Air, Disease, and Improvement in Eighteenth-Century Britain

Sir John Pringle (1707-1782)

by

Erich Weidenhammer

A thesis submitted in conformity with the requirements
for the degree of Doctor of Philosophy

Institute for the History and Philosophy of Science and Technology
University of Toronto

Air, Disease, and Improvement in Eighteenth-Century Britain: Sir John Pringle (1707-1782)

Erich Weidenhammer

Doctor of Philosophy

Institute for the History and Philosophy of Science and Technology

2014

Abstract

The Scottish-born physician John Pringle (1707-1782) achieved remarkable fame as a natural philosopher, eventually becoming a physician to King George III and President of the Royal Society of London. He did so largely on the basis of a single major work. The *Observations on the Diseases of the Army* (1752), founded on his experience as an Army physician during the War of the Austrian Succession and the Jacobite Rebellion, was a guide to the diseases facing soldiers in Northern Europe. It also examined the nature, prevention, and treatment of epidemic fevers that afflicted large groups living in close proximity.

Pringle believed, like many in his day, that epidemic fever was associated with the process of putrefaction taking place within the body. A member of the Royal Society, he performed a series of experiments on putrefaction which were subsequently appended to his *Observations*. These investigations earned him the Society's Copley medal in 1752, were widely emulated across

Europe, and established him as a natural philosopher of note. They represented, I argue, a promising approach to a problem of significant concern to early modern European society.

This thesis examines both the nature of Pringle's claims and the manner in which they shaped his reputation as a natural philosopher. Particular attention is paid to Pringle's Scottish education and early career among the medical community at Edinburgh. The first two chapters discuss, respectively, the observational and the experimental foundation of his medical claims. The final two examine his contribution within the context of eighteenth-century British society, especially its relation to the culture of British natural philosophy and the interests of his Hanoverian patrons. A prominent figure within the royal court, the Royal Society, and the military, Pringle became a patron to others whose work furthered his interests. He consequently played a significant role in the emergence of the Chemical Revolution.

Acknowledgments

I thank, first of all, my wife, Muriel, whose love, example, and support have permitted me to complete this thesis. I thank my family, whose faith and encouragement guided me through many early years of academic difficulty. I also thank my friends and fellow graduate students, especially Victor Boantza, John Christopolous, Gwyndaf Garbutt, and Yves Bourque.

I am particularly grateful to my friend Brendan Cook, whose appreciation for the history of the Western tradition continues to inspire me. As a teenager in Saskatchewan, I could not have imagined that I would eventually follow him to graduate school in Toronto. I thank Larry Stewart, a mentor, who first introduced me to the notion that ideas about nature bear the indelible mark of society and culture. I thank David Pantalony, whose generosity and enthusiasm for scientific material culture supports a vital academic community in Canada which I am delighted to take part in. I thank Roger Emerson, an exemplary patron of his discipline, who graciously places his remarkable knowledge of eighteenth-century Scotland at the service of young scholars.

I would like to acknowledge the Institute for the History and Philosophy of Science and Technology, a humane and supportive community. I sincerely appreciate the respect that the IHPST staff and faculty have shown for student initiatives. I wish particularly to recognize Muna Salloum, whose importance to the Institute cannot be overstated. It has also been a privilege to spend these years among my fellow IHPST graduate students. I would like especially to thank Ari Gross, Paul Greenham, and the many others who have helped to build the University of Toronto Scientific Instruments Collection.

My greatest debt is to my supervisors, Trevor H. Levere and Lucia Dacome. Both have been generous, helpful, conscientious, and above all patient, for which I am extremely grateful. Both belong to an essential, and often unacknowledged, subset of scholars who commit themselves fully to guiding graduate students through a lengthy and challenging process.

Table of Contents

Contents

List of Figures

Chapter 1: Introduction: Why Study John Pringle

The Scottish-born physician John Pringle (1707-1782) has been known to posterity mainly for a single major work, the *Observations on the Diseases of the Army in Camp and Garrison* (1752). In it he addressed the epidemic diseases that afflicted large groups living in close proximity, notably dysentery, what we today call typhoid fever, and scurvy. In the first systematic work on army medicine to be published in the early modern period, Pringle gathered observational and experimental evidence to assign these diseases to the passage of a putrid ferment between the body's surroundings and its interior. He proposed a reform of military life and medical practice aimed at preventing the occurrence of putrid diseases, and recommended treatments.

The *Observations* proved a success, going through seven English editions in Pringle's lifetime. It was translated into French, Italian, and German, earning him an international reputation as a natural philosopher.[1] Pringle was subsequently elected four times to the Royal Society's Committee before being unanimously elected President in 1772-1778. Beginning in 1749, when he became personal physician to the Duke of Cumberland (1721-1765), he rose through the ranks of Hanoverian patronage until he was named Physician Extraordinary to King George III

[1] Gordon (1989), p. 6. Pringle was renowned both as a practicing physician and as a contributor to natural philosophy. However, the distinction between the two is problematic. As we will discuss below, physicians grounded their claims to medical competence on knowledge of natural philosophy. In the early modern period, many philosophers who did earn their livings by practicing physic nevertheless cultivated medical knowledge, self-diagnosed, and treated friends and family members. While there were bodies of knowledge belonging specifically to physicians, this binary distinction obscures more than it reveals. Phrases such as "physicians and natural philosophers who did not practice medicine" are clumsy circumlocutions. Unless referring specifically to expertise cultivated by physicians, I will assume that "natural philosopher" covers that trade.

(1738-1820) in 1774.[2] His emergence as a patron of natural philosophy provided an impetus to the study of air and its relationship to human health, an investigation that would provide much of the foundation for the Chemical Revolution later in the century.

From his elevated position within the Royal Society, the royal court, and the Army, Pringle provides an overview of the social networks of British natural philosophy. He may be profitably approached, therefore, in much the same way as Mary Terrall has interpreted Pringle's near contemporary, the French mathematician and natural philosopher Pierre-Louis Moreau de Maupertuis (1698-1759), as a guide to concerns and contexts within natural philosophy.[3] Like Maupertuis, Pringle came from the minor gentry and emerged as a prominent technocrat for having distinguished himself in pursuit of a problem of significance to his royal patrons. Where Maupertuis, a mathematician, addressed cartography and participated in voyages of exploration, Pringle addressed disease within the military. Both flourished in the sociable milieux of their respective capitals.

I view Pringle, like Terrall's Maupertuis, as a subject worthy of a kind of intellectual biography that uses a prominent figure in pursuit of important themes and contexts related to eighteenth-century natural philosophy. Whereas Maupertuis's interest has generally remained evident to historians of the eighteenth century, Pringle's has not. My task, therefore, is also to establish the intellectual context of his work in relation to the historiography of chemistry and medicine before exploring its reception.

---

[2] Peterkin and Johnston (1968), p. 14. Kippis (1783), p. l. Kippis notes that Pringle was made physician extraordinary to the King in 1774 whereas according to Peterkin and Johnston, Pringle became Physician Extraordinary in 1772 and Physician in Ordinary in 1774.

[3] See: Mary Terrall (2002). *The Man Who Flattened the Earth. Chicago:* The University of Chicago Press.

A retired scholar with a vast knowledge of the social landscape of eighteenth-century Scotland recently remarked to me about the disproportion between Pringle's reputation among his peers and his seemingly modest output. This imbalance was also evident to Pringle's supporters. Comparing his medical contribution to that of the influential English physician Thomas Sydenham (1624-1689), Pringle's biographer Andrew Kippis (1725-1795) claimed that "Like Sydenham, too, he hath become eminent, not by the quantity, but the value of his productions; and hath afforded a happy instance of the great and deserved fame, which may sometimes arise from a single performance."[4] I believe that this evident disparity points us to the value of studying Pringle's work in order to understand important issues that exercised early modern natural philosophers.

Pringle has hitherto been viewed as a pioneer of army medicine, an early promoter of hygiene, and a peripheral player in the emergence of pneumatic medicine.[5] His experiments on putrefaction had been largely abandoned before the end of his life, while his putrid and miasmatic understanding of fever, upon which his ideas were premised, was ultimately abrogated by the germ theory of the nineteenth century. His therapies will inevitably appear dubious to those inclined to view the history of medicine as a chronicle of successful ideas. A fellow guest to the library of the Royal College of Physicians of Edinburgh dismissed him as "a bleeder"—a promoter of phlebotomy. Others have associated his promotion of therapies based on antisepsis

---

[4] Kippis (1783). p. xxv.

