conolly Armitage, an accomplished artist and designer in her own right, joked about his early experience of art school: “‘It was very old school,’ he told me, ‘like how they teach it in England. They put balls and pyramids in front of you and you have to... there’s a light from the upper left...’” The audience laughed right on cue. “I knew you would like that,” she quipped. When I presented preliminary findings to the Association of Medical Illustrators (AMI) meeting

a few years later, I too played to my audience, drawing laughs with my own “light from the upper left” remark.

The joke is funny because it refers to a shared language, a convention that all of the illustrators in the room, from first year students to retirees, can recognize. In the case of Conolly Armitage, the joke also alludes to the fact that Armitage’s influence in the field of medical illustration was precisely his break with conventions of lighting, orientation, colour, and depiction of space. Crucially, Armitage was never formally trained as a medical illustrator. Instead, his biomedical illustrations were heavily influenced both by his work in set design and years spent studying Mexican muralist traditions. As a designer for what would come to be known as Walt Disney Imagineering, he imagined elaborate sets of films and theme park rides, including the film *Fantastic Voyage* and the Wonders of Life exhibit at EPCOT. Armitage’s images are often architectural in sensibility, brightly coloured, and dramatically lit. They create a sense of being inside bodies, as exemplified by the arresting perspective of his set designs for *Fantastic Voyage*’s miniaturized scientists. In comparison to the standard anatomical views and the monochromatic or naturalistic but subdued colour palettes that characterized medical illustration for most of the twentieth century, they seem very contemporary.

Armitage’s architectural and expressive approach to rendering biomedical subjects challenged many of the conventions of medical illustration that had been cemented in earlier generations. However, it also reflected contemporary aesthetics and emerging technologies, enabling the stylistic shift to take hold, particularly in molecular illustration and advertising. Nevertheless, the profession as a whole remains aesthetically conservative and prone to relying on standardized viewpoints and conventions of representation in order to ensure legibility. Martin Kemp (2010) suggests that aesthetic trends in western scientific depictions reflect not

only the state of knowledge and the available technologies of rendering and reproduction, but also the instrumental roles that these images are expected to play and the philosophical commitments of those involved in their production. As Kemp argues, the paradigmatic visual rhetorical strategies and styles of medical illustration have evolved in tandem with the visual cultures in which they are produced. Moreover, they reflect the epistemic role of images that are designed to convincingly present the current state of scientific knowledge as *real*. Use of naturalistic light, shadow, and texture to convey spatial depth and use of graphic tools like dotted lines to make hidden layers visible are equally convincing tactics because they conform to established conventions and expectations.

Familiar faces

Reliance on conventional representations is sometimes a matter of expediency. Most biomedical illustrators are employed by researchers, physicians, and institutions or companies with specific requirements and deadlines the illustrator must meet. Although specifics may be provided by the client, it is often incumbent upon the illustrator to obtain and make sense of large amounts of background information to understand both the mechanisms and structures they are tasked with depicting. As I mentioned in Chapter Two, the model medical illustrator is one who, like Brödel, can conduct her own first-hand observation of the subject matter. However, it is usually both difficult (if not impossible), time-consuming, and expensive for illustrators to obtain access to specimens for independent investigation or dissection. More often, medical illustrators rely on a broad range of materials as both scientific and visual references, including relevant research studies, publications, and previous illustrations, as well as photographs and occasionally live models or specimens. For most common and well-established structures, illustrators turn to previous illustrations.

Image 14*Student workstation with reference materials*

Photo by the author.

The most widely accessible reference material tends to perpetuate the same standard bodies. Parker's study of medical illustrators' reference materials confirms that "the illustrator most highly referenced as inspiring was Frank Netter, whose anatomical textbook was found to be one of the most biased anatomical textbooks" depicting almost exclusively young, white, fit male bodies (2016, p. 177). Netter relied on his own family and neighbours for reference, resulting in a canon that is as white and upper-class as the artist (Netter, 2013). The runner up in Parker's 2016 study was Max Brödel, but his work was not specifically quantified in the study and a great deal of it was surgical. However, those images which depict patients' external

identifying features tend to follow a similar pattern, including several well-known self-insertions. While most illustrators consult multiple sources and are typically focused on anatomical details, not superficial aspects, the social position of these influential and prolific illustrators creates a standard of normalcy steeped in that same milieu.

Like Netter and Brödel, many contemporary illustrators also recruit models within their immediate social networks as part of their process (Parker, 2016). Although previous illustrations or stock photos can act as references for certain aspects of an image, they are often limited in terms of poses and lighting. During their training, graduate students often used each other as models. This meant that cohorts with a broader range of ethnicities also included a broader range in their work, whereas more racially homogenous classes tended to produce more homogenous work. With gender demographics of the student body at odds with the gendering of the standard anatomical body, male students (and male romantic partners) were in high demand.

Misfits and outliers

When certain bodies are always presented as a neutral, anatomical baseline, then those that deviate become signifiers whose presence and unique characteristics are assumed to carry further meaning. Thus, many illustrators (and their employers) understand marking a body as female or of a particular ethnic group as not only inherently significant to the reading of the image, but distracting and potentially misleading.⁵⁵ As Julie, an early-career faculty practitioner and member of the AMI's "Diversity Task Force," sheepishly explained,

We want the message to be in the organ that is being shown in the person or the molecule that's floating around their head. We don't want it to be noticeable, so we always pick a

⁵⁵ The medical illustrators who participated in Parker's study similarly referred to features such as breasts as a "distraction" or innately sexual (2016, p. 160). Indeed, she found that clients' "puritanical" attitudes towards nudity and female bodies in general also hindered illustrators' attempts to vary the bodies included in their illustrations (Parker, 2016, p. 179). By limiting their appearance to sexual and reproductive topics, the pervasive sexualization of female bodies and body parts perpetuates itself in medicine as a tautology: female bodies are inherently sexual because they only ever appear in relation to sexual function.

white man. You know? It's like, they blend into the background. They are human, you know. That represents all of humans. And the parts associated with women like breasts or the look of Africans, it like, I think as white people in medical illustration, we just think of it as distracting, automatically, you know?

Despite her own personal investment in questioning these norms, Julie's statement illustrates one of the difficulties of simply choosing to diversify medical images at an individual level. Because the white male body has historically represented "all of humans" it remains "unnoticeable." Conversely, any deviation from the "universal standard body" is significant (L. J. Moore & Clarke, 2001, p. 61). For medical illustrators seeking to convey specific information, *unintended* significations must be minimized if not fully eliminated. Illustrators continue to treat athletic white male bodies as the default or paradigmatic "healthy" body precisely because they are socially accepted as the normative convention and thus easily legible. They are relied upon because their use is expected and therefore inconspicuous and non-meaning-bearing, whereas deviations from standard tropes are noticeable and therefore significant.

Illustrators and their clients tend to construe the inclusion of gendered or racialized attributes not only as meaning bearing but as corresponding to pathology. For example, in Parker's study, "seven participants who reported that their work lacked diversity indicated that they would add diversity if it was indicative of the pathology that was being represented" (2016, pp. 165–166). Indeed, multiple respondents inferred that "if a non-normative gender or body type was used in an illustration then the audience could attribute that trait as part of the pathology" (Parker, 2016, p. 166). Standard practice is to include racialized, visibly disabled, fat, non-male, elderly, or youth bodies only if those features are considered directly relevant to the topic at hand, such as women's reproductive health or illnesses that affect that particular community. If race or gender is not understood to be a significant factor, the expedient thing to do is to remove those characteristics (i.e., revert to an unmarked white male body). Thus, as the novelty of Ibe's

illustration makes clear, Black women rarely appear in medical texts as something other than a problem.

