Cholera, Chloroform, and the Science of Medicine: A Life of John Snow

Peter Vinten-Johansen, et al.

OXFORD UNIVERSITY PRESS

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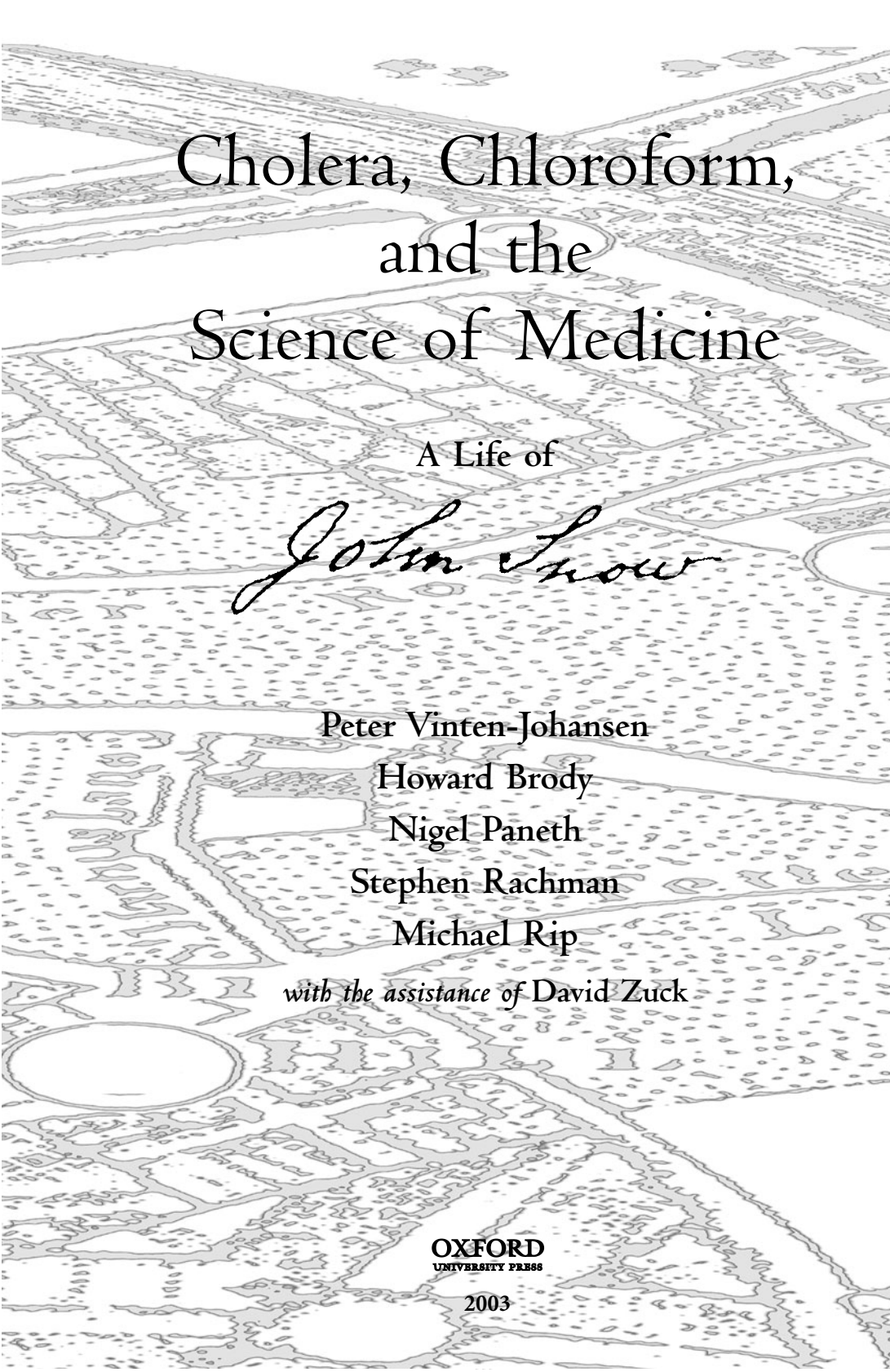

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with the assistance of David Zuck

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2003

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Oxford New York
Auckland Bangkok Buenos Aires Cape Town Chennai
Dar es Salaam Delhi Hong Kong Istanbul Karachi Kolkata
Kuala Lumpur Madrid Melbourne Mexico City Mumbai Nairobi
São Paulo Shanghai Singapore Taipei Tokyo Toronto

Published by Oxford University Press, Inc.
198 Madison Avenue, New York, New York, 10016
http://www.oup-usa.org

Oxford is a registered trademark of Oxford University Press

Library of Congress Cataloging-in-Publication Data

Cholera, Chloroform, and
the Science of Medicine:
A Life of John Snow
Peter Vinten-Johansen ... [et al].
p. cm.
Includes bibliographical references and index.
ISBN 0-19-513544-X
1. Snow, John, 1813—1858.
2. Epidemiologists—Great Britain—Biography.
3. Anesthesiologists—Great Britain—Biography.
I. Vinten-Johansen, Peter.
RA649.5.S66 S647 2003
617.9'6092–dc21
[B] 2002030347

2 4 6 8 9 7 5 3 1

Printed in the United States of America
on acid-free paper

Preface

This book is the product of an ongoing scholarly collaboration among five professors at Michigan State University who share an inordinate interest in the life and work of an early Victorian physician, John Snow. Early on someone tagged us with a mildly embarrassing nickname, "The Snowflakes," which stuck. Harmony does not always reign among five men with varied training and scholarly expertise: a European intellectual historian (Peter Vinten-Johansen), a philosopher–MD (Howard Brody), an epidemiologist–MD (Nigel Paneth), an American literary and cultural historian (Stephen Rachman), and a medical geographer–epidemiologist (Michael Rip). We began this project with very different views of Snow's writings and his significance in the history of medicine. Because we all agreed that his investigations during the 1854 cholera epidemic in London constituted a singular achievement, our initial intent was to feature that incident in a relatively brief biographical study. Several jointly crafted articles and presentations shaped our collective sense of Snow. In the process, however, we came to believe that only an extensive, interdisciplinary biography would do him justice.

In our view Snow's accomplishments in anesthesia and epidemiology are interconnected. His medical training occurred in the 1830s, when a new generation of medical men attempted to refashion medicine as a scientific discipline with linkages to "the collateral sciences" such as chemistry and comparative anatomy. In this vision of scientific medicine, the ultimate purposes of developing a solid grounding in the collateral sciences of medicine were to enhance one's clinical acumen and to improve the public health. Snow swallowed this intellectual regimen hook, line, and sinker and actualized the vision in his medical career.

Early on he took a special interest in respiratory cases among the patients he was treating, devised animal experiments, and presented his findings and case reports at medical society meetings and in the medical press. He was already a specialist, so to speak, in respiratory physiology and clinical practice when news of inhalation ether reached London from the United States in 1846. Within two years he was arguably the most accomplished anesthetist in the British isles—perhaps even farther afield. When the second pandemic of "Asiatic cholera" reached London in the fall of 1848, his understanding of gas law, respiratory physiology, and anesthetic agents led him to question the predominant theories about the nature and transmission of this devastating disease. The following year he published two essays that outlined his views

and offered preliminary substantiation. From then until his death, at the age of forty-five, in June 1858, his working days were spent administering anesthesia, conducting laboratory and autoexperiments on new anesthetic agents, and tracking down information on outbreaks of cholera. Snow was a shoe-leather anesthetist and epidemiologist par excellence.

It took us half a decade to develop this interpretation, but all along we were puzzled by the fractured life and legacy depicted by other scholars. We mean no disrespect. On the contrary, we acknowledge with admiration the devoted stewardship of his work undertaken by anesthesiologists and epidemiologists in Great Britain and the United States; John Snow memorial lectures are given annually in both fields. Since the mid-1980s scholars have recast our understanding of Snow's early life; edited one of Snow's major articles on narcotism and produced an annotated edition of his case books from the last decade of his life; self-published a biography; and written a dissertation from a historical–sociological perspective. In our view, it was time for a synthetic study of Snow as an interdisciplinary thinker and medical practitioner that integrated this recent scholarship.

We wanted to produce a monograph, not an anthology, so we selected a team leader–final reviser. For various reasons that role was given to Peter Vinten-Johansen; hence, he is listed as first author. Thereafter, the list is alphabetical because the book is a collective product. We designated various members of the team "primary" writers for particular chapters, but each chapter was subjected to rigorous group editing and revision. Two years into the project we made the acquaintance, first via the internet, of David Zuck, a retired anesthesiologist but an active historian of medicine. His contributions as on-site researcher and in-house editor have been substantial, and he richly deserves the acknowledgment on the title page. However, it should be said that we were sometimes unable to accept the Britishisms he strongly suggested would improve the readability of our book, or to include the detailed discussion of anesthesia topics he recommended.

Please consult the following Web site for searchable transcriptions of John Snow's writings (eventually, all of them), samples of word analysis and chronology comparisons used in our research, as well as additional maps and images: http://www.msu.edu/unit/epi/johnsnow.

East Lansing, Michigan

P.V.-J.
H.B.
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S.R.
M.R.

Acknowledgments

We have many people to thank for providing research assistance. At the Main Library of Michigan State University: Peter Berg, Special Collections; Michael McSeoin, Inter-Library Loan borrowing coordinator; Ann Silverman, cataloger (retired); and Agnes H. Widder, humanities bibliographer. Professorial assistants assigned by the Honors College at Michigan State University: Joshua Courtade, Kristin Slattery, Jeris Stueland, and Damon Williams. Also at Michigan State University, research assistance was provided by Jennifer Beggs, Lyman Briggs School; Andrew Bielaczyc, College of Arts and Letters; Dan Hesse, the Honors College; Anne Forrester Barker, PhD candidate in history; Debra Mulrooney and Talmadge Holmes, the College of Human Medicine. At the University of Michigan Libraries: Shabbir Boxwalla, Taubman Medical Library; Carol McKendry, coordinator of technical operations, Buhr Shelving Facility; and Dawn Wallace, technical library assistant, Buhr Shelving Facility. At the National Library of Medicine: Steve Greenberg and Betsy Tunis, History of Medicine Division; and Ken Niles, Collection Access Section. In Canada: Lee Perry, librarian, Woodward Biomedical Library, The University of British Columbia. In the United Kingdom: Dee Cook, archivist to the Society of Apothecaries, London; Kay Easson, librarian, Newcastle Literary and Philosophical Society; Stephen Freeth, keeper of manuscripts, Guildhall Library, London; Howard R. Hague, assistant librarian, Charing Cross Campus Library, London; Phoebe Harkins and Roy Porter (deceased), Wellcome Institute of Historical Research, London; Patricia Sheldon, assistant librarian, City Library, Newcastle upon Tyne; and Christopher Webb, archivist, The Borthwick Institute of Historical Research, University of York.

We are also grateful for the assistance provided by unnamed staff members at the following institutions: the London Metropolitan Archives (formerly the Greater London Record Office); the Taubman Medical Center, University of Michigan; the Wellcome Institute of Historical Research, London; and the Central Reference Library, York.