[5] Hamilton (1963), p. 139; Selwyn (1966), pp. 267-270; Golinski (1992), pp. 109, 119-120.

(a term that he invented to encompass processes that countered putrefaction) with a harmful delay in the adoption of the citrus cure for scurvy within the Navy.[6]

In this thesis I seek to demonstrate the manner in which Pringle contributed to the process of reconciling the classical foundation of Western medicine and the new philosophy of nature promulgated by the Royal Society, uniting them in an effort to prevent disease. His understanding of disease was informed by the Hippocratic reasoning of the university-educated physician, which combined skilled observation of the local environment with an understanding of factors relevant to maintaining the health of one's patient. It was equally founded on a self-consciously Baconian experimental account of the chemical process of putrefaction, whose link to epidemic disease he believed to be "among the surest of any that were admitted, before the theory of circulation was known."[7]

In my reading, Pringle provides two related themes of interest to historians of early modern medicine and science: the importance among eighteenth-century natural philosophers of discovering the origins and nature of disease, and the emergence, from within that effort, of an endeavour to improve the health of soldiers and sailors that propelled its Lowland Scottish author towards the pinnacle of London-based patronage networks. This thesis is divided more or less equally between these themes; chapters 2 and 3 focus primarily on the intellectual context of Pringle's work. They draw mainly on historical work related to medical observation and the

---

[6] See p. 104 for a discussion of Pringle's use of the term "antiseptic" and p. 263 for the alleged association between antisepsis and the adoption of the citrus cure.

[7] Boerhaave (1983), p. 134; Newton (1730), p. 317; Hales (1727), pp. 198-199; Pringle (1752), p. xiii. It should be noted that in the early eighteenth century, the word remained in use as a synonym for "chemical motion" . Newton's mention of gunpowder in the twelfth query, describe how "the acid Vapour of Sulphur… entring violently into the fix'd Body of Nitre, sets loose the Spirit of the Nitre, and excites a great Fermentation." Hales listed the mixture of white-wine vinegar and oyster shells as among fermentative processes producing air.

history of pneumatic chemistry. The final two chapters consider its meaning within eighteenth-century British society and are most indebted to historical work on the social order of England and Scotland, as well as the social context of natural philosophy.

Chapter 2 discusses Pringle's role as a medically-trained observer, a member of a medical trade grounded in an empirical tradition tracing its origins to antiquity. The tradition of early modern observation has been recently explored by Lorraine Daston who shows its re-emergence after the Hellenistic period to have been a distinctly early modern phenomenon. The systematic gathering of informed observations gave identity to the community of physicians, distinguishing them from other practitioners of medicine. As Daston notes, "As shared textual conventions, genres are intrinsically social: contributing to a genre means consciously joining a community."[8]

In my reading, Pringle's observational practices, recounted both in his published work and his unpublished *Medical Annotations*, bound him to the Edinburgh community of physicians. The sharing of published observations, on a model inspired by the Royal Society, joined this emerging community together, providing Pringle with a model for his *Observations on the Diseases of the Army*. Towards the end of his life, Pringle provided part of this community (the Fellows of Royal College of Physicians of Edinburgh) with a multi-volume compilation of "medical annotations" that he had gathered over the course of his life. These observations had particular value given the status that he had achieved as a physician, and because of its inclusion of selected correspondence with noted philosophers.

---

[8] Daston (2011), p. 48.

If the gathering and sharing of medical observation was a key characteristic of the Neo-Hippocratic movement in seventeenth-century medicine, so too was a tendency to observe the medical characteristics of places. A great deal of work has explored the medical contexts of these climatic investigations, though I am particularly indebted to the recent work of Jan Golinski and Andrea Rusnock.[9] These concerns linked the natural philosophical interests of medical men to those of a much broader community, centred on the Royal Society, who developed new instruments and methods for investigating the air and climate. The medical community at Edinburgh employed such tools to systematically investigate the relationship between air and disease.

Pringle's example provides an opportunity to explore the intersection between the epistemic genre of medical observation and neo-Hippocratic climatic concerns. His *Observations on the Diseases of the Army* began with a compilation of observations gathered during his years on campaign. Pringle built his case for the importance of putrefaction in the form of aerial vapours as a major causal factor behind outbreaks of fever by gathering observations within a particular setting (the Army), and a particular environment (the hot and humid fall and summer of the Low Countries).

Chapter 3 seeks to integrate Pringle's exploration of putrefaction with the existing historiography of eighteenth-century chemistry, particularly the importance of medical chemistry to the emergence of the Chemical Revolution. It focuses especially on Pringle's pharmaceutical interests and their relation to a series of experiments that were appended to the *Observations*.

---

[9] See Emerson (1979, 2004, 2012); Stewart (1992, 2009), Rusnock (1999, 2002 a & b).

The latter involved a thoroughgoing examination of the chemical process of putrefaction as it affected physiological processes such as digestion and the progress of disease.[10]

I argue that the authority of Pringle's experimental account flowed from an expertise in the pharmacopoeia, an area of chemistry that fell largely within the physician's domain.[11] Pringle's experiments were, in large part, intended to further pharmaceutical knowledge of the *materia medica*. They also permit us a view into his relationship with a community of natural philosophers and apothecaries that extended beyond the physician's trade.

Pringle's focus on putrefaction, founded on a chemically-oriented understanding of disease, illuminates the place of the particular chemical expertise of the university-educated physician within the history of chemistry. His emphasis on chemical processes challenged the prevailing mechanical model of the body—particularly as promulgated by the influential Leiden medical professor Herman Boerhaave. This tension permits us to study the place of chemical explanations within medical reasoning by examining the ways in which physicians characterised the animal economy through broad analogies, for instance, to chemistry, mechanics, or a vital force.

Pringle is frequently given a passing mention in accounts of the emergence of pneumatic chemistry, for instance by Jan Golinski, Simon Schaffer, and Christopher Lawrence, who

---

[10] The term "physiology" was in use throughout the early modern period in reference to the functioning of a living organism. The more usual terms among Pringle and the Edinburgh physicians seems to have been "animal œconomy" or "laws of the animal body." Given that "physiology" is conventional among many medical historians, and not brutally anachronistic, I will use it when speaking in general terms.

[11] Dingwall (2005), pp. 67-71; Within urban centers that were large enough to support corporations of medical practitioners, the right to concoct and dispense drugs, as well as the right to regulate the trade, was legally contested among organized physicians, apothecaries, surgeons, and (in Scotland) surgeon-apothecaries. All university-trained medical men, whether surgeon or physician, were educated in the material medica. It was, however, the physicians who collectively established the official pharmacopoeia.

acknowledge his influence within the Royal Society over the 1770s.[12] His work nevertheless deserves more attention than it has been given because his chemical account of putrefaction inspired experiments in pneumatic chemistry to a greater extent than has been acknowledged. Most notably, his invocation of the phlogiston concept, providing a chemical identity to disease-causing miasmatic vapour, represents an important contribution to the emergence of pneumatic chemistry in Britain.

I wish to emphasize Pringle's early association between the process of putrefaction and the phlogiston theory which anticipated, and probably encouraged, Joseph Priestley's exploration of phlogistic processes. This challenges the strong distinction, proposed by Frederic Lawrence Holmes, between the phlogiston theory of chemical combustion as received from a tradition of continental chemistry, and as reinterpreted by an emerging tradition of British pneumatic chemistry. Pringle, trained in the pharmaceutical chemistry of the medical college at Leiden, seems rather to blur this proposed distinction.