Attempts to convey etiology and risk through visual signifiers can also result in a simplification of complexity and context, reinforcing exclusions by constructing preposterous and monstrous bodies. For example, when designing informational posters and public health communications to convey a variety of population-level epidemiological risk factors, illustrators often include all of them in a single body, resulting in monstrous bodies that belong to no one. During my research, a second-year class of medical illustrators was tasked with developing patient education materials regarding Zika virus transmission. The students struggled to convey the complexity of risk and symptoms in a condensed poster-size image with few words. Although Zika is most prevalent in Latin American countries, which like North America include an array of ethnicities, ethnic or racial background has no biological relationship to risk of contracting or transmitting the disease. As a vector-borne illness transmitted through mosquitos, its prevalence in particular regions is primarily a matter of geography. Although the disease affects both men and women, the symptoms in adults are usually mild (when they are not effectively asymptomatic). The site of most public health concern is the risk of microcephaly in infants born to infected gestational parents. Most students' draft sketches included a pregnant woman with olive skin tone and dark hair as one, usually the only, human figure, with all possible symptoms apparent on her body and a larger-than life mosquito looming over the scene. Those that focused on risks to fetuses similarly embodied all risks on one hapless infant. Not only is such a proliferation of symptoms highly unlikely in any given patient, most adults infected with Zika show no symptoms at all.

The constraints of the medium (a poster with few words) and the extant cultural significations of gender, race, pregnancy, and visible physical difference complicate attempts to convey risk and complexity. Like other public health communications produced during the height of Zika anxiety, risks associated with geography and complex etiology became personified in bodies: the mosquito, the malformed infant, and the pregnant Latina. The medical illustrator translates complex and culturally specific semiotics of these figures into a seemingly self-evident story of communicable disease. The mosquito represents the looming danger of vector-borne illness. The pregnant figure's skin tone and hair colour stands in for a geographical location, while her apparent gender stands in for reproductive capacity. The visual expedient of mapping all possible symptoms onto a single body transforms a range of risks to infants and inhabitants of Central and South America into a single monstrous figure. The pregnant woman or malformed infant becomes the embodiment of risk and monstrosity. In so doing, it also flattens the range of people who might be concerned (thereby absolving others of responsibility). As became clear during the COVID-19 pandemic, focus on risk groups, particularly when risk coincides with race, gender, and size, can result in diminishing concern and responsiveness in groups construed as "low-risk" (Harell & Lieberman, 2021; Niño et al., 2021; Vargas et al., 2021). The monstrous mother renders complex elements of risk and vulnerability, including social contexts, as biological predisposition. Her isolation suggests that she alone is responsible for protecting the fetus. On the other hand, the monstrous (usually light skinned) infant evokes the innocence she is charged with protecting, threatened with an uncertain future of disability and exclusion. In this sense, conventional visual strategies transform the social and political complexities of epidemiological risk into a story of the racialized and disabled Other.

Medical illustrations are intended to be legible within the prevailing culture, which means that they must account for the assumptions audiences are already trained to make, including assumptions about race, gender, and disability. The pervasive logic of difference as pathological leads practitioners to worry that attempts to include the excluded in medical illustration could have unintended effects. Working medical illustrators interviewed in Parker's 2016 study were "concerned that the mere presence of a non-normative body would be interpreted by audiences as indicative of pathology rather than as an attempt to represent diversity" or might perpetuate negative stereotypes (2016, p. 175). Furthermore, some students expressed anxiety that using racialized bodies when depicting specific illnesses or pathological conditions not otherwise linked to race would be stigmatizing.⁵⁶ Because non-normative bodies are typically used in conjunction with pathology or to indicate genetic predisposition or epidemiological risk, to represent a person of colour or a woman could imply that being a person of colour or female is a risk factor or that the condition does not affect other groups. Conversely, because white male bodies are culturally understood to be neutral and conventionally used as such in illustrations, the presence of disease in such bodies can be interpreted as a value-neutral, generic instantiation of the disease, not as a commentary on an entire class of people.

As Star points out, "there are always misfits between standardized or conventional technological systems and the needs of individuals" (Star, 2015, p. 272). The response to this in many highly conventionalized contexts is to treat outliers as individual problems to be solved on an ad-hoc basis. Thus, "single-axis" responses to critiques of medical illustrations reinforce the

⁵⁶ Graduate students also tend to equate racialized bodies with poverty and low literacy, particularly in discussions of patient education materials, which make up a significant and growing portion of medical illustration work. The literacy and socio-cultural background of targeted patient populations informs their choices when producing materials. However, as in the medical field at large, the repetition of assumptions about the make-up of those populations can reinforce stereotypes and even the very stigmatization that they seek to dispel.

categories and exclusions that it seeks to address by addressing each deviation separately. As Star asserts, ad hoc modifications fail to capture the heterogeneity of bodies and experiences that exist in relation to the standard but are not included in it precisely because the standards remain unchanged. In the context of medical illustration, bodies that are not included in the standard are always a site of negotiation and ambiguity. As in the context of individual experiences (such as addressing allergies and dietary restrictions at chain restaurants or seeking disability accommodations in work or schooling), this negotiation takes time and energy, and the results are never guaranteed.

Enacted as a historical and disciplinary convention of representation and signification, the fit white male “universal standard body” perpetuates and reproduces itself precisely by virtue of already being the standard (L. J. Moore & Clarke, 2001, p. 61). This means that, as Parker points out, “any attempt to resolve a lack of diversity that focuses on only the intrapersonal contextual level is likely to be unsuccessful” (2016, p. 175). Constrained by deadlines, economic pressures, and unequal power relations, unconventional images are both socially and professionally dangerous, especially for medical illustrators whose livelihoods depend on both achieving specific instrumental goals and delivering a specified product to their employers.

Unconventional bodies

Since 2016, the AMI has undertaken various initiatives to redress the lack of racial diversity within the organization as well as to address criticisms of medical illustrations themselves. Much of this work has focused on recruiting students from a wider variety of racial and ethnic backgrounds. Those involved with these efforts hypothesize that diversifying the profession will lead to greater diversity in their work. However, if the gender demographics of

the field cannot guarantee a lack of sexism in the images they produce, it seems unlikely that a politics of inclusion will achieve substantive shifts in representational practices. As Sara Ahmed argues, the formation of “diversity” committees and initiatives can “function as a containment strategy” which ironically “allow[s] organizations... to conceal the operation of systematic inequalities” (Ahmed, 2012, p. 53). Just as a predominantly female profession can still produce sexist images, racism in medical visuals will not disappear as a natural and logical result of expanding the racial make-up of the field.

As I explored in Chapter Two, graduate programs emphasize the collaborative nature of their work alongside a mandate to be always conscious of “the audience” and “the story.” Thus, program director Lisa stressed the fundamental importance of “communicating in a way that you can best collaborate with the scientist or the content expert, surgeon, you know, molecular biologist, or a clinician who is trying to communicate to a patient audience and understanding the appropriate levels for that.” However, assumptions about the audience can be wrong, subject to cultural stereotypes, or simply incommensurate with a given viewer’s prior experience and understanding. The commissioning author or company may reject the illustrator’s proposals because they do not fit with normative assumptions. New research may render an image incorrect or obsolete. Moreover, affected communities are rarely included in this negotiation, and even more rarely treated as “content experts” in their own right, meaning that seemingly universal conventions continue to propagate, unquestioned. While individual illustrators might wish to change that, few have the ability to do so within the material and social exigencies of their employment.

As Parker (2016) notes, marginalized illustrators might be more aware of biases in their work, but most are still constrained by the references available and the demands of their clients.

Although most illustrators do significant background research on their subjects, information and examples for understudied populations are not always readily available. Citing a recent article regarding under-diagnosis of skin cancers in people of colour, Theresa, a junior faculty member, exclaimed,

We have a responsibility to show, from all of these perspectives, to give this variety, this cultural variety because otherwise we're actively harming the education of these people [medical students].