We discussed specific issues with many individuals, including Anthony Ashcroft, Frank A. Barrett, Charles Croner, Clive Davenhall, Andrew Dean, Andrew Dent, Rusty Dodson, Pamela Gilbert, Bill Henriques, William C. Hoffman, Joel Howell, Daniel Karnes, David P. Lusch, Kari McLeod, Arthur Robinson, and Catherine Schenck-Yglesias.

Ralph R. Frerichs, DVM, DrPH, Department of Epidemiology, University of California, Los Angeles, School of Public Health maintains an extensive Website on John Snow and consulted with us on issues related to mapping and the location of cholera outbreaks that Snow investigated. H. Spence Galbraith, MD, an indefatigable researcher into Snow's early life and extended family, read early drafts of several chapters and sent us manuscripts of prospective articles. Oxford University Press asked Christopher Hamlin, University of Notre Dame, to comment on a partial draft of the manuscript; he submitted an admirably detailed report that has proven helpful in our revisions. David M. Morens, MD, National Institute of Allergy and Infectious Diseases, read the drafts of several chapters and advised us on the history of cholera in the nineteenth century.

Throughout this long-term project, we received intellectual, emotional, technical, and financial support from faculty and staff at the Center for Ethics and Humanities in the Life Sciences, Michigan State University, and the Department of Epidemiology, Michigan State University. An All-University Research Grant from Michigan State University in 1997–98 effectively launched our project. After two years as a research team, we were honored in 1999 with the Excellence in Interdisciplinary Scholarship Award from the Honor Society of Phi Kappa Phi at Michigan State University; we used the monetary portion to cover research expenses and various production costs incurred in the preparation of this book. In addition, the Department of Epidemiology and the Mid-West Universities Consortium for International Activities covered a portion of Michael Rip's travel expenses for a research trip to England.

Contents

Abbreviations

AMJ	*Association Medical Journal.*
ApothAct	Holloway, Sydney W. F. "The Apothecaries' Act, 1815: A reinterpretation." *Medical History* 10 (1966): 107–29, 221–36.
BF	Galbraith N. Spence. "Dr John Watson (1790/91–1847) of Burnopfield and his assistant Dr. John Snow." *Bulletin, Durham County Local History Society* 57 (1998): 32–50.
BIHR	The Borthwick Institute of Historical Research, University of York, England.
BMJ	*British Medical Journal*
CB	Ellis, Richard H., ed. *The Casebooks of Dr. John Snow.* London: Wellcome Institute for the History of Medicine, 1994.
CIC	Cholera Inquiry Committee. *Report on the Cholera Outbreak in the Parish of St. James, Westminster during the Autumn of 1854.* London: J. Churchill, 1855.
CMC	Snow, John. *On Continuous Molecular Changes, More Particularly in their Relation to Epidemic Diseases.* London: Churchill, 1853.
CSI	Committee for Scientific Inquiries.
E	Snow, John. *On the Inhalation of the Vapour of Ether in Surgical Operations: Containing a Description of the Various Stages of Etherization, and a Statement of the Results of Nearly Eighty Operations in Which Ether Has Been Employed.* London: Churchill, 1847.
EMSJ	*Edinburgh Medical and Surgical Journal.*

GBH	General Board of Health.
GP	Loudon, Irvine. *Medical Care and the General Practitioner, 1750–1850.* Oxford: Clarendon Press, 1986.
GPO	Government Printing Office.
GRO	General Register Office.
HMSO	Her Majesty's Stationery Office.
HoC	House of Commons.
JPH&SR	*Journal of Public Health, and Sanitary Review.* Continued as *Sanitary Review and Journal of Public Health.*
JS	Shephard, David A. E. *John Snow, Anaesthetist to a Queen and Epidemiologist to a Nation: A Biography.* Cornwall, Prince Edward Island: York Point, 1995.
JS-EMP	Snow, Stephanie J. "John Snow 1813–1858: The emergence of the medical profession." PhD diss, University of Keele, 1995.
JS-EY	Galbraith, N. Spence. *Dr John Snow (1813–1858). His early years.* London: Royal Institute of Public Health, 2002.
L	Richardson, Benjamin W. "The Life of John Snow." Introduction to John Snow, *On Chloroform and Other Anaesthetics.* London: Churchill, 1858.
LJM	*London Journal of Medicine.*
LMG	*London Medical Gazette.* (To avoid confusion, we cite volumes by the old series throughout.)
LRCP	Licentiate of the Royal College of Physicians.
LSA	Licentiate of the Society of Apothecaries.
MCC	Snow, John. *On the Mode of Communication of Cholera.* London: Churchill, 1849.

MCC2	Snow, John. *On the Mode of Communication of Cholera*, 2d ed. London: Churchill, 1855.
M-CJ	*Medico-Chirurgical Journal.*
M-CR	*Medico-Chirurgical Review.*
MCS	Metropolitan Commission of Sewers.
M-CT	Royal Medical and Chirurgical Society, *Medico-Chirurgical Transactions.*
MRCS	Member, Royal College of Surgeons.
MSL	Medical Society of London.
MT	*Medical Times.*
MTG	*Medical Times and Gazette.*
Newton	Newton, John Frank. *The Return to Nature, or, A Defence of the Vegetable Regimen; With Some Account of an Experiment Made During the Last Three or Four Years in the Author's Family.* London: T. Cadell & W. Davies, 1811.
OC	Snow, John. *On Chloroform and Other Anaesthetics.* London: Churchill, 1858.
OED	*Oxford English Dictionary*
ON	Snow, John. "On narcotism by the inhalation of vapours." *London Medical Gazette* (1848–51).
PB	Galbraith, N. Spence. "Joseph Warburton (1786–1846) of Pateley Bridge and his assistant Dr. John Snow." *Yorkshire Archaeological Journal* 71 (1999): 225–36.
PharJ	*The Pharmaceutical Journal.*
PMCC	Snow, John. "On the pathology and mode of communication of cholera." *London Medical Gazette* 44 (1849): 745–52, 923–29.

PMSJ	*Provincial Medical and Surgical Journal.*
RM-CS	Royal Medico-Chirurgical Society.
SCME	Select Committee on Medical Education, House of Commons, 1834.
SR&JPH	*Sanitary Review and Journal of Public Health,* Continuation of *Journal of Public Health, and Sanitary Review.*
S&V	Southwark and Vauxhall Water Company.
VCH-Y	Tillott, P. M. *A History of Yorkshire. The City of York.* Victoria History of the Counties of England, edited by R. B. Pugh. London: Oxford University Press, 1961.
WH	Galbraith, N. Spence. "William Hardcastle (1794–1860) of Newcastle-upon-Tyne and his pupil John Snow." *Archæologia Æliana* (The Society of Antiquaries of Newcastle upon Tyne) 27 (1999): 155–70.
WMS	Westminster Medical Society.

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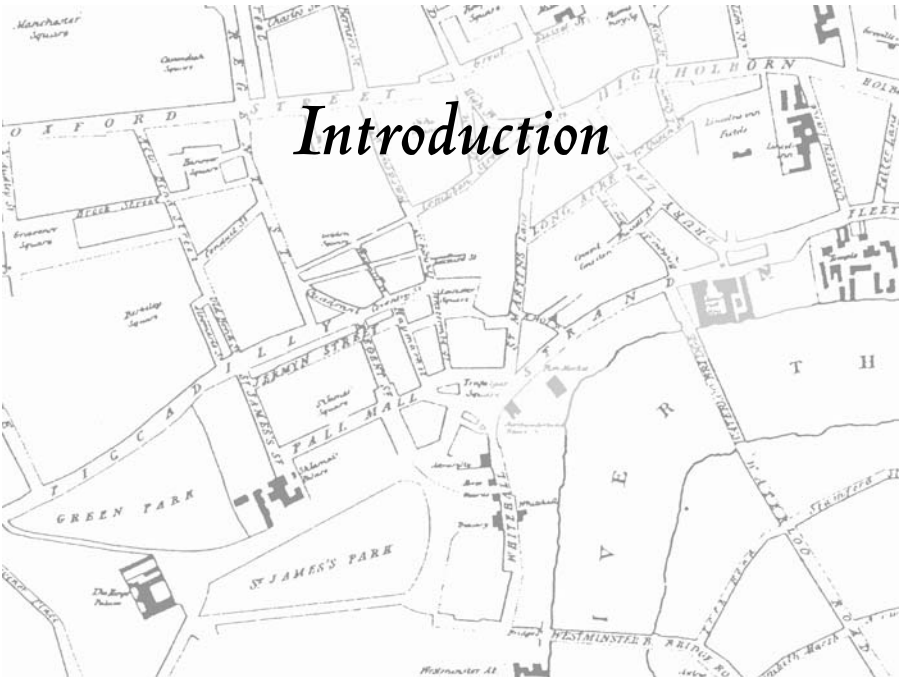


Introduction

SOMETIME BETWEEN 1839 and 1841, John Snow drowned a guinea pig.[1] It died in two minutes. An hour after its death, Snow began dissecting. He observed that the heart was perfectly still and that the right side was swollen with blood while the left was nearly empty. As he proceeded he noted that the surface of the lungs changed color when exposed to air. Then, much to his surprise, the heart twitched in the form of "a slight vermicular motion in the right auricle." He opened the trachea and began artificial respiration. The heart's ventricles began to move, and through the coats of the left atrium (the chamber that receives blood from the lungs) he could see oxygen-rich, bright red blood. The heart continued to contract weakly, unable to expel blood from its chambers, but it kept beating rhythmically for forty-five minutes.

What exactly was Snow up to in attempting to reactivate a guinea pigs's dead tissue? This particular experiment took place in the course of his investigations into respiration and asphyxia, undertaken with the desire to establish the physiological basis for pulmonary resuscitation on infants. His efforts involved more unsettled questions than would William Kouwenhoven's when he developed his cardiopulmonary resuscitation (CPR) techniques in the 1950s. In the 1840s, according to the data Snow cited, one in twenty births was stillborn, many of whom were asphyxiated at the very moment of birth. What method, based on principles rather than habit, he wondered, should be used to revive children "born in a state of suspended

animation"?[2] A number of practices were commonly used: dashing cold water in the infant's face; immersing it in warm water; performing mouth-to-mouth resuscitation; using a bellows (and extra oxygen) to inflate the lungs; and shocking it with electricity. Snow acknowledged that each of these measures had merit, but all entailed considerable risks.

For Snow respiration—"essential to the life of the whole animal kingdom"—was the fundamental physiological principle at issue, so measures that directly restored or established respiration would be most appropriate. Dashing cold water in a baby's face, immersing it in warm water, or stimulating its skin with electroshocks might well rouse the nervous system and facilitate breathing, but these seemed indirect, risky methods compared with artificial respiration, which Snow reasoned "must be had recourse to as quickly as possible."[3] However, he worried that "breathing into the lungs of the child" would be too unnatural to facilitate regular breathing and that such air probably contained too much carbon dioxide gas to be effective, yet the ordinary bellows frequently used could overinflate and damage the newborn's lungs.