Chapter 4 explores the relationship between air and disease as a venue for natural philosophers to advance their interests through patronage. I argue that Pringle's *Observations on the Diseases of the Army* articulated a physician-led reform of army medicine. It is therefore comparable to many other schemes through which natural philosophers sought to advance themselves through presenting credible improvements to British military and commercial interests. This claim is founded in secondary literature exploring the cultural context of eighteenth-century natural philosophy in relation to the British social order. Roger Emerson's study of politics and patronage in the Scottish Enlightenment, and Larry Stewart's research on the context of the

---

[12] Lawrence (1987), pp. 6-7; Schaffer (1990), pp. 284-285; Golinski (1992), pp. 106-110.

commercial and manufacturing origins of the Enlightenment in England, both provide an invaluable perspective from which to understand Pringle's progress from Edinburgh to London.

Pringle drew from his observations and experiments a number of practical measures that could be enacted by military officers to safeguard the health of those subject to institutional confinement. I argue that this was already a well-established venue for improving schemes among British natural philosophers—one whose importance rivalled that of contemporary efforts to determine longitude at sea. Pringle's work on military medicine consequently fulfilled a key promise of the Baconian program as adopted by the Royal Society: experimental knowledge in the service of state power. His reputation flourished because his scheme was well delineated, embraced by institutions of credit within the philosophical community, and supportable by patrons.

The roots of Pringle's *Observations* lay in the institutions of Early Enlightenment Scotland, in efforts by the country's small landholding elite to improve commerce and trade. Connections to this small oligarchy provided him an entry into networks closer to the centre of power through the military, one of the main organs of eighteenth-century British rule. His move to London—a transition common among well-to-do Scots—placed him in close proximity to military patronage networks.

Through exploring the military context of Pringle's work, I wish also to support a reconsideration of the place of Pringle's theory of antisepsis. William McBride has argued that Pringle's explanation of scurvy as a putrid disease requiring an antiseptic cure was, in the context of his day, far more conventional than his later critics, informed by anachronistic knowledge about vitamin deficiency, have maintained.[13] I seek to complete this picture by connecting Pringle's views on the nature and treatment of certain contagious diseases with the interests of physicians and their patrons within the military.

Chapter 5 addresses the nature of Pringle's increasing prominence within the community of natural philosophers, especially over the period following the successful reception of his research into putrefaction and his proposed reform of army medicine. It traces Pringle's emergence from the sociable environment of early Enlightenment Edinburgh through to his prominence within several critical institutions of British Power: the British Army, the Royal Society, and the royal court.

I argue that Pringle, as a personal physician to various members of the House of Hanover, may be seen as a client of the court, his position resembling that of an early modern court philosopher.[14] His progress from Edinburgh to London, and his subsequent rise to prominence, may be understood in terms of his connection to a series of well-placed patrons, Lord Stair and most notably the Duke of Cumberland, military commander and second son of George II, who likely viewed Pringle's medical reforms as complementing his ongoing efforts to reform the military. His philosophical prominence is, therefore, best understood in terms of the interests of his patrons.

From the mid-1750s until his death in 1782, Pringle became increasingly influential in guiding the investigation into putrid fever. His longstanding connection to the military enabled him to help others test ideas similarly aimed at preventing epidemic disease. As the Royal Society's

---

[13] Lawrence (1987), pp. 6-7; Lawrence (1996), pp. 86-91; McBride (1991), pp. 158-160.
[14] Biagioli (1993), pp. 15-17.

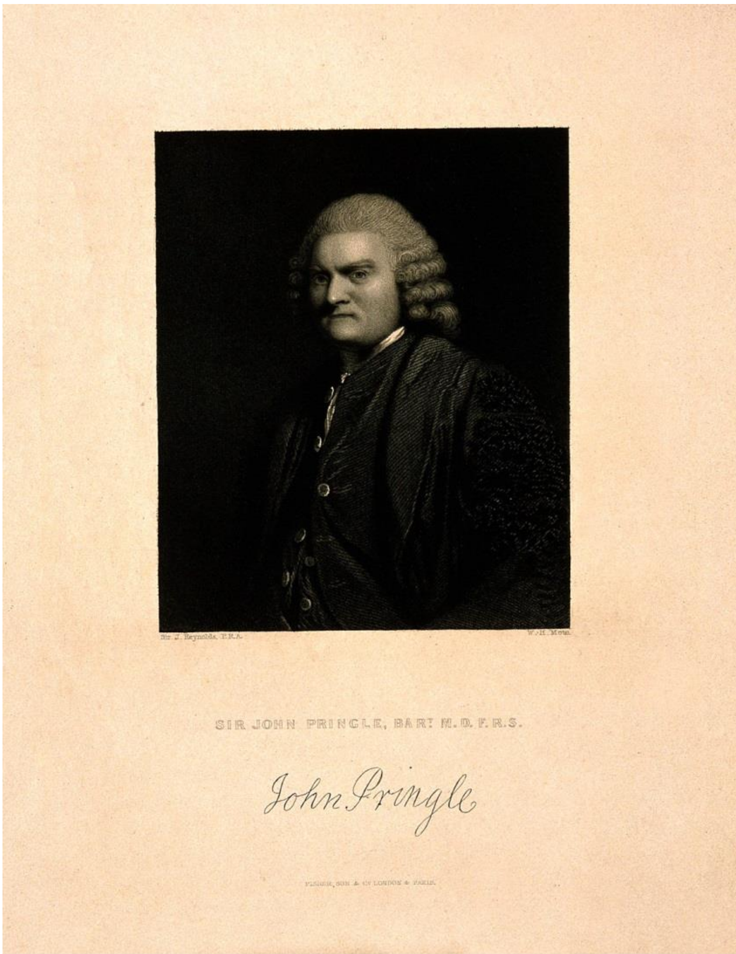
President from 1772-1778, he was also the Society's spokesman, delivering widely-praised discourses recognising the Society's best experimental work. As a royal physician, he used his connections to the court to advance friends and subordinates. Of particular interest to historians of chemistry is Pringle's support for the exploration of antiseptics (notably in the form of proposed schemes to prevent naval scurvy), as well as the study of the air, especially the nature of putrid effluvia.

Tensions developed between Pringle's various commitments when a controversy over Benjamin Franklin's lightning rods took root within the Royal Society in the years surrounding the American Revolution. His ties to a circle of Dissenters, many of them part of a prominent Whig faction within the Royal Society, threatened to undermine his duties as a courtier. As such, Pringle's example can contribute to a historical understanding of the political circumstances surrounding British natural philosophy during the revolutionary period at the end of the eighteenth century—a topic investigated, for instance, by Maurice Crosland, Simon Schaffer, Jan Golinski, and Trevor Levere.

The conclusion will consider the extent to which Pringle's example may illuminate the close and complex relationship between medicine and natural philosophy in the eighteenth century. It will also summarise his interest to historians of both fields.

Because the structure of this thesis is only broadly linear, and focuses primarily on themes relevant to natural philosophy and eighteenth century culture rather than biography, I have included a brief biographical sketch. I hope that this will help the reader to understand the chronological relationship of the episodes in Pringle's life that I mention below.

1.1 John Pringle's Life and Work



An engraving of John Pringle done in the mid-19th Century by the English engraver William Henry Mote (1803–1871).

It is based on a portrait painted in 1774 by Joshua Reynolds (1723-1792), a prominent and prolific 18th century English portraitist who was then President of the Royal Academy of Arts.

On the 19th of November 1778, Pringle gave the portrait to the Royal Society and it was hung in the meeting room. This was about two months after he had announced his intention to resign the presidency of the Royal Society.

Figure 1. Sir John Pringle. Stipple engraving by W. H. Mote after Sir J. Reynolds, 1774, ICV No 5001**,** Iconographic Collections, Wellcome Library, London **.**

In researching a historical figure over several years, one acquires interesting anecdotes and begins to form opinions about the character of one's subject. This is not, however, a work of pure biography tracing the development of a personality through time, but rather an attempt to approach the medical and scientific culture of a particular time and place from the perspective of a single (rather prominent) career. I have tried, in so far as possible, to introduce biographical detail in the context of relevant themes. Nevertheless, this account would be difficult to approach without an overall picture of Pringle's life and circumstances. What follows, then, is a brief review of existing biographical work on Pringle followed by a short narrative summary of his career. I hope that this will provide the reader with a better sense of the context and chronology of the events discussed in this thesis.