However, in many cases, these same groups are also under-researched or excluded from research. This lack of research and extant diagnostic information can make it difficult for illustrators to find reliable references that include those populations, especially in situations where etiology, presentation and diagnostic criteria, or clinical progression might differ. An illustrator must be both willing and able to invest additional time and effort to acquire the expertise necessary to portray under-researched and under-represented conditions, or to veer away from established conventions. Even when an illustrator is so motivated, her employer, agency, or the commissioning author might not be.

The existing professional and economic structures within which medical illustrators operate center scientists, surgeons, and physicians as “content experts.” Medical illustrators often have limited autonomy over their projects; according to Parker (2016), 70% of illustrators feel that clients and/or employers have equal or greater control. Respondents in Parker’s study often cited client attitudes and feedback as motivation to change an illustration to reflect the white male standard. Many described a clear preference for male bodies, such as one participant who asserted that “the male form is easier to make androgynous” (as cited in Parker, 2016, p. 159). Another of Parker’s interviewees described instances when clients explicitly requested “in pretty unambiguous terms – to change it to a ‘blue-eyed blonde’” (as cited in Parker, 2016, p. 164).

Enforcement of this standard starts early in graduate training. During a small group interview with graduate students, Quinn, a first-year graduate student, explained to me,

I've done projects in the past where you try to incorporate an ethnic minority as the subject in the illustration and the revision notes come back and say like, can you make it more generalized? And you ask yourself, what does that mean?

More generalized, is that more European or back to this sort of blue person that's used like way too many times in medical illustrations? You know what I mean, that like glowing blue [laughter] – which is, it's European. It's like, you know, very Greco-Roman, like, [laughs] antiquity head or profile, I guess. And for that to be the standard, general model of a human is – I think – problematic.

Like the working illustrator's assertion that the male is more easily construed as "androgynous," the student's observation reflects the normalization of European features as "the standard, general model of a human" (Quinn), regardless of colour. Attempts to portray a more generic human reinstate whiteness and maleness as unmarked categories. Her classmate Rachel emphatically agreed, citing lack of diversity and trans-inclusive materials as "something that I was really angry about [...] and I actually talked about that in my interview." Although both felt generally supported by their department, this frustration was a motivating factor in the students' work.

Even when there is relative freedom to do so, the process of developing *unconventional* representations is neither efficient nor predictable. During discussion of the Zika assignment, one student mused aloud as to whether there might be some sexism in targeting only women for educational campaigns. She pointed out that although asymptomatic men can transmit the virus sexually, they were largely absent from the materials the students were producing. This question became a catalyst for developing a poster that would communicate risk of asymptomatic infections and risks to men. Unlike her peers' highly detailed renderings of Latina women and babies, her sketches included more schematic human forms and bold slogans directed at men and asymptomatic carriers, focusing precisely on the fact that infection is often invisible. In

recognizing the limitations of the conventional form, she was able to consider bodies and populations who had been overlooked and restructure her approach to the material. But doing so meant putting herself at a disadvantage in terms of her productivity: at the end of the class, her sketches were the least developed, while others were nearly ready to begin rendering a final product. In the context of a quickly developing outbreak or a profit-driven pharmaceutical campaign, choosing to take the unconventional route could cost her the contract.

Medical illustrator Sarah Crawley negotiated this friction in her graduate thesis, an animation designed to “communicate the risk of HIV transmission via breastfeeding to mothers living with HIV in Canada [...] to allow women to make appropriate, informed decisions about whether or not to breastfeed” (Crawley et al., 2018). The project was explicitly designed to include multiple rounds of feedback from scientific experts, community groups, and HIV-positive gestational parents. Preliminary designs incorporated not only scientific research but also “analysis of the visual language used to describe HIV in art produced by members of the HIV community” (Crawley et al., 2018). However, some metaphors and character designs in early iterations used incited unintended responses. The original design used a first-person narrative of a Kenyan mother, but focus groups pointed out that instead of engendering a feeling of relatability and informality, this might suggest that a particular community was affected or responsible for the disease. Similarly, focus groups raised concerns that the “conventional factory metaphor” for viral reproduction suggested industrialization, colonization, and manual labour. In response, the student restructured the animation to include multiple characters of different backgrounds to better suggest “a diverse population of mothers living with HIV” and replaced the factory with an “automated bakery” in an attempt to reduce inappropriate connotations (Crawley et al., 2018).

In this case, working directly with the communities in question enabled the student to gain knowledge about the ways that her images were being interpreted, accounting not only for the heterogeneity of social and cultural contexts that her presumed audience might bring, but also the unquestioned colonial contexts of common explanatory frameworks. To create an animation that would enable a variety of parents with HIV to make an informed decision about caring for their children, the illustrator had to examine and re-fashion her own assumptions about who and what would make the audience comfortable as well as the cultural neutrality of her explanations. Unfortunately, even with the relative freedom of conducting such projects in an academic setting, other students I spoke with felt that they did not have the time to pursue this kind of iterative and audience-informed development process. Developing the work responsibly and responsively could require months or even years of planning, ethics approvals, revisions, and ongoing dialogue. Within the confines of a two-year graduate program, these timelines were not feasible for most. One graduating student explained ruefully that despite a strong desire to do so, the ethical and logistical constraints of engaging in this type of work in a health care setting, especially when working with populations deemed “vulnerable,” had been incompatible with the limitations of her degree program. Although she expressed a desire to continue developing the project in the future, few recent graduates have the time or freedom to design and conduct original research while establishing themselves professionally.

Enacting accuracy

“Lipstick on a pig”

In publications and communications medical illustrators emphasize “accuracy” as the element that definitively separates them from “our untrained competitors” (Demarest in *AMI*

Annual Meeting Program, 2008, p. 13). On the surface, the term “accuracy” seems to refer to scientific facticity: objective and legitimate knowledge, correctly obtained. However, medical illustrators’ use of the term suggests a far less tidy meaning. During one interview, graduate program director Adam described a recent encounter with a member of a review committee in the university, in which his data visualization had been called into question:

[...] That assumption [that] as kind of visual arts-associated people, as communications people, we don't give a shit about truth and that we're likely to screw something up, that's kind of annoying. [...] That's probably the last thing you should accuse us of. You know, we're very concerned about accuracy and, you know, ultimate truth or whatever. I know, we could have philosophical discussions about whether those things actually exist but we're-- but that's something we're obviously very concerned about and we're not about-- you know, we're not about putting [...] lipstick on a pig or something.

His impassioned outburst conveys the complexity of accuracy as a concept both fundamental to their work and exceedingly difficult to explain or prove.

As a statistical concept, accuracy has a well-defined meaning which hinges on a knowable, verifiably “true” value, or at least the assumption that such a value exists. Usually juxtaposed to “precision,” statistical “accuracy” denotes a relationship between the measurement obtained and the “true” value. Precision, on the other hand, refers to the degree of internal consistency between measurements. One is an ontological relationship which assumes a “real” value (which may or may not be known/knowable), while the other is an epistemological one, intended to account for the variability inherent in the act of measurement itself. As Donald MacKenzie (1999) has explored in relation to nuclear missile testing, this concept of accuracy is subject to changing meanings in practice. Although the word suggests a relationship to truth, that relationship is dependent not only on the truth it purports to approach, but on the contexts of its enactment. According to MacKenzie, the accuracy of nuclear missiles is constructed through a complex testing process, but “whether the results of this process are facts” and whether those facts are transferrable to other contexts (such as from firing on a test range to firing on an enemy)

have been repeated sites of controversy and uncertainty (1999, p. 346). In other words, even statistical accuracy is also an epistemological question.⁵⁷

Nevertheless, in our interviews, most medical illustrators invoked accuracy as an unproblematic concept, implying both precision and a clear relationship to facticity and truth. Indeed, in my interviews, practitioners and faculty repeatedly stressed that “accuracy is obviously super, super important” (Julie) with no further explanation. Students tended to emphasize the amount of research necessary to ensure one’s work is “accurate.” Yet, when pressed, accuracy entailed far more than precise measurement or a relationship to legitimate knowledge and research:

Interviewer: When you say accuracy, what do you mean by accuracy?