Snow delivered a paper at the Westminster Medical Society in October 1841 in which he proposed a resuscitating device constructed with newborn infants in mind. It consisted of two small syringes, one fitted over the mouth, the other fitted over the nostrils. While the syringe over the mouth drew air from the lungs, the one over the nostrils delivered fresh air. The device was as simple as a bellows but lacked its dangers: "The two pistons are held in the same hand, and lifted up and pressed down together, the cylinders being fixed side by side, and each having two valves. When the pistons are raised, one cylinder becomes filled with air from the lungs, and the other with fresh air from the atmosphere, which can be warmed on its way by passing a tube and metal coil placed in hot water." Snow had designed a hand-held resuscitator, complete with a warmer to enhance the oxygenation of the blood.[4] Snow's plan for an artificial respirator was a practical solution to a concrete and pervasive medical and social problem, accomplished by a cogent application of physiological principles.

As an understanding of diseases reveals underlying patterns of normal functions, asphyxia was important to Snow because it revealed the underlying pattern of respiration. Respiration was first and foremost a chemical exchange of gases—oxygen from the air for carbon dioxide from the blood—first shown by Lavoisier in the eighteenth century but most recently refined by the German physiologist Heinrich Magnus in 1837. Snow admired physiologists and chemists who were busy exploding the old vitalist doctrine that posited a peculiar lifeforce in living organisms, distinct from general physical and chemical forces. In Snow's mind respiration disproved vitalism because, although crucial to life, it was based on the same principles that guided all physicochemical forces: The exchange of gases "is not strictly a vital process, but only an operation of organic chemistry, since it continues after death as well as before, when the mechanical advantages for access of air remain the same."[5] There was general agreement that asphyxiation induced a distinct sequence of symptoms in adults

as well as newborns, but there was considerable debate as to what caused it. Bichat had concluded that oxygen-depleted venous blood acted as a poison when it was recirculated. Was he right? Or was asphyxia the result of "the poisonous effects of carbonic acid detained in it"? If so, was carbon dioxide gas formed in the lungs or the capillaries? There were other vexing questions, too: Was circulation primarily caused by the mechanical action of the heart or by the chemical exchanges in the blood? Was animal heat derived from this chemical exchange? Why did asphyxiation occur more suddenly at higher temperatures?

Snow offered answers to all these questions in his paper on newborn resuscitation at the Westminster Medical Society, citing what he deemed the most reliable studies and supplementing those findings with results from his own experiments. He thought Bichat went "rather too far" in calling venous blood a poison, because if respiration is renewed in time, no ill effects remain from the circulation of dark blood. In a series of eighteen experiments on small animals and birds, Snow had found that carbon dioxide gas's "injurious effects seem to depend rather on its physical properties, viz. its density and solubility in the blood than on any strictly poisonous qualities."[6] Asphyxiation was caused by the absence of oxygen, because experimental animals became asphyxiated when placed in nitrogen and hydrogen gas. The bulk of evidence in experiments by Alison, Edwards, and Reid suggested, as well, that the exchange of oxygen and carbon dioxide and the generation of heat and blood flow take place in the capillaries and that higher temperatures accelerated such exchanges.

So what had Snow learned by performing artificial respiration on his suffocated guinea pig? He surmised that the line between life and death was not fixed, and the heart retained its irritability (its ability to be stimulated by oxygen) beyond death. On this experimental and theoretical basis, Snow urged his colleagues to use his artificial respirator on still-born infants. The new physiology had shown that respiration was the key to life, so oxygen was the appropriate stimulant for the asphyxiated. Other measures were indirect at best, harmful at worst. Above all, he urged the avoidance of the application of warmth, despite its time-honored use in medical circles and endorsement by The Royal Humane Society. At higher temperatures and in the absence of new incoming air (as when an infant is simply placed in a warm bath to revive it), the oxygen still present in the blood would be converted to carbon dioxide more quickly, thereby accelerating the asphyxiation. In addition to questioning contemporary clinical practice, Snow's asphyxiation research allowed him to trace respiration and its basic chemical exchanges into the womb and to the caudal brainstem.[7]

It also prepared him to manage clinical problems in a scientific manner. In the 1841 presentation at the Westminster Medical Society, he noted "that even a strong child does not always begin to breathe the minute when it is born; but if the umbilical cord be pressed between the fingers it will instantly draw an inspiration."[8] Seven years later, on a Wednesday morning in November 1848, he was called in to advise on a difficult delivery. Mrs. Strachan, a mother who had already given birth

to several children in protracted, "very hard labors" was going through this ordeal again. She was distressed, tired, "out of patience," and "wished to know if something could not be done for her relief." Snow administered moderate doses of chloroform. The patient experienced immediate relief and remained in a light state of unconsciousness for the duration of the labor (two-and-a-half hours) until a baby girl was born, but the infant was in "a state of asphyxia, fetching a breath only at intervals of about a minute. . . . Dashing cold water on the child sometimes caused it to breathe a little sooner, & its lips remained black and limbs relaxed." The umbilical cord, however, pulsated as far as it was exposed, and shortly before the afterbirth was delivered, Snow compressed the cord between his forefinger and his thumb; immediately the baby began breathing naturally. When he released the cord the breathing diminished. On tying the cord the child breathed well and recovered quickly. He had resolved the asphyxiation, as his physiological inquiries over the years had predicted, by stimulating the urge to breathe.[9] In this way Snow's research would become his practice. He brought a knowledge of physiology and chemistry to bear on the task of saving newborns that come into the world apparently dead.

In Snow's day the scientific practice of medicine demanded the use of techniques often at odds with convention and established authorities. It also required a worldview in which humanity had to be understood as part of animal evolution rather than distinct from it. Perhaps drawing on the comparative anatomy and physiology he had learned at the Hunterian School of Medicine in London, he concluded his 1841 presentation on asphyxia with a comparison: "Moralists have often asserted that human beings come into the world in a more puny and helpless condition than any other animals; but in this they are mistaken; for, without including marsupial animals, the young of cats, and all those that are brought forth with their eyes closed, cannot maintain life without artificial heat, which they receive from lying close to the mother: in fact they can scarcely be said to have a proper temperature of their own. A child born at the full term, on the contrary, can maintain its temperature if well protected from cold."[10] In Snow's vision of life, newborn infants were not as defenseless as convention would have it. Our animal heat at birth was a sign of our respiratory power, our resiliency, and, to the scientific medical practitioner, our capacity for being restored to life from apparent death by the proper methods.

* * *

John Snow has been called a "compleat physician," meaning exemplary in every way, but the basis for this exemplariness has remained suggestive until now.[11] Qualifying as a surgeon-apothecary at the age of twenty-five in 1838, he had already had eleven years of medical training and experience. He had served six years as an apprentice to a surgeon-apothecary who was attached to the Lying-in Hospital in Newcastle, followed by three years as an assistant to two country apothecaries whose practices also included midwifery. Then, while a medical student in London, he studied

medicine with a physician who had a particular interest in obstetrics, and he studied midwifery and diseases of women and children with a physician who had a practice at the Royal Lying-in Hospital. After qualifying he established a general practice in the Soho area of London that involved many deliveries. The young clinician, who in 1841 "remarked that . . . if the umbilical cord will be pressed between the fingers it will instantly draw an inspiration" from a newborn who was not breathing, had probably already attended hundreds of deliveries.[12] Others at the time could equal or even surpass this clinical experience, but Snow belonged to a cadre of young medical men whose clinical practice was grounded in what was then called the collateral sciences of medicine. He chose to attend a London medical school renowned for the teaching of anatomy and staffed by instructors all of whom were keenly interested in Continental developments in physiology and chemistry and several of whom had trained in Edinburgh, who taught their students the newest ideas in comparative anatomy and Lamarckian evolutionary biology.

The antivitalist philosophy Snow confronted at the Hunterian School of Medicine was cutting edge thought in the 1830s, and it contributed to his becoming an advocate of scientific medicine as distinct from a singularly experiential (bedside) medicine that was dominant among many of his older colleagues. Snow's approach was to base clinical methods on the latest research in the sciences relevant to his chosen specialty. When confronted by a pressing medical and social concern—newborn infants were dying of asphyxiation at an alarming rate—he surveyed the literature on respiration, conducted experiments on a variety of animals, and designed a resuscitation apparatus that would perform according to scientific principles. One sees in his early research on asphyxiation the mind-set and process he would use in 1847 to base the administration of ether and chloroform on medical scientific principles rather than simple trial-and-error research. In some respects the ether inhaler he devised in 1847 permitted him to induce controlled "suspended animation" via the administration of anesthesia—in essence, the reverse of the resuscitation apparatus he designed in 1841. Like his colleagues in the Westminster Medical Society, Snow's theoretical and research interests were always stimulated by practical problems and directed to producing results with practical applications. There was no difference in English medicine at this time between the medical researcher and the clinician.

In addition to being a conduit for Continental and Scottish ideas, Snow was an exemplar of moderate medical radicalism. This movement arose in conjunction with debate on the First Reform Bill of 1831–1832, which eventuated in a modest expansion of the franchise for elections to the House of Commons (including Snow's father, who had become a property owner by then). Medical radicals agitated to replace the three medical orders of physician, surgeon, and apothecary, then under the control of elite corporations, with a unified program of medical training, a single qualification, and a democratic professional organization.[13] The Hunterian School of Medicine and the Westminster Medical Society were hotbeds for outspoken as well as moderate radicals in the 1830s. Snow's favorite teacher had earned his MD

in Edinburgh but refused to take a license to practice as a physician in London in protest of the power exerted by the Royal College of Physicians, but Snow was no agitator. Instead, he achieved three medical qualifications and then snubbed the corporate establishments for the rest of his career. The twenty-eight year old "Mr. Snow" who read a paper on resuscitating asphyxiated newborns at the Westminster Medical Society was a surgeon-apothecary, or general practitioner (GP) in emerging parlance, but within three years he would call himself Dr. Snow, having received the MD from the University of London. Certainly, he hoped to improve his prospects and expand his practice by becoming a physician, but the medical colleagues with whom he associated were medical radicals, and he occasionally found himself opposed to the medical establishment.

Snow's progression from animal experimentation to the invention of a device for the resuscitation of newborns exemplifies his scientific modus operandi for the work that made him famous in his lifetime—the development of scientific anesthesia. In addition, he was also profoundly interested in the public health questions of the day, and applied his scientific perspective to the major new epidemic disease of his time, cholera. Until his death in 1858 he would juggle a flourishing career as a premier anesthetist and new ventures in public health and epidemiology.