John Pringle flourished at the heart of the culture of Enlightenment first in Edinburgh then in London. Historians who have worked on the eighteenth century cultural establishment will typically find him a recognizable, though not quite familiar, figure. He was a close friend to Benjamin Franklin and lent vital support to the aerial investigations of Joseph Priestley.[15] He witnessed the Battle of Dettingen (1743), the Duke of Cumberland's campaign against the Jacobites (1746-7), and the Gordon Riots (1780).[16] He treated James Boswell (1740-1795) for his gonorrhoea (1768), and helped Captain James Cook (1728-1779) to prepare for his second voyage (1771-2).[17] He dined with the King of France and corresponded with leading continental physicians and philosophers.[18]At least twelve books were dedicated to him over his life.[19]

Existing secondary work on Pringle tends to fall into two categories: biographical treatments, often quite short, and peripheral discussions of his career and influence in work relating to other themes. Foremost in the first category is Dorothea Singer's three-part biographical treatment published in *Annals of Science* in 1949 and 1950. It remains useful for its detailed archival

---

[15] Hardy (1993), p. 65;

[16] Pringle (1752), pp. 23-24; Kippis (1783), pp. xl, xiv; John Pringle to William Hall, 20 June 1780, Papers of the Hall Family of Dunglass, East Lothian, GD206/2/428/12, National Archives of Scotland;.

[17] Porter and Porter (1989), p. 109; Lawrence (1996), pp. 86-87. See p. 234 for Pringle's relationship to Cook.

[18] Kippis, (1783), pp. xiii-xiv; Benjamin Franklin to Mary (Stevenson) Hewson 14 Sep 1767 in *The Papers of Benjamin Franklin,* vol. 14. January 1, 1767 to December 31, 1767, ed. Leonard W. Labaree, Helen C. Boatfield, and James H. Hutson. (New Haven: Yale University Press, 1970), 250-255; John Wain [ed.] *The Journals of James Boswell: 1760-1795 (selected)*. (London: Heinemann, 1990), 199

[19] See p. 197 for a list.

research. David Hamilton (1963), Sydney Selwyn, (1966), and Otto Sonntag (1999), have also contributed shorter biographical treatments.

Charles H. Gordon delved deeply into Pringle's copious *Medical Annotations* and attempted to produce a modern catalogue of its contents. Gordon was working on a large project related to Pringle's role in the development of army medicine, but passed away before finishing it. Though stymied by Pringle's proscription against citing the *Medical Annotations* (overturned in 2004 thanks to a privately funded legal effort by the Royal College of Physicians of Edinburgh), Gordon's unpublished guide is helpful, as is his published article on Pringle's work on the pharmacopoeia which led me to Boswell's surprising manuscript on Pringle's life.[20]

In my opinion, the richest biographical evidence remains the primary sources, some of it unpublished. Pringle's most substantial biography was written by Andrew Kippis, a member of his close London circle, a dissenting minister, and editor of the *Biographia Britannica*, the first volume of which appeared in 1778. Kippis' biography of Pringle was published in 1783 in the form of a long introduction to a republished collection of the celebrated speeches that he delivered before the Royal Society at the presentation of the annual Copley medal during his tenure as President. Whether in recognition of this effort, or simply as a token of friendship, Kippis received forty pounds in Pringle's will. Kippis wrote his "lives" largely as a form of moral instruction, "to give us just notions of the merit of our remotest ancestors, and of their posterity."[21]

---

[20] Gordon (1989), p. 5.

[21] Kippis (1747), p. xii. It is, perhaps, notable that Kippis' "Life of Pringle" was reprinted verbatim in a text entitled *Converts from infidelity; or, Lives of Eminent Individuals who Have Renounced Libertine Principles and Sceptical Opinions, and Embraced Christianity (1827)* by Andrew Creighton (1790-1855), an Edinburgh preacher.

Joseph Banks (1742-1820), Pringle's eventual successor as President of the Royal Society, found Kippis's "Life of Pringle" insufficiently reverent for a man who had held that station. In a letter to Benjamin Franklin in 1784, he wrote:

> I have enclosed you a Pamphlet written by Dr. Kippis who you may remember living in great intimacy with the late Sir John Pringle it is fair & very well tempered but so very mealy mouthed that it will possibly be right to publish something Else as no foreigner can conceive a man right who is not praised.[22]

Pringle's "life" might have been recounted differently. His young friend in London, James Boswell, informed Pringle in 1777, the year before Pringle retired from the Royal Society, that he was "ambitious to be your Plutarch…"[23] While Pringle evidently declined this offer, Boswell did write a life of sorts. A short manuscript of anecdotes regarding Pringle's life, probably written to assist Kippis' effort, survives in the Yale Boswell archive.[24] It is wonderfully candid and full of gossip. The two texts make a notable contrast.[25] A second unpublished life of Pringle was written by Benjamin Franklin in French.[26] This was intended for Félix Vicq-d'Azyr (1746-1794), who penned the eulogy that appeared in the *Histoire de l'Académie Royale des Sciences* in 1782—a text that Banks would, no doubt, have appreciated more than Kippis' "Life of Pringle."[27]

---

[22] Joseph Banks to Dr. Benjamin Franklin, Soho Square, 19 Nov 1784. In Banks (2007), vol. 2, p. 333.

[23] James Boswell to John Pringle, 2 Feb [1777], Yale MS. L 1081**,** Boswell Collection. General Collection, Beinecke Rare Book and Manuscript Library, New Haven.

[24] Boswell, James. (1782). "Pringle, Sir John, Memoirs" GEN MSS 89, M217, Boswell Collection. General Collection, Beinecke Rare Book and Manuscript Library, New Haven.

[25] Kippis (1783), pp. iii-iv.

[26] Benjamin Franklin "Éloge de M. Pringle", 1782. Retrieved January 30, 2014, from Franklinpapers.org, an online site provided by Yale, publishers of Benjamin Franklin's correspondence. This text is not published in the Yale Franklin correspondence and this online entry does not given a manuscript number, though I have contacted the editors for this information. Vicq d'Azyr's request to Franklin, dated 8 November, 1782 is published in vol. 36 of the Yale collected papers, pp. 291-292.

[27] Vicq-d'Azyr (1782), p. 66.

The arc of Pringle's career may be usefully broken down into three periods. The first encompasses his Scottish youth, his education in Edinburgh and Leiden, and the early development of his career within the Edinburgh medical community. The second takes him from Edinburgh, where he formed an important connection with the Earl of Stair, and into the Army where he first attained Hanoverian patronage. Finally, the third period of his life saw his establishment and rise in London. What follows is a very brief biographical sketch that should help orient readers through the chapters that follow.

John Pringle was born in 1707 on the modest family estate of Stichill located in the Scottish border county of Roxburghshire.[28] His father, John Pringle (1662-1721), was the second Baronet of Stichill. The title passed to the younger John Pringle's brother, Robert (1690-1779). Their paternal uncle, Walter Pringle (1664-1736), was a prominent lawyer. Knighted in 1718, when he was made Lord Newhall, he became a Lord of Session, that is, a member of the highest civil court in Scotland. A second uncle, Robert (*d.* 1736), left Scotland for the Netherlands during the

---

[28] Sinclair (1791-1799), vol. 3, pp. 290-293, vol. 20, p. 596; Timperley (1976) pp, 84, 314. The united parishes of Stichill and Hume are located in the former County of Roxburgh and Berwick (now within the Scottish Borders council area) near the point at which the border with England extends southward from the River Tweed. The Stichill property was purchased in 1628 by Robert Pringle of Bartingbush (c. 1581-1649), later MP for Roxburghshire 1639-1641. His grandson, Sir Robert Pringle (1630-1692, later Lord Newhall), also an MP for Roxburghshire, was made 1st Baronet of Stichill in 1682. Over the eighteenth century, the estate passed to his son Sir John Pringle (1662-1721), 2nd Baronet of Stichill, to his grandson Sir Robert Pringle (1690-1779), 3rd Baronet of Stichill, and to his great-grandson, Sir James Pringle (1726-1809), 4th Baronet of Stichill. Valuation rolls from 1771 list the valued rent on the Stichill property as £3,662, and that of the property owned by Sir Robert Pringle in the neighboring Hume parish as £646. *The Statistical Account of Scotland*, prepared by Sir John Sinclair (1745-1835) over the 1790s, show Stichill and Hume to have consisted of purely agricultural land, lacking in fuel. The parish experienced little growth, going from 959 inhabitants in 1755 to 1000 in 1790. Much information on the eighteenth century village life of Stichill can be gleaned from the published records of the Baron Court over which Robert Pringle, 3rd Baronet presided: George Gunn (1905). *Records of the Baron Court of Stitchill (1655-1807)…* Edinburgh: Printed at University Press by T. and A. Constable for the Scottish History Society.

reign of James the Second, returned with the Dutch invasion under William of Orange, and received a number of high government positions, notably Secretary of War for Great Britain.[29]

The Pringles had also won favour with the English as part of the "Squadrone Volante" faction in the Scottish parliament. Their backing of the 1707 Union with England Act, which dissolved the English and Scottish Parliaments and created a single London-based Parliament of Great Britain, was a crucial step in the centralization of British power in London. In their support for the Protestant Succession and the Act of Union, the Pringles chose the right side of history.