Genesis: Yeah, so that's a major thing that we focus on is accuracy. It's really what separates medical illustrators from just, you know, artists, fine artists. It's because of our accuracy in our work. I think the importance of that is to make sure that what we're conveying actually is beneficial and effective – I'll say effective, actually – because it can go as far as like, even causing maybe a surgeon or something like that to do a procedure wrong if we don't have accuracy in our anatomical illustrations correct. So, in that sense, like what we're doing, it has to be accurate because the way our work is used and what it's used for, for that understanding, really it shapes the outcome in people's lives and their health.

For Genesis, a recent graduate, to meet moral and instrumental goals – to be “beneficial and effective” – an illustration must be “correct.” Tautologically, in order to be correct, it must be beneficial and effective. As Kemp asserts, “every act of representation is purposefully selective” (2014, p. 345). For illustrators, the active selection and interpretation involved in the making of the image is deemed successful precisely when it is indistinguishable from fact. Having performed the labour of interpretation, the illustrator spares the viewer that effort. In this sense,

⁵⁷ For an insightful discussion of the notion of accuracy in text-based science communication, see Hansen (2016).

accuracy is also a matter of negotiating interests and managing meanings toward a particular interpretive result.

Accuracy is not merely adherence to scientific ideals of objectivity, precise measurement, and legitimate forms of knowledge-making. Faculty practitioners' emphasis on accuracy also reflects an ontological ideal of truth and deep understanding articulated in and through aesthetic ideals of beauty, purposiveness, and visual clarity. In a first-year course in anatomical visualization, students undertake a painstaking hand-drawn rendering of the three bones of the shoulder joint. The instructor, Yvonne, uses this assignment to consider forms of precise measurement available when rendering a three-dimensional form in two dimensions, using Renaissance drawing and perspective techniques like calipers and a gridded Plexiglas pane. It is a complex assignment, as the bones do not lie along the same visual plane, so the students must find and maintain a physical orientation where key structures and anatomical relationships are visible and then adapt their measurements to account for perspective. As Yvonne demonstrates painstaking measurements, using calipers to transfer measurements to tracing paper, she repeatedly emphasizes aesthetic concerns as integral to the process. On one hand, the illustrator's body and perceptual apparatus must be strictly managed, viewing with only one eye and ensuring the position of the head remains fixed. On the other hand, as Adam pointed out, "the eye is [...] not a measuring tool." Intentionally echoing Brödel, senior faculty member Paul stressed that the illustrator must also "go way beyond, they've got to be able to understand the *meaning* of the object."

A handout for Yvonne's class makes clear that this embodied sense of deep understanding is inseparable from aesthetic concerns. First, it sets out the stakes and interdependencies of accuracy and aesthetics:

Medical and scientific illustration involves accurate drawing. [...] The goal is not to present an impression of the specimen which could be accomplished with photography or an abstract painting of the subject. The observer must be precisely and completely informed about the structure of the specimen. This kind of drawing requires disciplined precision, but it must also be aesthetically pleasing. Accuracy, precision, and aesthetics must be combined. (*Anatomical Visualization Handout*, 2017)

Here, accuracy suggests proximity to truth, functioning alongside but separate from precision and aesthetics. However, the handout goes on to emphasize the contingencies of visual perception and precise measurement when a three-dimensional, potentially moving, object must be apprehended by a highly adaptive visual and cognitive apparatus and then rendered as a fixed two-dimensional image. It asserts that such renderings are the product of “compromises” and “limitations.” Furthermore, it explains, “[w]hile making all these computations to insure [sic] accuracy, the illustrator must also concentrate on recreating [and] experiencing the essential character of the subject”(Anatomical Visualization Handout, 2017). Taken together, the assignment suggests not only that accuracy, beauty, and precision are deeply intertwined with purpose, but that there is some “essential” quality that can only be obtained through the skillful management of all three as one.

Former medical illustrator Meaghan Brierly’s (2013) dissertation argues that “accuracy is managed and entangled across aesthetic decisions, technological choices and the science narrative explained” (2013, p. 175). Focusing on the pharmaceutical context, Brierly explores the powerful role of economic and corporate power structures in producing images which illustrators can nevertheless deem “accurate.” Illustrations are deemed “accurate” or “legitimate” as a result of a lengthy process of negotiation between powerful pharma executives, researchers, art directors, and the illustrator herself. Brierly contextualizes these negotiations across historical changes in working conditions and structures of oversight. Aesthetic decision-making is negotiated at the intersection of the available scientific information and the context of

dissemination (including both the intended audience and purpose), all of which are deeply contingent on social and material contexts that are subject to change. Constrained by deadlines, economic pressures, and unequal power relations, evaluations of accuracy are also informed by the specific instrumental goals of their employers. This process is always a negotiation, balancing the needs, expertise, and material constraints of these experts with those of the illustrator and other decision-makers such as funders and advertising executives. As Brierly makes clear, accuracy is a core value guiding medical illustrators' work processes and decision-making but it is deeply constrained by social and material contexts.

Feminist philosopher of science Letitia Meynell (2008) argues that interpretive flexibility is an inherent quality of pictures. She explains that "there is a flexibility allowing imaginative differences within the constraints of the prescribed imaginings" (Meynell, 2008, p. 17). "Imaginings" in this context are how the viewer makes sense of marks on the page as standing in for objects or actions in the real world, to the point that they will refer to the image *as the thing* it represents, not as marks on a page (not as an animation or a representation). For example, discussing an illustration of a heart as "the heart." The forms that such imaginings and interpretive actions may take are guided not only by the representational conventions which the illustrator chooses to follow or adapt, but also by the viewer's prior knowledge and interests, including the representational norms with which the viewer is familiar. The medical illustrator's drive to understand "the audience" is an attempt to maintain control over the potential imaginings a particular image makes possible.

Unlike many analysts of medical illustrations and visual culture, Meynell is careful to include the agency of illustrators and to account for elements, both social and material, which inform the process of bringing an illustration into being. Inclusion or exclusion of particular

details and viewpoints come about through research, negotiation and aesthetic problem-solving, which constitute “accuracy” for a medical illustrator. Taken as a whole, these inclusions and exclusions “prescribe the imagined functioning of the system” (Meynell, 2008, p. 23). She concludes that these contexts matter precisely because “conceptual decisions about what is truly important inform the visual hierarchies that organize the depicted objects and their relations and provide a crucial point for the possible introduction of patriarchal norms” (Meynell, 2008, p. 23). Thus, while the illustrator may intend accuracy when they omit or minimize the clitoris in conventional textbook illustrations of male and female genitalia, they suggest that it and its function are not relevant to reproductive processes. Moreover, these and other aesthetic decisions result in illustrations of male and female genitals which bear little resemblance to one another, obscuring the “shared developmental history of the clitoris and the penis” and thus reinforcing the “cultural unintelligibility” of intersexed bodies (Meynell, 2008, p. 23).

Accuracy is not, as is widely implied, a fixed, value-neutral relation to reality, but rather it emerges as part of a process of knowledge-making and meaning-making. For medical illustrators, it is a fluid concept, encompassing multiple, shifting definitions, values, and practices. An “accurate” visualization is the product of myriad relations and productive frictions between human and non-human actors, including medical illustrators, researchers, art directors, imagined and actual audiences, as well as their objects of study and the tools – both analog and digital – with which those objects are made palpable and meaningful. As Donna Haraway suggests, “[b]oundaries are drawn by mapping practices; ‘objects’ do not preexist as such” (1988, p. 595). The accuracy (and meanings) of an image thus produced remain mutable, subject not only to changes in scientific understandings upon which it was based, but also to shifts in the

contexts of dissemination and reception, including (but not limited to) social and cultural milieux.