Testimony, 1855

For Snow 5 March 1855 was a typically busy Monday. His anesthesia practice brought him to Hanover Square, a few blocks north of his residence in Sackville Street, to assist a dentist with a tooth extraction. There were complications, however. The attending physician was concerned that the administration of chloroform would place his patient, a young man named Tudor with a "weak constitution," at special risk. He reassured them both that everything would go smoothly, then took Tudor's pulse. It was weak. When told that he would feel no pain and had nothing to fear, the young man relaxed, and his pulse improved. Shortly thereafter Snow gave him chloroform without complications or subsequent depression of his pulse, and the dentist was able to remove two teeth.[14]

Next he walked west toward Hyde Park but stopped in the Mayfair district to give chloroform to a middle-aged man from Staffordshire who was undergoing a second operation to remove dead bone tissue from the femur. A longtime colleague of Snow's, Mr. Bowman, was the surgeon. The outcome seemed successful, and, from Snow's perspective, the patient tolerated the anesthesia very well.[15] His third anesthesia case of the day was near Clapham Common in South London. To get there he would have crossed the River Thames, then walked along the Wandsworth Road, where in 1849 he had investigated an epidemic outbreak featured in his first essay, *On the Mode of Communication of Cholera.* The uncle of yet another colleague, Dr. Spitta, was having lithotripsy, in which an instrument is inserted into the bladder to

crush stones. In the first decade of anesthesia use, only the number of dental extractions exceeded lithotripsy in Snow's caseload; third in frequency were lithotomies (surgical incision of the bladder to remove stones), followed by breast tumors, hemorrhoids, anal fistulae, harelips, and childbirth.[16] Anesthesia had become routine in medical procedures, major and minor. Snow would log more than 5,000 cases in almost a dozen years and in the process was exposed to every nook and cranny of London, every walk of life, and the widest imaginable array of diseases the metropolis had to offer.

Sandwiched among these visits, Snow found time on that Monday afternoon in March 1855 to testify at the Houses of Parliament, near Westminster Abbey, before the Select Committee on Public Health on the Nuisances Removal and Diseases Prevention Act. Parliamentary committees had been gathering data and hearing expert testimony for a quarter century on sanitary conditions throughout Britain, but especially in the "towns and populous districts." The sanitary reform movement was driven by the medical opinion that poisonous vapors, whether miasmas rising from marshes or from decomposing organic matter near human dwellings, were the main cause of disease, including epidemic cholera, which had killed tens of thousands of people in England since 1831. Much of the law resulting from this movement concentrated on removing sources of filth and smoke from the environment, improving sewage disposal, and forcing private water companies to provide purer drinking water. The bill then before the select committee would grant public officials the power to regulate or eliminate the so-called offensive trades that released foul-smelling, noxious fumes: gasworks, bone boilers and merchants, soap manufacturers, tallow melters, gut spinners, dye makers, market gardeners, and manufacturing chemists who produced artificial manure for agricultural purposes. At the least, sanitation reformers wanted to keep businesses from fouling up residential neighborhoods with pollutants viewed as pathogenic for a host of constitutional diseases and contributory to the cause and spread of epidemic cholera. However, Henry Knight, a bone merchant, and the consortium of "offensive trades" he represented believed the proposed act would, in effect, put them all out of business. He submitted Snow's name as an expert medical witness to plead their case, although he had never actually met him or discussed the matter with him.

The alliance between Snow and the "offensive trades" was entirely intellectual. Knight had read *On the Mode of Communication of Cholera*—the second, expanded edition—in which Snow presented evidence drawn from three epidemics (1831–1832, 1848–1849, and 1853–1854) that cholera could be transmitted only by swallowing the "morbid matter" specific to that disease. He completely ruled out as a cause of cholera the inhalation of miasmas and effluvia, whether from the atmosphere or the bodies of the sick. His argument featured two landmark epidemiological studies of cholera that would secure his reputation into the twenty-first century: an analysis of the differential mortality in thirty-two London subdistricts supplied by two companies drawing water from separate stretches of the Thames, and also

the linkage of a lethal Golden Square outbreak to contamination of a popular pump in Broad Street. Mr. Knight had been intrigued by Snow's view "that measures necessary to protect the public health would not interfere with useful trades."[17] Many of Snow's contemporaries were unconvinced by his reasoning and practical recommendations, even though he was by then a forty-two-year-old physician of some gravitas (Fig. Intro.1): current president of the Medical Society of London and the leading authority on ether and chloroform in Britain, who, two years before, had given chloroform to Queen Victoria when she was delivering Prince Leopold—an event generally accepted as instigating the use of anesthesia in childbirth throughout the West.

In preliminary remarks Snow stated: "I have paid a great deal of attention to epidemic diseases, more particularly to cholera, and in fact to the public health in general; and I have arrived at the conclusion with regard to what are called offensive trades, that many of them really do not assist in the propagation of epidemic diseases, and that in fact they are not injurious to the public health. I consider that if they were injurious to the public health they would be extremely so to the workmen

Figure Intro.1. Photograph of John Snow, mid-1850s.

engaged in those trades, and as far as I have been able to learn, that is not the case; and from the law of the diffusion of gases, it follows, that if they are not injurious to those actually upon the spot, where the trades are carried on, it is impossible they should be to persons further removed from the spot."[18] The crux of the matter for Snow was that "offensive trades," much as they might offend our olfactory sensibilities, would not cause illness in the general population if the workers themselves were uninjured. He knew from years of research, most recently on the properties of anesthetic agents, that gases were "injurious" to health only at close range in very high concentration, so if those closest to offensive smelling materials did not get sick, how could such trades be spreading disease-causing vapors? While some people today might quarrel with Snow's pollution-tolerant notion of public health, his conclusion was sound: Carcass renderers and their ilk were not propagating cholera or other epidemic diseases.[19]

But the chair, Sir Benjamin Hall, and twelve members of the Select Committee on Nuisances Removal and Disease Prevention did not share Snow's knowledge of gas laws and were, not surprisingly, utterly astounded by his opening statement. "Are the Committee to understand," Hall inquired, "taking the case of bone-boilers, that no matter how offensive to the sense of smell the effluvia that comes from the bone-boiling establishments may be, yet you consider that it is not prejudicial in any way to the health of the inhabitants of the district?" Snow replied, "That is my opinion."[20] The committee seemed eager to probe him, to catch him in a contradiction. If it made no difference living cheek by jowl to a knacker's yard, were "all animal substances" harmless to humans? "No," Snow replied, "I believe that epidemic diseases are propagated by special animal poisons coming from diseased persons, and causing the same diseases to others, and that they are extremely injurious; but that substances belonging to animals, that is to say, ordinary decomposing animal matter, will not produce disease in the human subject."[21] What about "decaying vegetable matter; do you consider that will not be productive of disease?" He did not, with the possible exception of ague (recurring fevers such as malaria), about which there was still medical uncertainty; "but in London, in any trade I am acquainted with, I do not believe that any decomposing vegetable or animal matters produce disease."[22]

Chairman Hall, however, remained in disbelief about Snow's earlier comment about the "knacker's yard," a slaughterhouse in which the animals are not fit for human consumption. Would the "very offensive effluvia" from a pile of rotting horse flesh "not be prejudicial to the health of the inhabitants round"? "I believe not," Snow first reiterated and then explained in reply to another questioner: "gases produced by decomposition when very concentrated, will produce sudden death; but where the person is not killed, if the person recovers, he has no fever or illness."[23] Another member wanted additional clarification of this point, and after two brief exchanges with Snow asked him, "Do you mean to tell the Committee that when the effect is to produce violent sickness there is no injury produced to the constitution or health of the individual?" Snow's reply was careful and discriminating: "No fever or special

disease."[24] But Mr. Greene did not catch his meaning: "Are you not aware that persons going into vaults where there are a number of dead bodies have suffered very severely, and that sometimes death has been produced by this cause?" "Yes, when those gases are extremely concentrated, they will actually poison and cause death." However, the cause of death resulted from the laws of gases, not the local miasma theory of disease, because the poisons in such gases do "not cause disease;" only poisons "that reproduce themselves in the constitution" can cause disease in that person and be transmitted to others to cause an identical disease.[25] Nevertheless, Snow's explanation left yet another committee member confused: "You say that effluvia arising from living subjects are dangerous?" He replied yes, "or even from certain persons who have died from disease," Snow added. Another committee member asked, "But not from the mere decay of animal matter?" Snow responded that that was correct.[26]

At this point the committee moved on to other topics, but these parliamentary exchanges offer a glimpse into Snow's theory of disease transmission and the conceptual impasse that stood between him and those most influential in British government at midcentury. The exchanges also reveal the differences between his thinking and germ theory, which crystallized in the decades after Snow's death in 1858. Snow's theory of epidemic diseases was based on the communication of "special animal poisons." As confusing as this notion was to the members of the parliamentary committee, he could not possibly have used a more precise term. In Snow's day the agents (some called them "germs," others an infectious "virus") that caused cholera, typhus, and measles, for example, were unknown—unknown in the sense of not yet isolated, observed, or classified. Nevertheless, Snow believed, on medical and social evidence, that cholera and other epidemic diseases were propagated from one diseased person to another, that like caused like, and that a particular disease-causing agent could not cause a different disease in someone else. Even though the agents were unknown, the signatures of epidemic diseases were sufficiently apparent for him to hypothesize how they were communicated from one person, household, town, city, nation, and continent to the next. Moreover, the pathways were sufficiently clear for preventive public health measures to be enacted, whether or not the organized life forms that caused the disease in the human body were identified.

If the members of Parliament found Snow's theory implausible, the *Lancet*, a leading medical journal of the day, considered Snow a traitor to empirical medicine and a fellow-traveler with an "unsavory" consortium of profiteering businessmen. His testimony lent support to the producers "of pestilent vapors, miasms, and loathsome abominations of every kind" who fatten themselves "upon the injury of their neighbors."[27] Equally galling to the editors of the *Lancet* was Snow's use of a public forum to truck his unsubstantiated theories. "Is this evidence scientific?" *Lancet* asked rhetorically. "Is it consistent with itself? Is it in accordance with the experience of men who have studied the question without being blinded by theories?" There was ample evidence that fumes from gas-producing trades made local people ill.

> And we presume that there is hardly a practitioner of experience and average powers of observation who does not daily observe the same thing. Why is it then, that Dr. Snow is singular in his opinion? Has he any fact to show in proof? No! But he has a theory, to the effect that animal matters are only injurious when swallowed! The lungs are proof against animal poisons; but the alimentary canal affords a ready inlet. Dr. Snow is satisfied that every case of cholera for instance, depends upon a previous case of cholera, and is caused by swallowing the excrementitious matter voided by cholera patients. Very good! But if we admit this, how does it follow that the gases from decomposing animal matter are innocuous? . . . If this logic does not satisfy reason, it satisfies a theory; and we all know that theory is often more despotic than reason. The fact is, that the well whence Dr. Snow draws all sanitary truth is the main sewer. His *specus*, or den, is a drain. In riding his hobby very hard, he has fallen down through a gully-hole and has never since been able to get out again. . . . And to Dr. Snow an impossible one: so there we leave him.[28]

The *Lancet* diatribe reverberates with the contumely that Snow's ideas engendered when they were first proposed. The most unpleasant aspect of Snow's thesis—that the mass of cholera victims were swallowing other people's fecal matter—made him appear to the *Lancet* to be like an offensive tradesman himself.[29] We part company with Snow when he argued that "ordinary decomposition" was not a source of disease, because we associate decomposition and putrefaction with the bacteria and fungi that cause them, but the "germs" involved in bone-boiling and the other "offensive trades" that Snow considered harmless will not cause cholera or any other epidemic disease. Snow was correct (or at least more correct than the *Lancet*) on these matters.