John Pringle received a good education despite being the fourth son on a modest estate. He was tutored at home before being placed in the care of Francis Pringle (c. 1665-1747) "a near relation of his father" (probably a cousin) who was a professor of philosophy at St Leonard's College of the University of St Andrews from 1699 until 1747, obtaining the professorship of Greek in 1702.[30] Another uncle, also named Francis Pringle, was President of the Royal College of Physicians between 1724 and 1731.[31]

In October of 1727, John Pringle began a year of study at Edinburgh University. That same year he appears in the record book of the surgeon Alexander Monro (1697-1767), an energetic professor of anatomy who animated the local medical community.[32] This may perhaps suggest that Pringle intended to pursue medicine when he began his university studies. Boswell later wrote that Pringle had intended to pursue commerce in the Low Countries before being

---

[29] Kippis (1783). pp. i-iii.

[30] Stewart, M. A. (1990), pp. 391-395; Kippis (1783), p. iii.

[31] Kippis (1783), p. ii-iii.

[32] On 18 Oct 1727 Pringle appears in .*A Monro's Record Book of Students, Scholars 1720-1749*, Manuscript Dc.5.95, p.43. Archives of the University of Edinburgh. he is listed as scholar beside Robert Hope, master; A Society in Edinburgh (1737), vol. 1, p. 139. Monro would later refer to Pringle as his "ingenious friend and quondam pupil" while praising him for a prescient anatomical observation concerning the muscles of the jaw.

inspired to pursue medicine after hearing a lecture by the noted Leiden University professor Herman Boerhaave (1668-1738).[33]

Monro was a member of the University of Edinburgh medical school that, in 1726, had been consolidated through the creation of four new chairs. All were occupied by former students of Boerhaave who were already teaching in the community. This development was the culmination of an ongoing effort to improve medical education at Edinburgh. It was carried out by the Scottish political establishment, in imitation of the Leiden teaching model, with the hope of attracting British students who were otherwise drawn to the Continent.[34] Pringle himself left the following year for Leiden to attend Boerhaave's lectures—he may also have studied in Paris as well.[35] In July of 1730, he received a Leiden degree, signed by Boerhaave along with several others, for a Latin dissertation on the physical changes of the aging process.[36]

The subsequent four years, during which he worked to establish himself in medical practice in Edinburgh, remain indistinct. James Boswell's unpublished biography describes his situation as "comfortless" on account of the many well-established physicians there. According to Boswell, well-connected friends provided opportunities for him to prove himself in practice though they tried and failed to secure him a place as physician to George Heriot's Hospital, an Edinburgh orphanage. It is notable, however, that Pringle's uncle Francis was President of the Royal College of Physicians of Edinburgh (RCPE) from 1727 to 1731.[37]

---

[33] Boswell (1782), p. 1; Kippis (1783), p. iv. Pringle's attendance of medical classes at Edinburgh before his departure for the Continent strongly suggests he had, at very least, considered medicine before his departure.

[34] Emerson (2004), pp. 187-188, 200-217.

[35] Kippis (1783), p. iv. Kippis notes in his preface that Boswell believed Pringle to have completed his medical education in Paris. Unable to confirm this, he excluded it from the main narrative of his "Life of Pringle."

[36] Singer (1949), p. 131.

[37] Underwood (1977), p. 141.

Pringle's fortunes lifted considerably in 1734 when, at the age of twenty-six, he was appointed Joint Professor of Pneumatics and Moral Philosophy at Edinburgh University. The vast majority of professorships were secured entirely through patronage.[38] His lectures provided moral guidance to university undergraduates based on the Stoic philosophy of Cicero and Marcus Aurelius, along with the work of Bacon, and the German-born philosopher and jurist Samuel von Puffendorf (1632-1694).[39] They boosted his local profile and his practice while providing a modest salary. One month before his appointment, Pringle had been admitted as a full fellow of the RCPE.

Pringle was set on a new course through his attachment to a well-born client, the Leiden-educated John Dalrymple, Second Earl of Stair (1673-1764), a successful army officer turned diplomat. Accounts differ about how this connection was formed, though Pringle may have been recommended by one of his own relations when Stair fell ill while his physician was away.[40] They were acquainted during a period in which Stair had returned to his Edinburgh estate to rebuild his fortunes after an expensive stint as a diplomat in Paris. As Stair lived on an estate outside of Edinburgh, each visit involved Pringle being ostentatiously collected by a coach and six—the source of some envious gossip.

In March of 1742, Stair was given command of an expeditionary army sent to counter French ambitions in Austria. Pringle was made Stair's personal physician. This attachment led to his being made Physician-General to the military hospital in Flanders, a position of significant

---

[38] Emerson (2004), p.187, Boswell (1782), p. 2.

[39] For a contemporary description of Pringle's program see Henderson (1741); A transcription of Pringle's lectures on Cicero, the first of which was delivered on 28 Jan 1741, survive in manuscript MS 74 D, attributed to James Brown, at the Centre for Research Collections, The University of Edinburgh.

[40] Boswell (1782), p. 3; See p. 212.

responsibility. It placed him at the head of a small medical committee that oversaw the provision and management of the general and regimental hospitals and medical care in the Army. He would serve with Stair until 1744 when the Duke of Cumberland took over command of the army and became Pringle's next patron.[41]

Made Captain General in 1745 at the age of 23, Cumberland was the second most powerful figure in the British Army after than the King himself. As Cumberland's Physician General, Pringle would accompany him to Scotland for his campaign against the Jacobite rebellion of 1745, where Cumberland's brutality earned him the nickname "butcher of Culloden." He returned with Cumberland to the Continent until the signing of the Treaty of Paris in 1748. Over this period, Pringle became Cumberland's client. He was made Cumberland's Physician in Ordinary in 1749, and a half-pay officer subject to recall to the army. Pringle's affiliation with the Army did not end when the military hospital closed at the end of the War of the Austrian succession. He would be recalled intermittently for a decade.

Pringle settled in London after the Treaty of Aix-la-Chapelle ended the War of the Austrian Succession in 1748. By 1750, he was on military half-pay, building his medical practice while preparing his book on army medicine based on observations relating to epidemic fever that he had made during his time on active duty. This was a period of intense activity as he sought to establish his philosophical credentials in London. In May of 1750, he published *Observations on*

---

[41] Gabriel (2013), p. 57-61, 104-109; Drew (1968), pp. xxi-xxv. In early modern Europe, organized medical care within the military evolved in tandem with the nation state and national armies. In England, senior medical men had presided over medical care within the army since the late Renaissance. By the restoration of Charles II, senior medical staff, including a Surgeon-General, Apothecary-General, and Physician-General, were appointed to supervise regimental medical staff and to organize care within the military generally. This senior staff expanded in times of war with commissioned medical officers appointed to a large general hospital established for the duration of a campaign.

the nature and cure of Hospital and Jail fever as a letter to Richard Mead, a powerful supporter, in response to an outbreak of fever at the Old Bailey courts. Between June 1750 and February 1752 he read a series of seven papers recounting experiments into the nature of putrefaction before the Royal Society, to which he had been elected in 1745. His 1752 marriage to Charlotte Oliver (c.1728-1753), daughter of, Dr. William Oliver (1695-1764), the foremost physician at the fashionable resort town of Bath, would have brought him to the notice of the fashionable and important, though they were separated a year later and Charlotte died tragically soon after.[42]

Pringle's book appeared in March of 1752, with his experimental papers appended to it. The experiments won him the Royal Society's Copley medal for 1752. His *Observations* confirmed his status as an authority on the subject of fever while creating a scholarly foundation for Pringle's subsequent rise. Pringle thrived in the clubbable atmosphere of London—a milieu that was not always welcoming to ambitious Scots. [43] In 1753, he was elected to the Royal Society's Council. He also formed a close relationship with Benjamin Franklin who had won his Copley the year after Pringle. Such connections to the sociable elite permitted him to become one of the city's premier hosts.[44] Pringle's Pall Mall residence became a destination for visiting foreigners who often attended Royal Society meetings as his guest. It was also the site of his "Sunday evening conversations" which were attended by some of London's leading intellectuals including several prominent Society members.[45]

---

[42] Kippis (1783), p. xxii.