As Meynell makes clear, the training of medical vision (and by extension the wider public) through medical illustrations constructs the intelligibility of only certain kinds of bodies and relations as “normal.” The conventions and norms of representation in medicine align a narrow set of athletic white, male bodies with normalcy and situate all others as deviant or problematic. These standards of practice are not only entrenched through long histories of colonialism and sexism but also through the continued organization of social and material concerns that dictate which objects and relationships are “truly important” and which are irrelevant or even distracting (Meynell, 2008, p. 23). However, as a “beneficial and effective” representation of the range of human embodiments, this unmarked “universal standard body” is quite simply *inaccurate* (L. J. Moore & Clarke, 2001, p. 61). How then can illustrators develop rendering practices that reflect the full range of human morphology and experience?

Unsettling accuracy

In her influential 2011 article, “Matters of care in technoscience,” Puig de la Bellacasa responds to Bruno Latour’s formulation of “matters of concern,” which she characterizes as a “re-baptism” of “matters of fact” – those things that scientific endeavours purport to produce, that medical illustrations purport to represent, and whose production scholars of Science and Technology Studies and related fields have sought to understand (Latour, 2004; Latour & Woolgar, 1986; Puig de la Bellacasa, 2011; Shapin, 1984). In her reading, Latour’s proposal advocates “a respectful and, we could say, constructive way of exhibiting matters of fact as processes of entangled concerns” (Puig de la Bellacasa, 2011, p. 89). Puig de la Bellacasa’s

feminist intervention extends this proposal to “matters of care,” stressing the ethical and affective entanglements, attachments, and commitments that inform the ways in which knowledge is made and represented.

According to Puig de la Bellacasa, both “concern” and “care” derive from the Latin *cura*. Although the *Oxford English Dictionary* denies this common ancestor, extending etymological tendrils I find that “accuracy” derives from the Latin *accūrāre*, “to give attention to, to perform with care” (Oxford English Dictionary, 2020). If to care suggests, as Puig de la Bellacasa proposes, “an affective state, a material vital doing, and an ethico-political obligation,” what kinds of medical illustrations might emerge from conceiving of accuracy as a form of care and, on the part of critics, approaching visualizations as artifacts made by humans who care deeply about them (2011, p. 90)? Concern for ideals like truth and humanitarianism motivates medical illustrators to express accuracy as a core value. Yet these commitments are often unrecognized, ill-defined, or subsumed in instrumental mandates to “communicate” and “educate.” On the other hand, critiques which treat medical visuals as ready-made or machine-made reflections of biomedical knowledge misconstrue both the affective and world-making dimensions of biomedical visualization as an epistemic practice. Rethinking accuracy as a form of care acknowledges both the affective commitments that incite practitioners’ emotive outbursts and attachments to the work, as well as the “responsibility to intervene in the world’s becoming, to contest and rework what matters and what is excluded from mattering” (Barad, 2003, p. 827).

Conceptual decisions about what is important or necessary for “accuracy” inform visual hierarchies throughout the process of creating medical illustrations. However, what is deemed accurate in a biomedical visualization is not solely contingent on evaluations of the current state of accepted knowledge. It also emerges from intertwined material and social relations as well as

the affective and aesthetic investments of the illustrator herself. As Puig de la Bellacasa argues, “ways of studying and representing things can have world-making effects” (2011, p. 86).

Treating accuracy as a matter of care means attending to the values and hierarchies that inform which relationships and processes are deemed essential to correct knowledge. It also presents possibilities for intervening in normative ways of seeing and understanding both bodies and the medical visualizations that purport to stand in for them.

Feminist critiques of science have repeatedly called into question the false dichotomy of reason and emotion, emphasizing instead the urgency of acknowledging that the “affective entanglements of inquiry” that compel researchers to pursue their objects of study are integral to scientific ways of knowing (Myers, 2015, p. 5). Natasha Myers explores the ways in which a protein crystallographer’s “body is invested in his interpretation of protein structures” and “this bodily intuition” provides a foundation for ongoing research commitments in search of “the crystal structures that can validate this feeling” (2006, p. 7). Far from articulating attentiveness to feeling as a particularly gendered way of doing science, she argues that affective and embodied investments permeate scientific endeavours, regardless of the researcher’s gender.

This is not an argument for a special feminine politics of feeling, nor “care” in the sense of gendered health-work (e.g. Armstrong & Armstrong, 2005; Keller, 1983). As Michelle Murphy demonstrates, “the elevation of a politics of care by 1970s feminists was simultaneously conditioned by white privilege, capitalism, and postcolonial humanitarianism” (2015, p. 721). Murphy cautions against a reading of “care” as positive affect, arguing instead for “[u]nsettling [...] the purposeful undoing and troubling of particular arrangements so that they might be acknowledged and remade in better, less violent, more livable ways” (2015, p. 722). In this sense, unsettling accuracy requires not only acknowledging the ways in which colonial histories

suffuse practices of rendering and medical knowledge-making but also seeking to remake those practices and knowledges in more livable ways. To perform medical illustration with care entails not merely adherence to the current state of biomedical knowledge and to the story that the commissioning researcher wants to tell about it, but also attention to and purposeful engagement with the forms of life that it renders intelligible or unthinkable.

Despite medical illustrators' rhetorical emphasis on the purposive aspects of aesthetic decisions, there remains an affective surplus that elides explanatory frameworks. Questions about aesthetics and beauty often elicit effusive emotional responses – thick descriptions and strong adjectives, full-bodied gestures and respectfully hushed tones or joyful laughter. As she enthusiastically shared with me a portfolio of her own work, Julie explained:

If I show this to my friends who are not medical illustrators, they think it's horrifying. But like, when I show it to medical illustrators, everyone's just like “oh, that's so pretty!” [laugh] Because it is horrifying. Like, this is a chocolate cyst, it's really painful, it's endometriosis all over the pelvis, but for me as a medical illustrator it's like, how can I make the raking light highlight the tissue-y aspects of the uterus and [laughs] it's like, to me, that's beautiful, you know? So, highlighting the intrinsic characteristics of the anatomy or the molecules or any subject matter [...] in a way that is just pleasing to the eye is, I feel like that's what we're sort of getting at when we talk about beauty in medical illustration. Like, that was like, really satisfying to do. [laughs]

Like Adam's emotional outburst, these expressions of aesthetic and sensory pleasure suggest that affective and embodied investments in their labour exceed the instrumentality of the image. This impassioned excess denotes deep commitment, care, and attachment to both their objects of study and to their representations.

The question of which aspects are beautiful and why is bound up with both the purposiveness of the illustration as a source of reliable knowledge and the illustrators' joy in rendering. Although aesthetic decisions are routinely figured as secondary or even opposed to correct scientific information, they are at the same time fundamental to the work of managing attention and interpretation. On the one hand, as graduate faculty member Diana put it, “there is

value in aesthetic beauty. It attracts your eye to [...] the structures that you're meant to be looking at.” On the other hand, as Julie explained, one might be obligated to “eliminate these gorgeous aspects of an illustration in order to have the moment shine through that you're talking about.” In other words, aesthetic choices are strategies for making people *care about* things and also reflections of what the illustrator *cares about*.

To care about what one studies is a prerequisite to all epistemic practice. Acknowledging the forms that this care takes enables practitioners, users, and critics of biomedical visualizations to become responsible for *how* we care. Understood as a form of care, accuracy does not stand in for a detached form of mechanical objectivity, at odds with emotional and subjective aesthetics. Instead, it suggests attentiveness to both the known and the unknown, negotiation of interests and affects not only of researchers but also of those who are affected by the research, and an acknowledgement that the illustrator’s aesthetic and emotional investments are integral to her work. It also entails a responsibility to intervene, to contest and rework those social arrangements, standards, and conventions that are doing harm.