* * *

These two snapshots of Snow—dissecting a guinea pig, then being dissected by Parliament—are illustrative of the medical road he traveled. He began his career studying the physiology of respiration and asphyxiation, which paved the way for his approach to researching and administering anesthetic agents after 1846. When a second cholera epidemic began in England in 1848, his understanding of gas law, the mechanism of respiration, and human physiology made him skeptical of the view he had once shared that this was fundamentally a febrile disease. These vignettes also show the resistance Snow encountered when he sought to clarify his "special poisons" theory and its ramifications for public health.

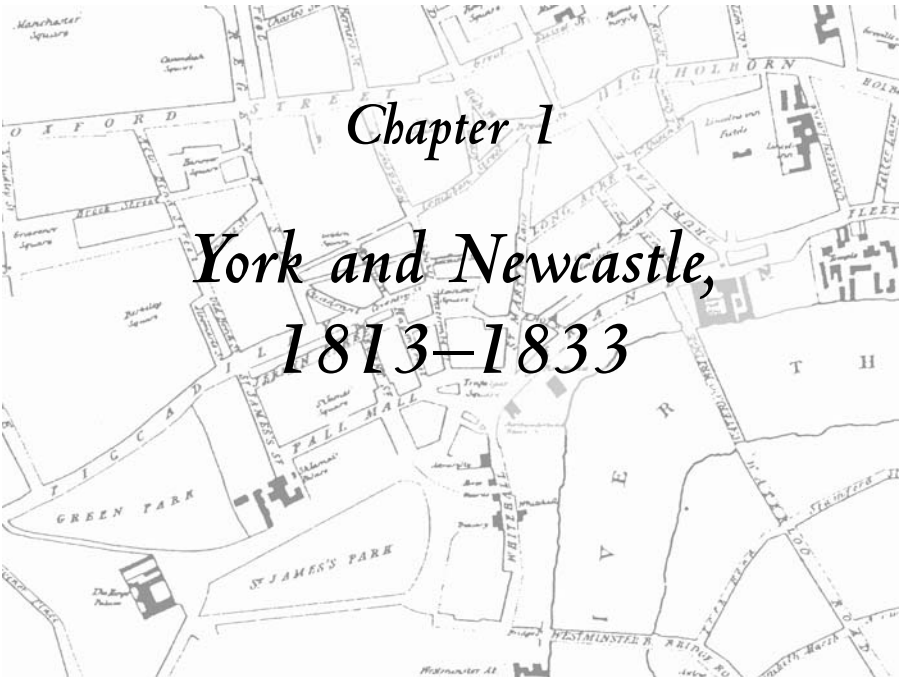
The *Lancet* editorial considered his reliance on "theory" as suspect in itself, but the fundamental disagreement was over which theory to trust and whose authority to follow in the pre-germ theory era characterized by many informed and partially informed opinions along with so many unknowns. Snow lived three more years

after testifying before the parliamentary committee, during which time he continued to defend his sanitary ideas in the London medical press and in the medical and social circles in which he traveled. He did not succeed in his lifetime, although he would be vindicated after the fourth cholera epidemic of 1866. Even so, who could possibly have imagined that an impoverished Soho medical man and son of an unskilled Yorkshire laborer would ever have achieved such notoriety?

Notes

1. Snow mentions this in "On asphyxia and the resuscitation of still-born children," *LMG* 29 (1841–42): 226. The exact date of the experiment is not known, but his interest in the subject is easily traceable through his published writings on respiration and asphyxia dating from January 1839.
2. Snow, "On asphyxia," 224.
3. *Ibid.*, 223, 225.
4. Snow's device was actually an adaptation of one designed for adults by a Mr. Read of Regent Circus, who introduced the syringe method for artificial respiration at the Westminster Medical Society in 1838, coinciding with Snow's burgeoning interest in respiration. See Snow, "On asphyxia," 225.
5. *Ibid.*, 221–24. Other physiologists he cited over the years were William Frédéric Edwards, John Reid, Xavier Bichat, François Magendie, Collard de Martingny, Pierre Hubert Nysten, and William Alison.
6. On Bichat, see *Ibid.*, 223. Snow performed these experiments in March 1839, but he described them several years later; see Snow, "On the pathological effects of atmospheres vitiated with carbonic acid gas" (1846). In the same passage Snow added that "this view is supported by Nysten's experiments of injecting it [CO_2 gas] into the blood-vessels" (55) and then quotes Nysten's article, in French.
7. In Snow's mind there was nothing vital or special about the process: "Physiologists have amused themselves in speculating on the cause of the first respiration; but doubtless it is the same as the second and third, and all succeeding respirations; namely, a sensation or impression arising from a want of oxygen in the system, and conveyed to the medulla oblongata, either by the blood circulating in it, by the nerves in connection with it, or by both causes"; "On asphyxia," 227. He was referring to earlier generations of physiologists. For a parallel argument that, "even a generation previously, Snow's reasoning would have been improbable, if not impossible," see Rosenberg, *Explaining Epidemics*, 118. Although Rosenberg was referring to Snow's reasoning about cholera, he goes on to mention "advances in chemistry, in pathology, in technology, and in public health practice"; *Ibid.*
8. Snow, "On asphyxia," 227.
9. Ellis, *CB*, 22 (1 November 1848).
10. Snow, "On asphyxia," 227.
11. Shephard, *JS*, 279–94.
12. Snow, "On asphyxia," 227.
13. Desmond, *Politics of Evolution*, 11–12, 102–04.
14. Ellis, *CB*, 360.
15. *Ibid.*, 360, 356.
16. *Ibid.*, 360, 596–616. The contemporary term for lithotripsy was lithotrity.

17. UK HoC, "Select committees on medical relief and public health," par. 119, p. 328.
18. *Ibid.*, par. 120, p. 328.
19. Lilienfeld, "John Snow: The first hired gun?" 8; Vandenbroucke, "Invited commentary: The testimony of Dr. Snow," 10, 12.
20. UK HoC, "Select committees on medical relief and public health," par. 121, p. 328. Hall was also President of the Board of Health.
21. *Ibid.*, par. 122, p. 328.
22. *Ibid.*, par. 123, p. 328.
23. *Ibid.*, par. 124, 126, pp. 328–29.
24. *Ibid.*, par. 129, p. 329.
25. *Ibid.*, par. 130–32, p. 329.
26. *Ibid.*, par. 133–34, p. 329.
27. Editorial, *Lancet* 1 (23 June 1855): 634.
28. *Ibid.*, 634–35.
29. A fortnight later, a medical journal that had been receptive on past occasions to Snow's views and theories regretfully criticized his testimony before the Parliamentary Committee, albeit without the vituperative ad hominem tone used by its rival; "The Public Health Bill," *MTG* 11 (1855): 12–13. A few days later, Snow published an open letter to the chairman of the committee in which he referred to the harsh criticism dished out by the newspaper and medical press for his ostensible support of noxious trades, even though "I explained the grounds of my opinions as well as the opportunity permitted"; Snow, *[Open] Letter to the Right Hon. Sir Benjamin Hall* (1855), 3. Snow continued, "The writers of these attacks have assumed and asserted that the opinions I have expressed on the subject of offensive trades are altogether new and peculiar"; *Ibid.*, 4. Quite the contrary, Snow argued, and cited similar views of the non-danger attached to gases from decomposing organic matter published by Bancroft (1811) and Thomas Watson (1841–42). In mentioning Watson, Snow added that his attackers had assumed that he was drawn to his conclusions about offensive gases because of his pet theory of cholera transmission, whereas in actuality Snow had entertained his views on gases long before he began to study cholera; *Ibid.*, 9. In an 1856 article published by the *Lancet* he marshaled statistics to show that workers in those trades seemed as healthy as other workers; Snow, "On the supposed influence of offensive trades on mortality" (1856).



Chapter 1

York and Newcastle, 1813–1833

A PICTURESQUE GRAVEYARD adjacent to the church of All Saints North Street (Fig. 1.1) in the ancient English city of York contains one of the few tangible traces of John Snow's origins: the Snow family plot with a gravestone for four members buried there just before city authorities outlawed intramural interments. The church was one of six in Micklegate Ward, an area of about forty acres south of the River Ouse. The ward included the northern part of North Street and contiguous courts, rows, and alleys, many named Tanner, indicative of a long-standing local industry, tanning (Fig. 1.2). The buildings were a mixture of residential housing, craft shops, flour mills, and warehouses. Carts from the southern and western hinterlands carrying grain and produce, cattle bound for the central market, and coaches all used the city portal at Micklegate Bar, where incoming traffic was inspected and tolls assessed. Quays along the Ouse were the unloading point for goods brought downstream by barges and small boats from the west and the north via a tributary, the River Swale, as well as from London, Newcastle, and elsewhere via the Humber inlet from the North Sea. The vessels were then refilled with cattle, agricultural produce from the Yorkshire countryside, and assorted commercial goods. Large warehouses lined the riverbank and served double duty as dikes, protecting low-lying houses in North Street from periodic flooding of the slow-moving river. Laborers were in great demand, as were transport workers such as carmen. Alleys connected the quays with North Street, which intersected Micklegate

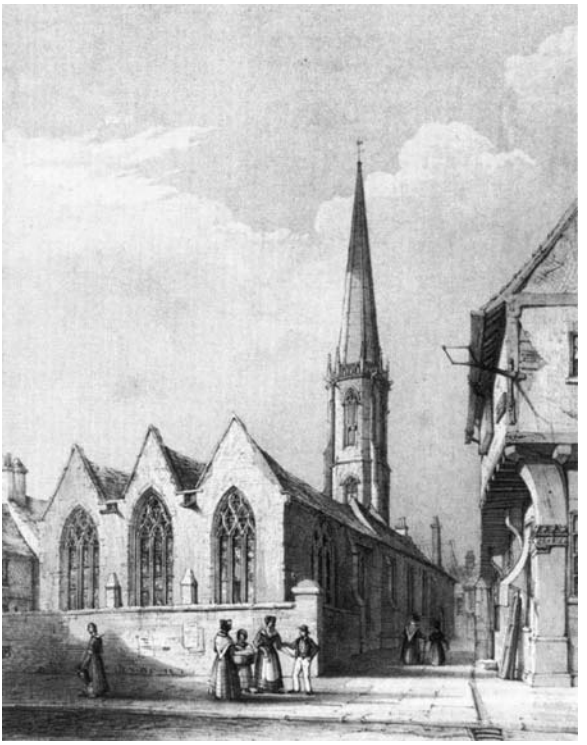


Figure 1.1. Church of All Saints North Street, c. 1840
(F. Bedford, illustrator, from Booth, pl. 13).

near the Ouse Bridge, the only vehicular and pedestrian connection to the rest of the city lying north of the river.[1]

Early in the nineteenth century the city of York bore traces of a history spanning almost two millennia. It was still a walled city. The foundations of some walls erected during the Roman era for a small military outpost of the empire were extended and repaired over the centuries as York was transformed into an autonomous borough. Some street names still ended in "-gate," medieval Danish for "street" and indicative of a ninth-century occupation by Scandinavian invaders. By the late Middle Ages, however, York had risen in significance to become a cathedral town (York Minster) and the northern capital of England by virtue of its location at the junction of two rivers and at the confluence of roads from the hinterlands. Some of the medieval quays and market squares still hummed with activity at the turn of the nineteenth century, when almost 17,000 people inhabited a contained area intended for half that many. At a time when the Industrial Revolution was transforming economic life, roiling social relations, and altering the landscape elsewhere in England, York was dominated by artisan guilds, and the mayor annually rode ceremoniously across the im-