[43] Schama (2001), pp. 386-388.

[44] Crane (1966), p. 212.

[45] Kippis (1783), pp. lxiii; Boswell (1782), pp. 10-11. On February of 1754, Dr. Oliver published an allegorical poem entitled "Myrna: A Pastoral Dialogue" in *The Universal Magazine*. In it he intimated that Dr. John Pringle was responsible for her death.

Pringle's attachment to the Duke of Cumberland was to be the first rung on the ladder of Hanoverian patronage. When Princess Charlotte of Mecklenburgh-Strelitz arrived in England to marry King George III in 1761, Pringle became a physician to her household.[46] His rise in London was made possible through his connections to the Royal Family, the most well-place clients available to a physician in Britain. By 1774, he was appointed Physician Extraordinary to the King himself, an achievement which was likely related to his presidency of the Royal Society in 1772.[47]

Pringle's presidency lasted from 1772 to 1778. He was particularly noted for his "Copley Addresses" which accompanied the awarding of the Copley medal each year at the Society's anniversary meeting. These speeches, all of which were published at the Society's expense, were meant to contextualise and explain the work being recognised. They were also demonstrations of Pringle's own erudition and broad learning, evidence of his status within the natural philosophical community. His reputation grew abroad as well. In 1778, he replaced the recently deceased Carl Linnaeus as a foreign member of the Académie des Sciences.[48]

Pringle benefited from his dual role as a well-connected court philosopher and a representative of the Royal Society's interests at court until his responsibilities came into conflict in the period surrounding the American Revolution. His ties to figures such as Joseph Priestley and Benjamin Franklin, who considered natural knowledge as potentially subversive to the established political order in Britain, brought him into conflict with his Hanoverian masters and probably led to his downfall as head of the Royal Society. This was the notorious "lightning rod controversy" which

---

[46] Kippis (1783), p. xxxi.
[47] Gordon (1989), p. 7. Underwood (1977) p. 158, Kippis (1783), p.1.
[48] Histoires (1782), p.66.

took place in the shadow of the Revolutionary War—a remarkable preface to the scientific culture war that would colour British public life following his death during the period surrounding the French Revolution.[49]

An elderly man, Pringle sold his Pall Mall home in April of 1781 and attempted to resettle himself in Edinburgh. There he found the climate too cold for his failing health and he returned to London.[50] Before leaving, he gave the Royal College of Physicians of Edinburgh, with which he had been involved his whole life, a compilation of his medical notes bound into ten volumes. Pringle was buried on the 19th of January 1782 at St. James Anglican Church in London and given a memorial sculpted by Joseph Nollekens (1737-1823) in the south transept of Westminster Abbey. This is located beside the memorial to his fellow philosopher and collaborator Stephen Hales.[51]

---

[49] See especially Mitchell (1998).
[50] Kippis (1783), pp. lxi-lxii.
[51] Kippis (1783), p. lxv; Vicq-d'Azyr (1782), p. 67.

Framing Concepts

Before embarking on a focused discussion of several themes relating to Pringle's career, it is necessary to deal with several key interpretive concepts and assumptions that will shape the analysis below.

1.1.1 Sociability, Patronage, and Influence

In order to approach the question of how Pringle's work may have influenced the goals and aspirations of others, I would first like to present my interpretation of how the concept of "influence" ought to be used in this context. It is certainly possible to achieve precision through very constricted definitions of influence, for instance "to signify a two-sided relationship between teacher and student…"[52] Another perspective, drawn from the history of scientific ideas, studies influence in order to understand the causal factors underlying changing theories within scientific communities. This tradition may be traced from Kuhn, through the sociology of scientific knowledge (SSK) emerging in the 1970s, to current work near the border between history and philosophy of science.[53]

My own inclination as a historian is towards an account of the characteristics of particular communities rather than generalized claims about the processes governing scientific change in general. It should, in my view, be possible to make a case for multiple forms of influence at work

---

[52] Casteel (2007), p. 3.

[53] For an overview of these formalized approaches, focusing on the work of historian of physics Paul Forman, see: M. Norton Wise. (2011). "Forman Reformed Again." In *Weimar Culture and Quantum Mechanics. Selected Papers by Paul Forman and Contemporary Perspectives on the Forman Thesis*, edited by Cathryn Carson, Alexei Kojevnikov, and Helmuth Trischler, 415-431. London: Imperial College Press, 2011.

among a particular community of people working on similar problems under similar circumstances. A study of Pringle's increasing influence over the second half of the eighteenth century within the community of British natural philosophers permits us to approach important themes within early modern historiography: most notably sociability and patronage.

Of these two factors, sociability is perhaps the more subtle, though it also assists us in situating Pringle within the debates about the nature of Scottish Enlightenment. The term refers simply to the quality of friendliness or affability. Within the context of the cultural history of early modern Britain it is used to explore the emergence of a largely urban public culture in which social relations, and social rank, were negotiated in the convivial atmosphere of clubs, private gatherings, and coffee houses.

Historians who defend the notion of a Scottish Enlightenment, as a phenomenon distinguishable from an overall British movement, may draw from intellectual history, identifying new concepts of human nature and civil society ("the science of man") developed by figures such as Francis Hutcheson, David Hume, and Adam Smith.[54] They may equally point to the close social networks among Scots with common philosophical interests, whether in the Scottish cities or elsewhere in the British Empire. Richard Sher, for instance, has pointed to the closely knit literary community of Scottish authors and publishers as a major nexus of the Scottish

[54] Ahnert and Manning (2011), pp. 3-6; Lawrence (1979), pp. 23-31 Lawrence's classical paper draws a parallel between accounts of sociability and civil society among Scottish Enlightenment philosophes, and physiological notions of nervous sensibility among Edinburgh physicians. Neil Vickers'"Aspects of Character and Sociability."(2011) also draws parallels between Scottish medical theory and theories of sociability, though in more modest terms. In my view, however, Pringle's account of the body is not easily characterized in terms of sensibility.

Enlightenment. Others have looked to the Scottish university system as a central institution driving Scottish letters as a whole and natural philosophy in particular.[55]

Such readings place Pringle at the centre of important Scottish networks which branched outwards to centres of philosophical prestige in London. Familial and social connections brought him first to Edinburgh University and a professorship in moral philosophy, and later to the service of the Earl of Stair, a powerful Lowland servant of the crown who led him towards Hanoverian patronage.[56] Throughout his journey to prominence as a London based natural philosopher of international repute, he kept the company of Scots, be they men of letters (Colin MacLaurin, Lord Kames, David Hume, James Boswell), the medical men incorporated in the cities or serving in the military, or the university professoriate that intersected both communities.

Underpinning these intellectual and vocational bonds were the familiar mechanisms of eighteenth-century sociability. Evidence survives in the form of thousands of polite letters and numerous references to social gatherings, such as the meetings of the literary club at Ranken's Tavern in Edinburgh, the Edinburgh Musical Society, or later the Royal Society Club which met at the Mitre Tavern in London. Pringle's own residence in London figured as a major social gathering place for visitors to the Royal Society. His personal correspondence offered a means for outsiders to attract the Society's attention and demonstrates the intersection between sociability and influence.