Caring about conventions

The usage of specific signs and symbols within Euro-American visual culture and medical illustration is contingent upon the ways in which they have been used in the past. As Moore and Clarke point out, “Within the sciences, then, disciplinary and specialty conventions develop over time into regimes of interconnected assumptions - paradigms of specialty representation” (2001, p. 61). Communication scholars Gunther Kress and Theo van Leeuwen argue that “The effect of convention is to place the pressure of constant limitations of conformity on sign-making; that is, the way signifiers have been combined with signifieds in the history of

the culture, acts as a constantly present constraint on how far one might move in combining signifiers with signifieds” (2006, p. 12). Representations can neither be made nor interpreted without reference to prior usage. Modulation of shading and angles of view in an image can be understood as “realistic” form in part because contemporary western eyes are trained in chiaroscuro and single point perspective. The legibility of shapes which consistently position light in the upper left is a matter of habit and cultural consensus, like driving on the right or left side of the road. Either side is functional, so long as everyone agrees on the convention. Breaking with conventions can be startling, confusing, and even dangerous.

Like Meynell (2008), Kress and van Leeuwen (2006) suggest that regimes of knowledge and representation are not naturally occurring but rather are the products of the histories and cultures within which they are produced. However, although this embeddedness in cultural and historical contexts is intrinsic to the process of making representations, they continue, “[c]onvention does not negate new making; it attempts to limit and constrain the semiotic scope of the combinations” (Kress & Leeuwen, 2006, p. 12). Unlike drivers, image-makers can and do violate and disregard conventions of representation, either intentionally or through misconstrual of context. “And what in one context is accepted convention may in another be a startling mistake or an innovative experiment” (Kress & Leeuwen, 2006, p. 120). Unconventional images also have the potential to reorient knowledge and sense-making.

Illustrator and molecular biologist David Goodsell and fellow illustrator Jodie Jenkinson (2018) argue that conventions of representation are not inherently legible. Their discussion of the evolution of representational forms in molecular modeling and illustration demonstrates how representational conventions (such as ribbon models) and analogies (such as the “lock and key” model) become legible through repeated use and through the explicit training of viewers. When

correctly interpreted, these analogies, models, and representational strategies provide a helpful shorthand for both teaching and research, but they are not *inherently* legible; new scientists must learn to make sense of them. Without prior knowledge of both representational conventions and common analogies, untrained viewers (like medical students) tend to interpret images anthropomorphically or teleologically, according to intuitive or common-sense reasoning grounded in their prior experience (Goodsell & Jenkinson, 2018). Like the graduate student's factory metaphor for HIV reproduction, even seemingly common-sense metaphors and interpretations can lead to misunderstandings and misapplication of concepts. The "acquisition of visual language and disciplinary conventions" is required in order for viewers to make sense of these images and – crucially – to derive the intended interpretation (Goodsell & Jenkinson, 2018, p. 3979).

Interpretive practices are also changed *through* the practice of engaging with unfamiliar representational practices. Janet Vertesi's (2014) concept of *drawing as* insists upon the interpretive labour of image-making not just in training the eye but in establishing the existence of something noteworthy to be seen, guiding interpretation thereof, and creating consensus. Like Meynell, Vertesi suggests that interpretive rigidity is built into images through "purposeful visual construal" (2014, p. 18). Ranging from the use of recognizable rendering techniques such as chiaroscuro and shading in Galileo's drawings of the moon to selective manipulation of multi-layered visual data collected by the Mars Rover, insight is both gained and enacted through image-making; as images circulate, they redefine what insights are possible.

Thus, while the interpretive practices of audiences are a product of their overall social environment and prior experience, they are also changeable. New rendering practices can establish new conventions, even in well-worn areas of research, and enable users to know their

objects and enact that knowledge in new ways. Like the spatial shift epitomized by Armitage, Goodsell's paintings of cell interiors present an unusual view of the relationships between elements within a cell. Unlike the familiar science class image of the cell, in which particular features such as mitochondria and ribosomes float in a relatively empty sea of cytoplasm, Goodsell's brightly-coloured watercolour paintings depict cellular interiors as vibrantly crowded environments, densely packed with proteins and molecules of various sizes and configurations. Although these images are in fact pared-down – omitting molecules such as water and ions – they convey a dense tangle of proteins, nucleic acids, and other small molecules. Far from the discrete structures that many are familiar with, they suggest a much higher sense of the complexity and interdependencies of cellular environments than typical images prior to Goodsell's intervention (*Goodsell Gallery*, n.d.). The result is not only visually arresting, it also presents an innovative and practically useful way of understanding how the elements within the cell interact.

Goodsell's colourful renderings are not merely clever or aesthetically pleasing, they have created new conventions in rendering biomolecular data. Goodsell's illustrations were originally developed through a complex process of experimenting with and extending the affordances of emerging imaging, graphics technologies, and analog rendering. However, the style has since been incorporated into specialized computer graphics software, such as CellPAINT (developed by Goodsell and his collaborators at Scripps).⁵⁸ Although they are often used for educational purposes, Goodsell et al. suggest that these visualizations are also “thinking tools” for scientists, allowing them “to capture the current state of the field and identify gaps in knowledge” (2020, p.

⁵⁸ This trajectory is not uncommon. Many of the conventions of molecular representations which are now standard in computer graphical rendering programs, from ball-and-stick or ribbon diagrams to standard colours, are based upon hand-drawn predecessors; see Goodsell (2005) and Goodsell and Jenkinson (2018).

474). Visualization at the “mesoscale” (that is, between the microscale of cellular structure familiar to most lay people and the nanoscale of atomic structure) also enables researchers to test hypotheses about “the relevant proximity of biological entities and properties that emerge as a result of packing within the crowded biological compartments” (Goodsell et al., 2020, p. 480). Consolidating the findings of disparate forms of research into a single image enables researchers to conceptualize unforeseen interactions. Rather than compressing variation into a conventional shorthand like the monstrous bodies of Zika symptoms, this synthesis of available information opens up new interpretive possibilities.

The example of molecular illustration provides some insight into the possibilities and challenges of changing representational conventions of race, gender, and ability in medical illustration. Unlike molecular illustrations, the conventions of anatomical and medical illustrations have an immediate and direct relationship to the visible social world, established and entrenched over centuries. However, the persistence of gendered and racialized assumptions in scientific research and education beyond gross morphology is well-documented, from genetics and immunology to brain scans and nanotechnology (Dumit, 2004; Martin, 2011; S. S. Richardson, 2012; Subramaniam, 2014; York, 2015). Even when subject matter seems quite distant from that of human social and political interactions, both the conventions used and their interpretation emerge from material practices, prior experiences, and larger ideological frameworks. The black-boxing of aesthetic conventions is as much a product of historical and social processes as of physiological responses to visual stimuli. Attending to those histories and the social exclusions they enact presents possibilities for constructing new ways of seeing and making sense of human-scale environments and interactions as well.

Chapter Seven: Conclusion

Claiming kin

Refuse reconciliation to ongoing brutality. Refuse to feast on the corpse of others. Rend the fabric of the kinship narrative. Imagine otherwise. Remake the world. Some of us have never had any other choice. (Sharpe, 2016)

A portrait of Max Brödel looms on one wall of a small seminar room, opposite a wall of cabinets in which the archive of his life is stored. Between them, six senior graduate students, all young women, present their surgical illustrations. The room is packed with presentation boards and photocopied layouts, faculty, and other students. I squeeze myself into the one remaining seat near the door and take notes furiously. A student is presenting a series of illustrations of laparoscopic total colectomy (removal of the entire large intestine). A senior faculty member interjects to question the orientation of anatomical elements in one of the images. A heated discussion ensues.