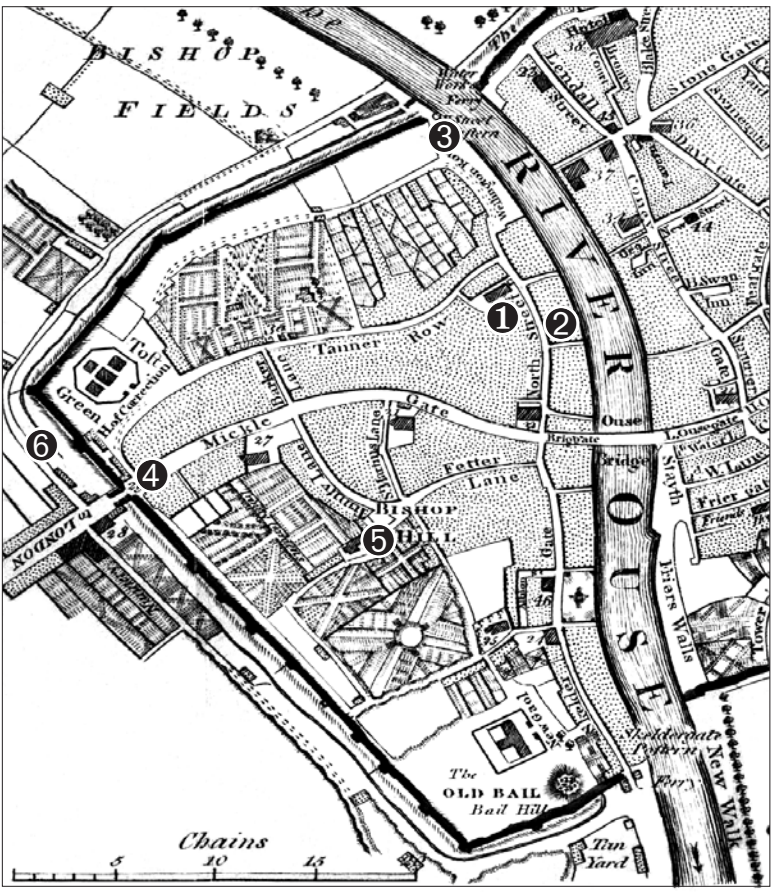


Figure 1.2. Micklegate Ward: 1—All Saints North Street Church; 2—Possible location of Snow family residence and John Snow's birthplace; 3—North Street postern by Wellington Row, to which the Snows moved in the early 1820s; 4—Micklegate Bar entrance; 5—Dodsworth School that Snow may have attended from approximately 1819 to 1827; 6—Queen Street, where the Snows moved in 1825 (adapted from Hargrove, vol. 2, between iv and 6).

mediate suburbs that were claimed by the four wards into which the city was divided for administrative purposes.[2]

Much of Micklegate Ward, particularly the streets near the river, was considered unsanitary, even in Snow's day. For centuries most of the parish had drawn water for household use from the Ouse near the North Street postern. In the 1670s the city corporation commissioned the York Waterworks company to provide running water. For more than a century the company pulled relatively fresh water from the Ouse near the North Street postern, eventually serving many customers in the three northern wards with running water via taps to cisterns placed in backyards and court-

yards. The water company found few customers in Micklegate Ward, however, because of low pressure and intermittent supply; the hollow tree trunks that carried water under the Ouse Bridge frequently developed leaks because of the heavy traffic above. Consequently, many residents in the ward as a whole, All Saints North Street parish in particular, drew water for drinking and washing either from shallow local wells or directly from the river. Neither source was particularly salubrious. The river water below the North Street postern was frequently polluted by discharges of dung from livestock pens near the ferry crossing. Although most houses in the parish had water closets connected to basement cesspits, which night soil men emptied periodically for a fee, some householders ran drains directly into the river to avoid paying sewage rates.[3]

Similar violations of city regulations for the disposal of human and industrial wastes occurred north of the river. The result was that water quality gradually deteriorated as the river bisected the city and was foul when it reached the Skeldersgate postern and the southern suburbs. All wells situated in the Ouse River floodplain received episodic overflows and became contaminated. Runoff from tanneries and market squares polluted springs that supplied wells or drained through cracks in linings into the wells themselves. Water tables within the city were also tainted by seepage from cemeteries and dunghills where night soil wagons dumped their loads for use as manure in the communal vegetable gardens. Conditions for residents near the River Ouse were often unsanitary, but they were much worse in the eastern and southeastern parishes of Walmgate and Monk Wards near the River Foss. A lock near the junction with the Ouse turned the Foss into a stagnant river, with an adjoining bog into which "poured the fetid contents of the drains" from nearby houses. City authorities in the eighteenth century considered such problems with water supply and sanitation unavoidable annoyances, but they became a matter of increasing concern among the earliest sanitary reformers in the 1820s, when the population of York exceeded 22,000—an increase of twenty-five percent since 1801.[4] In such an unsanitary environment, Frances Snow would give birth to seven healthy and long-lived children before the family moved to higher ground just outside the city walls in 1825, when their first-born, John, was twelve.[5] Perhaps the unhealthy conditions during these formative years stimulated his later obsession with the purity of what people ingest.

The Snows in York

Frances (Fanny) Askham was the "base born," or illegitimate, daughter of John Empson and Mary Askham. Being illegitimate, she was assigned her mother's surname. In 1792, three years after Fanny's birth, her parents exchanged vows of marriage in the parish church of the village of Acomb, two miles west of York (Fig. 1.3).[6] The couple had another daughter and three sons in the following nine years, all sur-

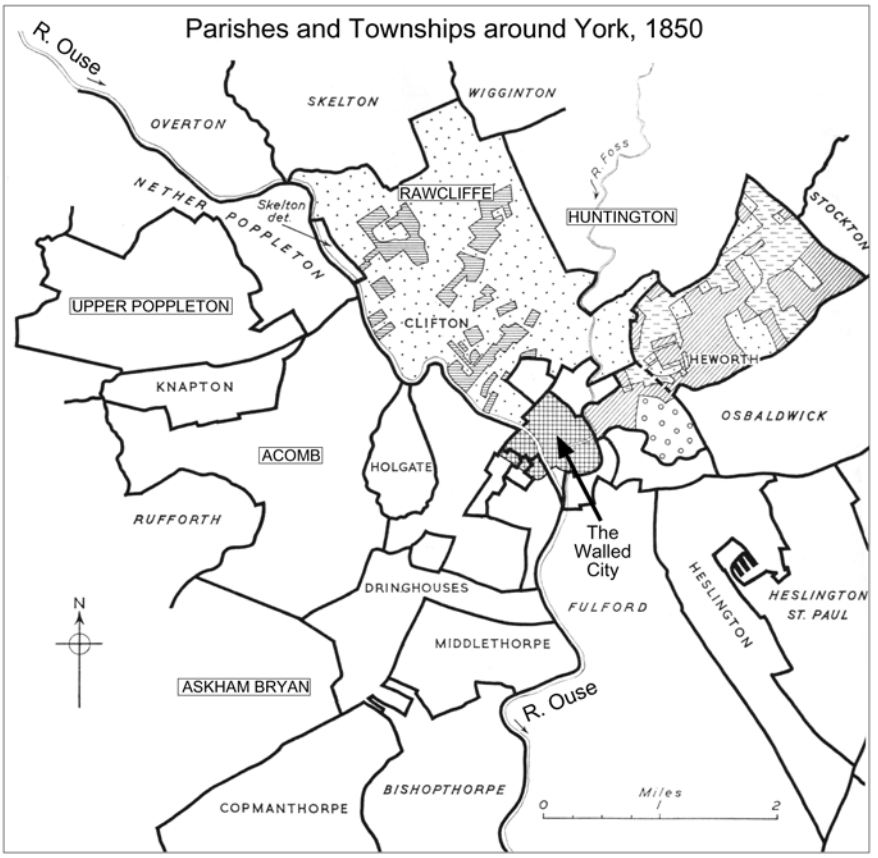


Figure 1.3. Parishes and townships around York (adapted from Tillott, 312).

named, unlike their elder sister, Empson (Fig. 1.4). During this period John Empson was a weaver, a "gentleman's servant," and a laborer—all "genteel occupations" in an era when self-reliance was the hallmark of respectability among the working poor and lower middle classes.[7] Sometime after 1801 John and Mary Empson moved to Huntington, a farming parish on the northern outskirts of York.[8]

In 1812 Fanny Askham, aged 24, married William Snow, aged 29. Both were sufficiently literate to sign the marriage register, and both listed their residence as Huntington. William Snow was a laborer.[9] His parents, Hannah and William Snow, are more mysterious than his in-laws. One view is that they were longtime residents of York, perhaps in the parish of All Saints North Street because their names are carved on a family tombstone in that churchyard. It is more likely, however, that they owned a farm in Upper Poppleton a few miles east of the city.[10] Shortly after their marriage William and Fanny Snow moved into the city of York. They set up a household somewhere in North Street, described in an 1818 guidebook as a "narrow" street with

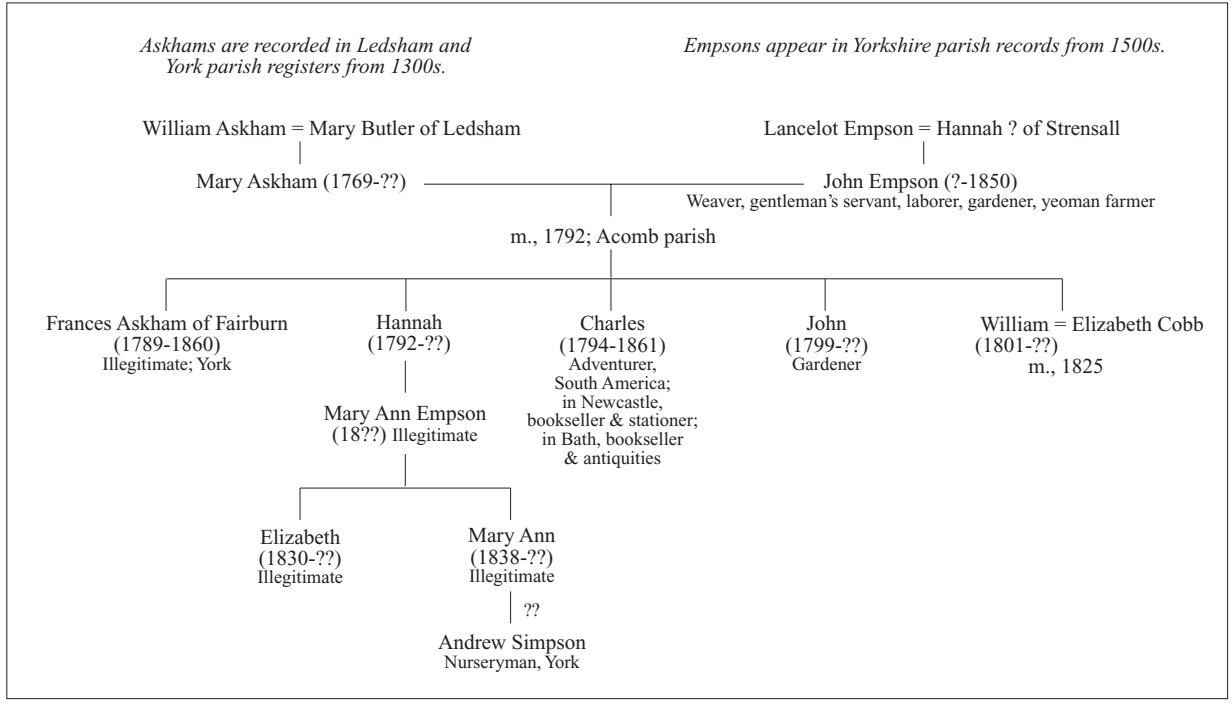


Figure 1.4. Askham–Empson genealogy.