While sociability cannot fully account for Pringle's role as an arbiter of philosophical debate, one finds many instances in which he used his social connections to advance those whose views

---

[55] Sher (2006), pp. 18-21; Golinski (1992), pp. 13-15.
[56] Ahnert and Manning (2011), p. 9.

he endorsed. Examples that we will encounter include letters of introduction or references to a client's work in Pringle's international correspondence, visits to witness a subordinate's achievement, or invitations to polite gatherings with his well-placed friends. If sociability represents one perspective from which to address the question of Pringle's influence within British philosophical circles, patronage seems closely related and somewhat easier to characterise.

It is evident, for instance, that patrons within the nobility enjoyed the capacity to promote the philosophical claims that they favoured.[57] Indeed, as we shall see, Pringle's own tenure as President of the Royal Society was likely brought to an end when George III chose to support an interpretation of the workings of lightning rods that Pringle, a supporter of Franklin, could not.[58] It seems equally reasonable to suggest that a figure ensconced within institutions that dispensed patronage and credit to natural philosophers might be seen as wielding powers of patronage. One can identify younger scholars who defended Pringle's contribution, or acknowledged a debt of gratitude for his assistance, in their texts. Such examples demonstrate influence at work within natural philosophy through patronage relationships.

If sociability and patronage provide some idea of the means through which Pringle exercised influence, we must study his own work to determine the purpose of this influence. In the fourth chapter, I argue that the problem of air and disease was of vital importance to the upper echelons of British society. The need to preserve the lives of soldiers and sailors engaged in commerce and the expansion of empire consequently provided opportunities for natural philosophers to

---

[57] Biagioli (1993), pp. 54-59.

[58] Mitchell (1998), pp. 323-324; See p. 257.

advance themselves. Pringle, I argue, exercised an ever greater role in defining and brokering these exchanges, by delineating areas of investigation within natural philosophy—notably the chemical study of antiseptics—in which others might distinguish themselves by supporting the work that he most favoured.

This claim may be rendered more concrete by studying the manner in which Pringle framed his work relative to existing bodies of knowledge and forms of knowledge making. This permits us to see how others understood his work and adapted it towards their own ends—surely a form of influence. Here I wish to emphasize the relative prominence that Pringle's *Observations* achieved, both in Britain and abroad. Pringle's ability to define his work in terms that were of interest to several audiences was also essential to establishing a position of influence within British natural philosophy.

Pringle's *Observations on the Diseases of the Army* was a prominent text. Among the seven English editions appearing between 1752 and 1775 at 6s for a portable octavo volume, was a run of the fifth edition produced in quarto at 15s—an indication of the commercial promise that it retained and the audience at which it aimed.[59] The work enjoyed enough prestige among French natural philosophers that the physician Antoine Poissonnier-Desperriéres (1723-1793), a writer on scurvy, complained publicly of having been written out of Pringle's history of disease prevention.[60]

---

[59] Sher (2006), pp, 275, 622.

[53] Poissonnier-Desperriéres (1780), pp. 247-248. This author devoted a chapter of his text to demonstrating his precedence in matters relating to scurvy and its prevention which he felt had been systematically, and deliberately, ignored.

At the apex of his career, Pringle could marshal powerful allies within the Royal Society to criticize experimental conclusions that contradicted his own.[61] He dominated conversations related to putrefaction and antisepsis in British philosophical circles to the extent that he could exclude some work entirely. The French noblewoman and experimentalist Madame Marie-Geneviève-Charlotte Thiroux d'Arconville (1720-1805) published some 300 putrefaction experiments in her *Essai pour servir à l'histoire de la putréfaction* (1766). Although d'Arconville's experiments were similar in extent, organization, and presentation, to work that received Pringle's approbation and support, he did not, as far as I am aware, acknowledge them in his published work or his correspondence, nor did any of his clients.[62]

This was not, I believe, because he regarded Madame d'Arconville's views as unacceptably critical. Pringle had several times engaged in public discussion over the merits of his own claims, on occasion submitting to correction instead of marshaling supporters to his defence.[63] Nor was it likely on account of her sex. Madame d'Arconville, like many other women in the French Enlightenment who wrote on topics relating to natural philosophy, published anonymously. She was publicly identified with her philosophical work only later in the century.[64] Rather, philosophical discourse might itself constitute a form of patronage, a process that required an acknowledgement of status.[65] To admit someone into a conversation in which one's opinions held sway was to confer on them the status of a near equal, recognition that Pringle was, for whatever reason, unwilling to confer upon Madame d'Arconville.

---

[61] See p. 233.
[62] Van Tiggelem (2011), p. 100-102.
[63] See p. 106.
[64] Carlyle (2011), p. 72; Van Tiggelen (2011), pp. 100-102.
[65] Biagioli (1993), p. 55.

Such was Pringle's influence within the domain of British experimentation into putrefaction and antisepsis. Having established a field of experimental study—"un vaste champ pour les observations" in Madame d'Arconville's estimation—Pringle's increasing prominence within the community of British natural philosophers permitted him to further define, delimit, and police the several fields to which he had contributed.[66] These may be considered military knowledge, fever literature, and Baconian experimentation, though these were assigned different weight within his *Observations*.

Pringle introduced his treatise as a philosophical work of military knowledge, a field that would also have included the study of navigation and gunnery, both of which were of interest to natural philosophers. The work was intended primarily to synthesize the complexities of military medicine for an audience of officers and aspiring military men. This was a topic with little precedent. The ancients, he noted, had had ample opportunity for such observations as "their troops were constantly employed, and in very different climates", though they wrote little. The moderns, for their part, had added nothing of consequence. The subject, he concluded, "which ought by this time to have been compleat, is still in a manner new: so little is a military life consistent with that state of tranquility requisite for study and observation."[67] Several decades later, his biographer and friend Andrew Kippis echoed the sentiment, noting that: "He was happy in the choice of his subject" which, "ought long ago to have been touched upon."[68]

Pringle's treatise on army medicine seems to have established a new area of medical inquiry. A survey of British medical publications from 1660 to 1800 reveals that, aside from treatises on

---

[66] D'Arconville (1766), p. iii.
[67] Pringle (1752), pp. iii-vi
[68] Kippis (1783), p. xxvi.

naval surgery and scurvy, it had little precedent. It was followed, however, by a great deal of similar work. Richard Brocklesby (1722-1797), Physician General to the Army in Germany during the Seven Years War, and Donald Monro (1728-1802), also a Physician to British Army hospitals in Germany, both published accounts of military medicine in 1764. To this one could add numerous treatises recounting the diseases prevalent among soldiers garrisoned in various parts of the empire.[69]

If Pringle presented his text as filling a lacuna in military science, he nevertheless intended it to engage with a more specialized and developed area of medicine: the study of fevers. By the eighteenth century, fevers had become a very prominent topic on which to publish, and the proper treatment of fevers produced a significant amount of written polemic in Britain.[70] Engagement with this literature was largely subsumed within the broader narrative of Pringle's text, which was focused on the military context of his observations and their implications. His *Observations* represented, however, a substantial enough contribution that he was afterwards considered the writer "most read and in practice followed" on the treatment of putrid malignant or hospital fever by an author critical of his methods.[71]

Reading Pringle's text against the backdrop of fever literature tends to highlight some of its major characteristics. Fevers, according to the classical conception that remained in place throughout the early modern period encompassed a vast spectrum of ailments all of which were the consequence of the physiological process by which the human body expelled morbific

---

[69] Rogal (1992), pp. 211-214. For a list of British medical publications on military topics. This list is, however, incomplete (it omits Brocklesby's text) and contains errors. The author seems to have misread "miliary fever" (named for the eruption of small pustules resembling millet seed or *milium*) as "military fever", and thus included several unrelated works in this category.

[70] Bates (1981), pp. 46-47; Cunningham (1981), pp. 71-72.

[71] Sims (1773), p. 238.

matter.[72] All fevers were characterised by excessive heat.[73] The typology of fever did not, like our modern understanding of disease, reflect causes, but instead grouped illnesses by patterns of symptoms and, consequently, the treatment to which a certain species of fever (continuous, intermitting, hectic, etc.) was known to respond.