The conversation hinges not only on how visual conventions are mobilized in medical illustration but also what happens when these conventions are challenged. The senior faculty member, an experienced surgical illustrator, protests ardently: the image does not make sense. Eventually, they come to the crux of the matter: in a standard anatomical atlas, the large intestine is conventionally rendered ascending the left side of the image, turning right to cross the image then descending the right side of the image to the anus. Because the student's surgery is laparoscopic, she has situated the ascending colon at the top of the image, as it would be visible via the camera, not at the left. To orient the viewer within the space, the student has also chosen to show more of the anatomy than would be strictly visible from the camera, with an inset

diagram showing the camera's viewpoint. However, this unusual orientation creates confusion: certain anatomical elements seem to be in the wrong place or do not "look like" what they are, especially for those who are less experienced with laparoscopic views. The conventional orientation does not reflect the actual surgical view, but the unconventional is more difficult to interpret.

Drawing on her recent experience illustrating a book on laparoscopic surgery, a mid-career female faculty member suggests that surgeons familiar with laparoscopic views will not find the image jarring. She assures the student, "I think you've put some good thought into this convention and it's evolved." However, the tension in the room is only fully diffused when another younger male faculty member echoes her suggestion to emphasize the change in perspective by rendering the ascending colon at more of an angle so that it looks less like the overhead view that characterizes illustrations of open surgery. As the discussion wraps up, he jokes, "not that we don't always agree!"

So many pieces of the puzzle seemed to come together in that moment, in a room dedicated to the memory of the professional patriarch, physically crowded with images, bodies, and archives. Yet when I returned to my notes later, I found that the tension that was so palpable in the moment had not translated to the page. The scene was difficult to write (and still feels incomplete). In part, the biomedical specifics at the heart of the debate were hard to describe. I worried that I had misunderstood the conversation or gotten important details wrong. Even if I was factually correct and could accurately convey the biomedical aspects, it felt too intimate. It is difficult to make clear the social tensions – including age, gender, and race – without rendering the characters easily identifiable to anyone in the field. Although the conversation remained always cordial and the remainder of the presentation was far less eventful, I remember feeling

that more was at stake than the orientation of an image. A surplus of meanings and emotions – the ones I did not write – hung in the air. It never seemed to find its place in the body of my dissertation.

But this moment of confusion merits retelling precisely because it was also a moment of friction and possibility. The discussion called into question not just the student's choices, but also broader anxieties around shifting technologies and medical practices, gendered and generational conflicts, the material limitations and possibilities of specific visual media, and the cultural and epistemic practices of medical illustrators. Experience, gender, and areas of specialized expertise competed for epistemic authority and the right to decide which representations are acceptable. Caught in the middle, the student walked the tightrope of defending her decisions while taking on criticisms, all earnestly aimed at rendering the final product both accurate and legible.

Claiming kin

This dissertation began as a kind of recuperative project, not just of women but of image-makers in science. Despite excellent work on representation in my home field of STS, the specialized expertise and epistemic contributions of medical illustrators and visualization specialists is often overlooked or misconstrued. To adequately explain (much less address) the persistence of sexism, racism, and other inequalities in these images, we need a better understanding of the people who make them – especially in light of the gendered dynamics of the field. It is neither accidental nor natural that women dominate a field where the efficacy of one's labour requires it to be imperceptible as labour. This invisibility and elision is a feature, not a bug. The naturalizing of medical illustrations as fact relies upon the continued invisibility of their creators as active agents. However, acknowledging women's agency means also seeing the ways

in which women – particularly white women – have been complicit in building and maintaining conventions and hierarchies that do harm.

Like the student in critique, I have struggled to convey the complexity and tensions of this field accurately but not uncritically. Throughout the project, I have tried to balance my deep respect for the crucially important and skillful work of medical illustrators – past and present – and critical engagement with conventions and hierarchies within the field that continue to do harm. The devaluing of women’s labour as illustrators and as professionalizers elides their agential role in the construction of biomedical knowledge. In doing so, it also absolves them of their responsibility for the institutionalization of structural exclusions in medicine. Their invisibility is not merely a matter of sexism and patriarchy, but also a tool for maintaining white supremacy. Attending to the professionalization of medical illustrators not only provides insight into representational practices in medicine, it also enables us to see the mechanisms by which colonial values and culture are institutionalized and reproduced as disciplinary values and culture.

The pervasiveness of kinship as an organizing metaphor in the training and professional culture of medical illustrators is neither unique nor benign. As Black and Indigenous scholars like Cheryl Harris, Kim TallBear and Christina Sharpe argue, settler colonial configurations of kinship in North America emphasize heritability, continuity, and property as the basis of social relations and belonging (C. I. Harris, 1993, 2020; Reardon & TallBear, 2012; Sharpe, 2016; TallBear, 2013). These configurations not only structure histories of colonialism, slavery, and eugenics, they are also mechanisms for the “continued enfleshment” of those histories in the present (Sharpe, 2016). These scholars make clear that there are other ways of understanding kinship, particularly in communities marked by fragmentation, displacement, and resource

extraction. However, contemporary health and medicine depend on these colonial configurations to function. They do more than just configure which bodies and lives are construed as “normal,” desirable, or worth living. They also structure knowledge of family medical histories, access to social and material stability, and the ability to communicate needs and experiences in ways that practitioners understand. They shape not only standard bodies but also standard practices and judgements, from the grueling hours and expense of medical training to judgements regarding “noncompliant” or “unreliable” patients. Colonial configurations of kinship are woven into the very fabric of medical knowledge and practice.

Denying this inheritance is not only impossible, but counterproductive. Disavowing our racist relations does not undo the ways whiteness continues to structure our lives. As the COVID-19 pandemic has made clear, the social and economic arrangements that predispose certain human groups to poorer outcomes are buttressed by underlying assumptions about which bodies are worth saving and which deaths are acceptable, inevitable, and even necessary. As Cheryl Harris points out,

Inequality is not the product of dysfunctional culture, or the biology - the "comorbidities" - of misbehaving, undisciplined bodies: rather, racial regimes construct and exploit vulnerabilities. These are preexisting conditions, embodiments, material manifestations of exploitation. (2020, p. 3)

The continued dominance of the (not so) universal standard body in medicine not only perpetuates structural inequalities in health care, it legitimates social and political discourses which treat “return to normal” as an unproblematic goal. Assurances that only certain kinds of people are at risk – the marginalized, the aged, the disabled, the poor – reformulate the eugenic premise that some bodies (including the wrong kinds of white ones) are marked for premature death and even *better off* dead. The imperative to ignore and even hasten their deaths in the name of a “normal” life for the rest replaces early calls to look out for and protect one another. A world

in which every body is a good body and every life is worth living becomes increasingly unfathomable.

In order to envision more livable worlds and ways of life, it is necessary to examine the mechanisms by which particular human bodies and forms of life become naturalized as not only normal but superior and desirable while others are made intolerable, exploitable, and expendable. Building on the work of TallBear and Sharpe, Alexis Shotwell suggests that what matters is not only “what we claim about who we are; it also matters who claims *us* as kin” (2019, p. 8). In other words, descendants of white settlers (like Shotwell and myself) may reject these histories and values, but those who rely on whiteness as a measure of kinship and humanity may claim us as their own. Shotwell proposes “claiming bad kin” as one strategy for descendants of white settlers to transform social relations and remake a more equitable and livable world (2019, p. 8). Instead of claiming innocence or rejecting our shameful relations, “refusing to capitulate to current configurations might require white settlers to acknowledge our social and political entanglement with them” (Shotwell, 2019, p. 8).