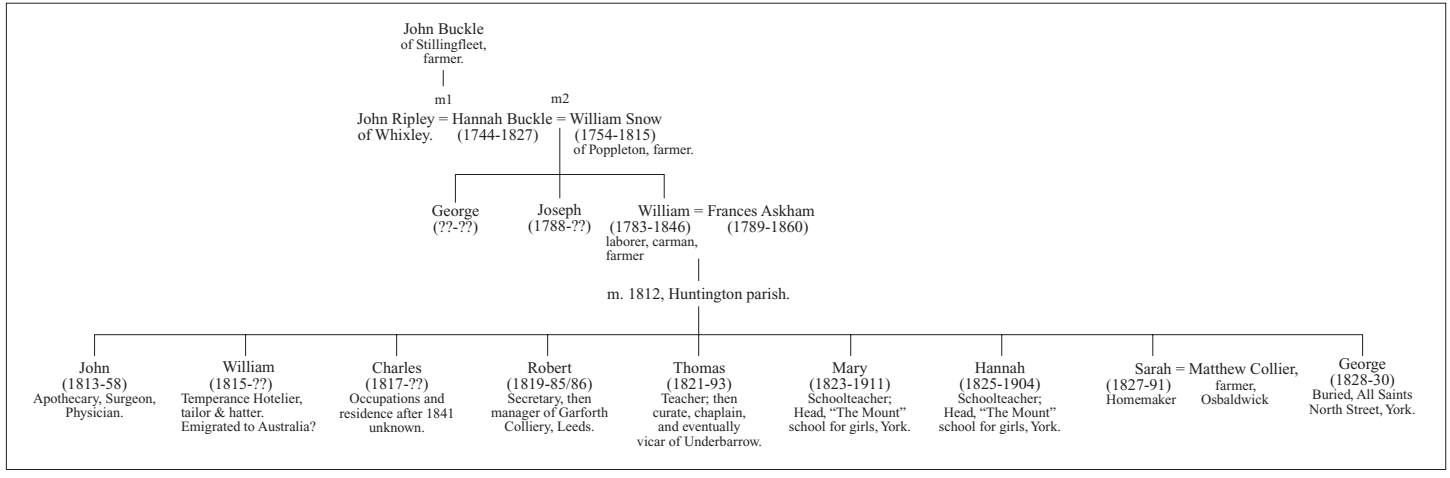


Figure 1.5. Askham–Snow genealogy.

"several good houses" remaining from the previous century, but most houses were apparently in various stages of disrepair and occupied by renters.[11] Their neighbors were also general laborers, as well as watermen, cowherds, tanners, skinners, sail and flag makers, weavers, joiners, bakers, painters, merchants, and small manufacturers.[12]

William and Fanny Snow began their married life as a laboring family with the advantages of literacy and connections to extended families with modest resources.[13] On 15 March 1813 Mr. G. Brown, the minister at All Saints North Street since 1798, baptized "John son of William & Frances Snow," born the same day.[14] John's birth occurred ten months after his parents' marriage; they had eight more children, three daughters and five sons, over the course of fifteen years (Fig. 1.5) and maintained attachments to their home parish throughout. They had ambitions for all their children and would provide each child with basic schooling. How an unskilled laborer accomplished this feat is unclear. They had no prospects of a substantial inheritance from the Empsons, although the Upper Poppleton farm that may have been owned by William Snow's father would likely pass to their eldest son, but the in-laws could have provided some financial assistance during hard times.

There were notable changes in the family's circumstances by the early 1820s. The first indication was a change in William Snow's occupation from unskilled to semi-skilled laborer sometime after the birth of his third son; the baptismal registers list him as a carman from 1819 until 1828 (Table 1.1). Precisely what this occupation involved other than driving a cart is unclear. He may have worked for someone else, hauling goods from the quays on North Street to other parts of the city. He may have invested in his own rig and could have owned several. If so, he needed access to a stable for the horses. Regardless of whether he worked for someone else or was a proprietor himself, William Snow's income increased sufficiently from 1821 to 1823 to allow him to move his family several blocks into "a row of new houses" on Wellington Row, an extension of North Street to the postern by the western wall.[15] In 1824 a William Snow appears in a county property tax register for St. Mary Bishophill Junior, the parish to which Upper Poppleton belonged, as owner of land valued at

Table 1.1. William Snow's occupational history and changes in family residence

Dates	Occupation	Residence
1812–1819	laborer	North Street (rental?)
1819–1821/23	carman	North Street (rental?)
1821/23–1825	carman	Wellington Row (rental?)
1825–1830	carman	Queen Street (property holder)
1830–1832	farmer	Queen Street (residence unclear)
1832–1846	farmer/landlord	Queen Street (property holder)[a]
1841–1846	farmer	Rawcliffe (purchased farm in 1841)

[a]Collected rents on four properties in Queen Street during this period.

Source: BIHR, PR Y/ASN 4; S. Snow, JS-EMP, 37.

nearly thirty-eight pounds, a substantial holding at the time.[16] The likelihood is strong that this person was John Snow's father because the following year William Snow purchased a home with some adjacent land on Queen Street, just outside the wall but still on the southwestern side of the Ouse. That is, the property in Upper Poppleton was apparently transferred to William Snow, which he used to purchase a house on Queen Street rather than move his family to the farm. His listed vocation remained carman until 1832, when he registered himself as a farmer when voting in the first reform Parliament. He continued to live in Queen Street and collected rent on four properties. In 1841 he purchased a farm in Rawcliffe that he worked until his death in 1846, aged 66.[17]

However, if William Snow hankered to farm while he was still a carman in the 1820s, he might have done so long before he formally registered himself as a farmer. All inhabitants of Micklegate Ward had access to the ward's "stray," approximately 500 acres of unenclosed pasturage southwest of the city. In addition, all residents of York could apply for the privilege of grazing cattle and horses throughout the year on various moors and commons surrounding the city.[18] It is entirely possible under such circumstances that before he bought property of his own on Queen Street, William Snow grazed the horses he used (or perhaps owned) as a carman on the rough pasturage in Micklegate Stray and the encircling average grounds of Nun Ings, Campleshon, and York Fields. Such an arrangement would explain an otherwise puzzling statement that John Snow, as a boy, "occasionally assisted his father in agricultural pursuits . . . [on] early winter mornings."[19]

Snow's Elementary School

William Snow's vocation changed from general laborer to carman about the time his eldest son was ready to enter an elementary school. State-subsidized, universal education did not begin in England until the 1880s, but York in 1819 had many pedagogical institutions, public and private, that catered to the poor and laboring classes.[20] *Public* meant that a school received substantial funding and direction from external sources such as religious organizations, local government authorities, and philanthropies. In York, for example, there were day schools administered by the Church of England and a Blue Coat Charity School. Students attended such public schools either free of charge or for a very modest "school-pence."[21] There were also about fifty for-profit preparatory academies and at least thirty "private schools for the education of the poor" (common day schools) operating in York between 1819 and 1823, including two common day schools in the parish of All Saints North Street, which charged parents about six pence per week for each child enrolled.[22] John Snow might have attended one of these day schools.[23] However, because there were already three boys in the family queue behind John Snow and his parents were dedicated to giving all their children primary education, we think it likely that they would have

preferred to send him to a less expensive alternative, the Dodsworth School in a nearby parish.[24]

John Dodsworth, an ironmonger, founded three schools in York and established endowments that paid a teacher to instruct poor boys in reading and writing free of charge. In this respect Dodsworth Schools were philanthropic charities, but because parents paid fees for their children to be taught some subjects as well as the fact that the schools were administered locally by parish officials rather than centrally by the Anglican Church, Dodsworth Schools were private schools by contemporary standards. In short, Dodsworth Schools were curricular equivalents to common day schools, just less expensive.[25] The charter for the school that had operated since 1803 in a house adjacent to the Church of St. Mary, Bishophill Junior, required "that twenty poor children from the six parishes on . . . [the Micklegate Ward] side of the river, in proportion to their sizes, should be educated therein, free of expense."[26] The allotment for All Saints North Street was three. The Snow family's long-standing connection with the parish church would have made their eldest son a suitable candidate for admission. From 1824 to 1832 William Snow did a variety of odd jobs for the church, and he became a warden in 1836.[27] Therefore, if a space was available around 1819 and the vestry recommended him for it, we believe that the "private school in York" Snow attended was the Dodsworth School at Bishophill.[28]

On the assumption that Snow attended this elementary school, he would have traversed the heart of the ward twice every schoolday for eight years. A short walk from home along North Street lay the Ouse Bridge at the intersection with Briggate. Across this major thoroughfare lay Skeldergate, a "narrow, and disagreeable street" along which he would have continued east for one block. At the Elephant and Castle, a "commodious and respectable inn," he would have turned south into "a narrow dirty street" called Fetter Lane. About 150 meters west, Fetter Lane intersected Bishophill. The Dodsworth School was sixty meters straight ahead, occupying the ground floor room of a small house; the master lived above the school-room.[29] The curriculum—"reading, writing, arithmetic, and the Scriptures, Church Catechism, and the use of the Prayer Book"—was similar to that offered by the private schools in the ward, with the possible exception of the absence of Latin.[30] Every pupil was required to attend Sunday school in his home parish. The rector at All Saints North Street ran "a Sunday School, supported by voluntary subscription, in which about forty-five boys are instructed,"[31] so Snow's Sunday school was independent of the Church of England.[32]

Apprenticeship in Newcastle-upon-Tyne

As Snow approached his fourteenth birthday his parents began looking for a suitable apprenticeship for him. It is unclear who suggested the unusual route of a medical career. In Suffolk, for example, about half the apprentices came from medical

families, while the remainder were sons of clergymen, farmers, gentlemen, and a scattering of artisans and tradesmen. Not a single apprentice was the son of a general laborer or carman. In Bristol the distribution was similar to that in Suffolk, although there were fewer sons of surgeon–apothecaries and more whose fathers were artisans; only one listed his father as a carrier.[33] Similar studies do not exist for York, but by 1827 William Snow's listed vocation no longer reflected his financial situation as a property holder.[34] The Snows could probably have afforded the indenture fee required for a medical apprenticeship in a provincial town.[35]

William Snow reached an agreement with William Hardcastle, a surgeon–apothecary in Newcastle upon Tyne and close friend of Snow's maternal uncle, Charles Empson. A native of York born in Micklegate Ward in 1794, Hardcastle was the son of a cobbler. In 1808, aged 14, Hardcastle had been apprenticed to a licensed surgeon, William Stephenson Clark, who expanded his premises on Micklegate, the thoroughfare that bisected the ward, to include an apothecary shop.[36] When Hardcastle completed his indenture in 1814, he joined the practice of an established apothecary in Newcastle upon Tyne. Two years later he traveled to London to take the lecture courses and practical medical training necessary to become a Licentiate of the Society of Apothecaries. He continued his training for an additional six months with lectures in surgery and midwifery, as well as participating in surgical rounds at a London hospital, and then passed the examination that gave him membership to the Royal College of Surgeons of London. Dual qualification as a surgeon–apothecary made Hardcastle a general practitioner. He returned to Newcastle in the spring of 1818 and purchased the practice of his former principal. Within a few years he was appointed surgeon–apothecary to the Newcastle Lying-in Hospital, where he and two colleagues shared duties as male midwives.[37]

Changing Medical Orders in England

Snow began his apprenticeship during a period of transition from local to national regulation of medical corporations. Medicine as a profession had been "incorporated" in England since the sixteenth century, when local authorities began delegating control of occupational training and practice to guilds, or companies. The result in London and large towns was a tripartite division of medical activities similar to, if less rigidly enforced than, many Continental versions. University-trained physicians diagnosed and prescribed for "internal" complaints (medicine, or physic). Barbers and barber–chirurgeons (surgeons) were considered the manual workers who performed venesection and treated a variety of "external" conditions. Apothecaries—originally general merchants and retailers in spices, drugs, and medicinal compounds who had become specialty shopkeepers selling medicines and filling prescriptions written by physicians—were considered tradesmen and the lowest of the three medical orders by people who believed the professions should be gentlemanly occupations.[38]

Local authorities of the City of London had given physicians and barber–surgeons charters of incorporation to control their own affairs.[39] Henry VIII created the College of Physicians of London, which gave its members independence from local authorities, but he refused their request for nationwide jurisdiction (Table 1.2). The Barber-Surgeons of London remained a city company after unsuccessful lobbying for parity with the College of Physicians. In the next century the apothecaries were separated from the Grocers' Company when James I chartered the Worshipful Society of Apothecaries of London, but independence came with a proviso: London apothecaries could fill prescriptions written only by physicians licensed by the College of Physicians.[40]

Surgeons did not extract themselves from their corporate affiliation with barbers until the mid-eighteenth century. Their practice premises became "surgeries" to distinguish them from barber shops. They gradually replaced another corporate vestige, the apprenticeship, with formal schooling including anatomy lectures and dissections. In 1800 London surgeons shed their company status for good, becoming a royal college with authority to establish requirements for anyone who sought its diploma and a license to practice in the City of London. The college had no jurisdiction in the provinces, however, where competition with apothecaries and irregular practitioners of all types remained the norm.

Surprisingly, the Worshipful Society of Apothecaries was the first of the London medical orders to achieve nationwide authority. As late as the mid-eighteenth century, the apothecary's vocation was considered an intellectually undemanding, albeit often prosperous, trade.[41] The Apothecaries' Act of 1815 empowered a reorganized society to establish licensing requirements for all apothecaries in England and Wales, to conduct examinations, and to monitor the behavior and services of its membership. Henceforth the apothecary's duties were legally limited to compounding medicines prescribed by a licensed physician. In the words of one angry critic, the apothecary was reduced to "the phisician's cooke,"[42] but compounding and dispensing became the exclusive purview of apothecaries under the act, which expanded prerogative distinctions among the three medical orders in London to all of England and Wales. As such, the 1815 act affirmed the physicians' long-standing claim to exclusive treatment of internal ("constitutional") diseases, and only licensed surgeons were supposed to treat external diseases and perform surgical procedures.[43]

However, the Apothecaries' Act of 1815 was a jerry-built dike, unable to contain the tides of medical convergence that had begun a century earlier. Part of the problem was that licensed physicians, who constituted less than five percent of medical practitioners at the turn of the nineteenth century, were concentrated in London and the larger provincial towns. Apothecaries continued to advise patients on how to treat internal complaints and to charge for such advice, either separately or absorbed in the cost of the medicines they dispensed. Among the middle and upper middle classes, surgeons served similar functions. They attended patients presenting internal and external complaints alike, they occasionally cut into bodies, and increasingly

Table 1.2. English medical orders: from London medical corporations to unified medical register

Physicians	Surgeons	Apothecaries
1518 College of Physicians of London (by charter from Henry VIII). Removed physicians from control by church authorities. Privilege to give licenses and right to suppress unlicensed practitioners of physic (medicine) in London and within 7 miles of the City. **1523** Royal charter reconfirmed. Authority over London apothecaries established.	**1300–1540** Company of barbers (incorporated 1462) and Guild of Surgeons (not incorporated), City of London **1540** Company of Barber-Surgeons, City of London (no authority beyond City). Barbers and surgeons maintained distinct functions; surgeons could operate and treat external injuries/complaints. Apprenticeship required. **1745** Company of Surgeons, City of London. Anatomy schools evolved in response to the emergence of new hospitals in London. Apprenticeships gradually fell out of favor. **1800–1843** Royal College of Surgeons of London, Lincoln's Inn Fields. Apprenticeships not required. Minimal formal training until Apothecaries' Act of 1815, after which RCS developed parallel requirements for prospective members. Lectures must be completed in London; hospital training in specified metropolitan hospitals.	**Medieval Times** Apothecarius (Spicer or Pepperer) became part of monarch's retinue. **13th/14th centuries** Apothecaries joined Company of Grocers, City of London. Joint responsibilities for regulating the importation and sale of drugs, spices, and medicinal compounds. Apothecaries gradually specialized in preparing medicinal compounds. **1523** Apothecaries in London and within 7 miles of the City permitted to fill only prescriptions written by licensed physicians. **1617** Worshipful Society of Apothecaries, City of London (and 7-mile radius) (by charter from James I). Restrictions from 1523 remained in force.

Anatomy Act of 1832

Medical profession permitted to use "unclaimed bodies" in dissecting rooms of medical schools.

1832

RCS recognized provincial medical schools that offered curricula similar to what was available in London, but at least six months hospital training had to be completed in specified metropolitan hospitals.

1843

Royal College of Surgeons of England.

1858

Medical Act established a unified register of licensed practitioners, specified requirements for qualification, and created the General Medical Council to investigate charges of malpractice and improper conduct.

1703

House of Lords ruled that apothecaries could give advice on internal complaints but could not charge for it.

1815

An Act for better regulating the Practice of Apothecaries throughout England and Wales (Apothecaries' Act).

1834

In *Woodward v. Ball* apothecaries could mix medicines prescribed by themselves. In *Apothecaries' Co. v. Lotinga* the apothecary was defined as "one who professes to judge of internal disease by its symptoms and applies himself to cure that disease by medicine."

Source: Adapted from Cope, *Royal College of Surgeons;* Copeman, *Worshipful Society;* Holloway, *ApothAct;* Porter, *Greatest Benefit;* SCME; Wall, *London Apothecaries;* Wall, Cameron, and Underwood, *Worshipful Society of Apothecaries.*

they advertised as male midwives. Surgeons who wished to augment their practices with the sale of medicines continued to do so after 1815 with little fear of prosecution. Despite the provisions for distinct functions, the 1815 act actually furthered the emergence of the general practitioner by permitting dual qualification as surgeon and apothecary. When the Society of Apothecaries upgraded its curriculum for prospective licentiates in the decades after the 1815 act, the Royal College of Surgeons of London was spurred to raise its standards for membership and, eventually, work with the society in developing a complementary training scheme. By the mid-1820s there was a noticeable increase in the number of licensed surgeon–apothecaries such as Hardcastle—medical men who were Members of the Royal College of Surgeons (MRCS) as well as Licentiates of the Society of Apothecaries (LSA).[44] Legal barriers to general practice in the 1815 act were eliminated by a series of judgments. By the mid-1830s surgeon–apothecaries were essentially unrestricted in their practice opportunities, fulminations from the Royal College of Physicians notwithstanding.[45]

However, when John Snow finished elementary school, the separation into three medical orders mandated by the 1815 act was still in force. Dispensing drugs provided the bulk of a practitioner's income, so the prospective medical man in England and Wales normally completed the requirements for a license from the Society of Apothecaries. The Society required a five-year apprenticeship, which Snow began under Hardcastle's tutelage in June 1827.

Life as an Apprentice

It was some eighty miles from York to Newcastle, a journey of five or six days by foot, or a day by coach, in 1827. Mail coaches were the safest mode of travel available, because they carried armed guards to discourage highway robbers.[46] A smooth turnpike linked York to Northallerton, a rough road traversed County Durham to Gateshead, and then a short bridge took the traveler over the River Tyne to Newcastle (Fig. 1.6). Like York, Newcastle was a walled town but had twice as many inhabitants. Hardcastle lived in a house at 52 Westgate Street, next to the Spital field by the western wall and directly opposite St. John's Church. The accommodations were spacious, including a personal apartment, surgery, and shop and a stable off the courtyard behind the house.[47]

We have not located Snow's actual indenture, but we assume it was similar to the standard version used during the reign of George IV.[48] By law, all masters were required to feed their charges, while lodging, laundry, and tools of the trade were negotiable. In turn, the medical apprentice was expected to serve his master "well and faithfully," to follow all "lawful Commandments," to stay clear of alehouses, and to abjure from playing "Dice, Cards, [gambling] Tables, Bowls or any other unlawful Games."[48a] In addition, the apprentice was expected to accommodate to his master's domestic routine and remain a bachelor for the duration of his contract.

Figure 1.6. Newcastle upon Tyne from the south, 1827 (Wright, 16).

Typically, apprentices rose early enough to sweep the shop floor and set up for business and were already washed and dressed for the day before eating breakfast. Shop tasks included much drudgery, such as washing bottles, maintaining an inventory of drugs, "dispensing" (filling prescriptions and running them to patients' houses), and keeping accurate ledgers. It was not uncommon for apprentices to diagnose and dispense for anyone who could not pay for the master's attendance. Such patients received medical advice for the cost of drugs alone. Many masters dictated information about each patient's age, occupation, constitution, living conditions, and presenting symptoms that apprentices wrote in ledger books.[49] Apprentices were also responsible for delivering drugs to patients at all hours of the day and night.[50] After several years apprentices often served as unsupervised assistants, making house calls, handling emergencies, and riding to mining villages if their masters were retained by one of the local collieries. Thomas Giordani Wright, a senior apprentice from 1826 to 1829 to the surgeon James McIntyre, with premises in nearby Newgate Street, recorded in his diary that he had set fractures, lanced abscesses, undertaken postmortem dissections when the relatives would approve it, handled a bewildering array of accident injuries, pulled the occasional rotten tooth, and used a stethoscope for auscultation. Such clinical encounters were over and above his usual routine of compounding medicines, treating childhood diseases, confronting the occasional measles epidemic, and dealing with recurring bilious disorders.[51]