In claiming and situating the contributions of well-meaning white women to colonial configurations of kinship and embodiment, my aim is not to render them as either heroes or villains, but rather to begin the daunting project of imagining new forms of solidarity by “pulling back on the ties that bind us to kinship relations of expropriation and violence” (Shotwell, 2019, p. 11). Tracing the contexts and contributions of medical illustrators and allied scientific visualization workers makes clear the epistemic implications of gendering labour, expertise, and authority. At a time when many fields are increasingly concerned with matters of equity and diversity, the rhetorical and social reproduction of the field as “family” elides structural inequalities in favour of unifying narratives of belonging and shared epistemic values. However,

the alternative to just-so stories of great men is not equally just-so stories of great women. Medical illustrators are neither passive vessels nor noble heroes; medical illustrations as objects of critique are neither wholly malicious misrepresentations nor simply the result of careless mistakes. The ambiguity and contingency of individual and collective agencies evades clear, linear narratives and simple answers. Rather than offering another tidy story, claiming these women introduces an unsettling friction to the frictionless, teleological and sentimentalized kinships of medical illustration's professional discourse.

No amount of revising history will undo its effects in the present. Like Shotwell, Michelle Murphy suggests that “non-innocent bodies are caught up in each other's conditions of life support and diminishment” (2017, p. 3). Recognition of this entanglement and the impossibility of escape from it is a pre-condition for seeking alternative genealogies and kinship structures. However, this is only a first step. As Murphy argues, colonialism has irrevocably altered the forms of life (both biological and social) available to humans and other living creatures. There is no innocent position or unmarked body to which we can return. The question then, is not only how to transform this damaged world into something more livable but also how to navigate our damaged relations and live well with one another right now. Indeed, these two questions are intimately connected.

The present conditions of human life have been forged in violence; the resulting states of injury are as interdependent as they are unevenly distributed. Eve Tuck calls on both scholars and marginalized groups to reject both pathologizing and compensatory forms of “damage-centered research” that frames environments, bodies, and communities as inherently “depleted,” “broken,” and in need of repair, repossession, or elimination (2009, p. 409). Similarly, instead of accepting this inherited state of disruption and inequality as inevitable or fetishizing the study of damaged

environments, bodies, and lives, Murphy invites us to reject “the eugenic residual that calculates lives worth living, deviant lives, risky lives, unproductive lives, and killable lives” (2017, p. 8). Commitment to healing and remaking the world requires us to reject the categories of normal and abnormal that enable some lives to matter more than others and to dismantle the infrastructures and standards that prevent us from valuing those lives *as such*. It requires us to refuse eugenic models of kinship as purity, property, and exclusion and instead to claim and be claimed as always already kin, bound to care for and about one another.

Generative frictions

“All of us inherit history; the life we enter into is a product of what has come before us. [...] We aren’t personally responsible for the social relations and material conditions that came before us or that we enter in to, but we can become responsible for what we do in response to those conditions.” (Shotwell 2019, p. 9)

I do not know how the student chose to resolve her surgical illustration, or whether she (or anyone else) was satisfied with the outcome. The younger male faculty member’s desire to smooth the friction and to restore order is understandable, but these frictions are not just inevitable, they are vitally necessary. For medical visualizations to accurately reflect the vast diversity of human bodies and experiences, it is necessary to challenge established disciplinary structures and narratives and to embrace the necessary and productive frictions that visualization practices enable. Claiming kin requires us to resist the impulse to smooth frictions and let stories settle back into familiar and comforting arrangements. Becoming accountable for the worlds we inherit requires us to stay with the troubling parts of our histories and to *remain* unsettled. I hope that this study will be taken up not only by scholars of representational practices in science and

medicine but also by medical illustrators as an invitation to reject narrow conceptions of kinship and belonging, to embrace unsettling and generative frictions, and to reimagine the stories we tell about bodies.

Transforming the standards and conventions of medical practice demands continued attention to the integral role of “purposeful visual construal” in the apparatus of knowledge production (Vertesi, 2014, p. 18). Continued historical attention to the development of medical illustration and allied fields of scientific visualization as skilled professions in the twentieth century is sorely needed to make sense of the material and social practices through which norms of representation have been constructed. Recognition of the agential role of medical illustrators and visualization specialists in making medical knowledge provides tools and language for scholars interested in exploring visualization practices as generative knowledge-making practices. Participatory and open-ended approaches to visualization and visual communications drawing on feminist research practices, disability studies, and critical design offer strategies for producing more equitable visual materials.

Since 2016, the Association of Medical Illustrators (AMI) and affiliated graduate departments have made concerted efforts to implement various measures to address the normalizing of white male bodies in their work, increase the diversity of their membership, and acknowledge the many histories of their field. These efforts include a range of interventions and approaches from yearly plenary talks, recruitment efforts, and mentorship opportunities to the 2023 launch of a “Diversity Fellowship” focused on producing a database of publicly available racially diverse illustrations for the pharmaceutical company Johnson & Johnson. It is far too early to say whether these efforts will be sufficient to transform the conventions of medical

illustration, but they do suggest more than a passing engagement with expanding visualization practices to better embrace the ecstatic variety of human bodies and lives.

There are many more stories to tell about the professionalization and practice of biomedical visualization. Although archival records of the everyday working lives of medical illustrators and allied occupations are often difficult to locate, they also present enormous potential to continue this work and to expand the repertoire of disciplinary stories. While they are rarely addressed explicitly, attending to how gender, race, class, and ability inform specialization and professionalization in science and medicine also has profound implications for present-day discussions of equity and inclusion. For example, historical analysis of debates and policies around regulating membership and material practices across various professional organizations related to medical illustration and visualization can provide rich insight into how these social categories informed the efforts of such groups to define their respective areas of practice and to regulate boundaries and belonging. Uncovering these histories can contribute to efforts by practitioners to recognize and dismantle the traditions and structures that reproduce historical hierarchies and exclusions.

Further qualitative and ethnographic research can help make sense of the negotiation of power, expertise, and uncertainty in the process of developing novel visualizations, particularly when dealing with unsettled or controversial topics. Visual practices enable some forms of knowledge to be made visible and fixed in place as evidence or scientific fact while others remain sites of intense epistemic ambiguity and distrust (Baigrie, 1996; Daston & Galison, 2007; Gilman, 1995; Lynch, 1988). They are also key strategies for rendering certain bodies and forms of life meaningful, valuable, and desirable. As such, they are critical sites for managing social, political, and material concerns to defend values, limit interpretive flexibility, and achieve

normative outcomes. For example, incomplete data and moments of uncertainty are potentially generative spaces of knowledge production, but this process is poorly understood and its potential often squandered. This process has implications not only at the level of political or social discourse, but also for the future directions that research and theorizing might take.

Exploring these tensions as both value-laden and potentially generative presents possibilities for more interventionist work as well. Researchers, medical practitioners, and health workers employ visual practices in their communications and clinical encounters, but patients, disabled people, and health activists also make use of visual practices to document or communicate their lived experiences and embodied knowledge. For example, extemporaneous drawing, visual record-keeping, analog symptom-tracking, and activist interventions emphasize working with the affordances of the present moment to negotiate gaps in knowledge and conflicting forms of expertise, make sense of lived experiences, resist pathologization, and craft livable lives. Feminist, anti-colonial, and crip methodologies suggest alternative frameworks for developing visualizations that acknowledge relations of power, respond to material and technological contingencies, and manage epistemic frictions – without necessarily resolving them into tidy narratives or naturalized conventions. More importantly, they offer strategies for imagining and crafting futures very different from our present. For communities and bodies that are often over researched yet undervalued, visual strategies contain the potential to “refuse ongoing brutality” and to remake the world by embracing the “collective, messy, experimental, frictional, and generative” aspects of visualization practices (Hamraie & Fritsch, 2019, p. 22). Treating visual practices as generative knowledge work and their creators as vital epistemic agents is one step toward crafting a more equitable and livable world for all of us.

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