The treatment of fever demanded a physician's grasp of the relevant literature, an ability to read changing symptoms representing the progress of a disease, and an understanding of the body's normal response to medication and physic during a given stage of illness. The third part of Pringle's work, directed specifically to medical men, advanced a series of claims about the treatment of fevers characteristic of the conditions that he had observed on campaign, along with a broad physiological account of fevers in general founded in the chemical process of putrefaction and the body's relationship to the air and environment. [74]

Finally, given the importance assigned to the appended chemical experiments as evidence of his medical claims, Pringle's *Observations* was intended as a contribution to Baconian natural philosophy. These experiments, read before the Royal Society and disseminated in its journal, were intended for a broad community of experimentalists, many of whom lacked a university medical education. They provide the clearest indication of his contribution to that community and, consequently, of its subsequent elaboration by others—a process of major importance to an understanding of the early Chemical Revolution.

---

[72] Bates (1981), p. 66; Cunningham (1981), p. 75.
[73] Bates (1981), p. 47;
[74] Pringle (1752), pp. x-xi.

Pringle's experiments were presented as an exemplary Baconian endeavour. Bacon had maintained that his method, founded on an inductive examination of particular phenomena, would permit a thorough re-examination and advancement of every branch of knowledge, including medicine.[75] Pringle's investigation provided a summary and re-examination of chemical phenomena relating to putrefaction and fermentation while introducing the concept of antisepsis. Moreover, Pringle pointed to passages in Bacon's work concerning natural history as having inspired this inquiry.

Serving as evidence supporting his overall effort to improve medical care within the Army, Pringle's experiments were acknowledged by the Royal Society and were awarded the Copley medal for having fulfilled the Baconian promise of utility. This confirmed Pringle's experimental investigation as having delineated the study of putrefaction as a new domain of inquiry for experimenters seeking to make a successful contribution to the community of natural philosophers.

[75] Cook (1990), p. 397

1.1.2 Air and Disease

John Pringle founded his medical claims on a particular understanding of contagious disease. In his estimation, many such diseases could be attributed to a putrid substance arising from the environment. Two essential points need to be made: The first is that Pringle took part in an early-modern movement to clarify the mechanisms underlying ancient assumptions regarding the body's relationship to the environment via the air. The second is that his evident success as a natural philosopher may be attributed to his having presented a plausible explanation for this relationship and, perhaps most importantly, for having derived a set of medical measures for preventing diseases. These measures, discussed in the fourth chapter, may be reasonably considered a "program for medical reform."

Pringle's medical contribution may be viewed against the backdrop of a "neo-Hippocratic" focus on the role of the environment, particularly weather and climate, in determining human health, which gathered strength in the seventeenth century. With the invention of new instruments to study the air and weather, and the incorporation of new observation and recording techniques, this became a major area of investigation among British natural philosophers (a category which I take to include university-educated physicians), particularly under the auspices of the Royal Society.

A great deal of secondary work has focused on this movement, which represented a significant outlet for the natural philosophical interests of medical men, as well as the medical interests of philosophers without formal medical education. Broadly conceived, the "neo-Hippocratic" movement could cover a range of inquiries related to the medical implications of the environment, though historians have tended to focus on local characteristics of weather.[76] I would like to stress a particular aspect that I will refer to as the “relationship between air and disease.”

Early Modern British natural philosophers studied air and climate for a variety of reasons. One of the more prominent was a desire to determine the nature and origin of disease-causing effluvia.[77] Pringle’s writing stressed the putrid origin of effluvia, linking it to the climate and environment through a series of causal explanations focusing on the view of a hydrostatic body—relatively susceptible to putrefaction as the fluids and fibres were altered by temperature, pressure, and humidity—and a landscape that produced putrid vapour during certain seasons. Perhaps the most significant characteristic of this theory was that it emphasized the chemical origin and nature of putrid air, both within and without the body.

Pringle considered putrid air to be a primary cause of sickness.[78] His own work was founded on a pre-modern understanding of air as a single complex entity capable of being compressed, heated, mixed with fine particles of other substances, and cleansed of them.[79] Pringle’s success in emphasizing the prevention of disease through understanding putrid air provided a motive for others to further investigate air’s chemical identity. Joseph Priestley, whose experiments initiated a profound change in the understanding of air, initially approached his various “species” of air in terms of their capacity to support life and halt, or reverse, putrefaction.[80] His early efforts make sense in the context of the study of aerial putrefaction and antisepsis raised by Pringle. In

---

[76] Golinski (2007), pp. 140-150.
[77] See p. 74.
[78] Pringle (1753), p. 115.
[79] Crosland (2000), p. 83-86.
[80] Golinski (1992), pp. 105-106.

referring to the relationship between air and disease I therefore mean to include this broader investigation into the chemical nature and origin of aerial effluvia, rather than simply the meteorological approaches most prevalent in the first half of the eighteenth century.

I will use the concept of "putrid disease", to refer to the means by which Pringle attributed common epidemic fevers (typhoid fever, dysentery) as well as several non-epidemic diseases, to a putrid ferment taking hold within the body. This heuristic shorthand does some violence to the subtlety of early modern notions of disease causation in the physician's trade. Pringle's own views regarding disease causation were anything but monolithic.[81] It is, however, clear that Pringle's writing on army medicine was meant to identify and clarify a broadly putrid cause to which bodies were susceptible when subject to institutional confinement in certain environments. Such reasoning is plain enough in several places in the *Observations on the Diseases of the Army*:

> I conceive that the miasma or septic ferment (consisting of the effluvia from putrid substances) received into the blood, has a power of corrupting the whole mass. Its resolution and sometimes even its smell in the advanced state of a malignant fever, the offensiveness of the sweats and other excretions, the livid spots, blotches, and mortifications incident to this distemper, are proofs of what is here advanced.[82]

Other diseases, such as scurvy, might be the result of a slower process of putrefaction, while even the plague could be assigned a putrid cause.[83] When characterising Pringle's *overall* view of epidemic fever as "putrid disease", however, I do not wish to misrepresent the complexity of the historical discourse surrounding the nature and cure of fevers.

---

[81] Pringle (1752), pp. xii-xiii.
[82] Pringle (1752), pp. 354-355.
[83] See p. 95.

Pringle’s claims regarding putrid air are significant because they provided a philosophical basis for his bid for a contribution to the “improvement” of the Army—a concept that I discuss in more detail below. He has been characterized in the secondary literature as supporting “atmospheric improvement” in the several decades over 1750.[84] This interpretation seems reasonable to me as well as useful to an understanding of Pringle’s role in the early Chemical Revolution. I also believe, however, that the antiseptic measures to prevent the spread of putrid vapours that Pringle proposed represent a program founded in the reasoned management of the health of the military by university-educated medical men.

Pringle’s efforts to improve army medicine are evident both the content of his work and subsequent appraisals that followed his death. After explaining the “general causes of the sickness” in his *Observations*, he proceeded “to point out the means of removing some, and rendering others less dangerous.” Without this addition, he claimed, “the former considerations could have been of little use.”[85] His biographer Kippis cited an instance of a general in the Caribbean who saved the lives of seven hundred men through following the measures recommended by Pringle.[86] Félix Vicq-d'Azyr, his eulogist for *the Histoire de Académie Royale des Science,* also cited the importance of his proposed reforms:

> It is not only a work destined to instruct physicians, all men may draw useful lessons from it, and those responsible for administering a country, or governing a large number of men, may come to know the precautions necessary for the

[84] Golinkski (2007), p. 161.
[85] Pringle (1752), p. ix.
[86] Kippis (1783), pp. xxviii-xxix; See p. 217.

> conservation of those entrusted to their care, and inform themselves of the important measures that are one of their primary obligations.[87]

While it is true that the prevention of disease had long been connected to the suppression of foul air—existing practices included quarantine measures and the fumigation of ships using vinegar or sulphur—these efforts took on a special significance in the context of the improving culture of eighteenth-century Britain.

[87] Vicq-d'Azyr (1782), p. 60. "Ce n'est point seulement un Ouvrage destiné à instruire les Médecins, tous les hommes y peuvent puiser des leçons utiles ; & ceux qui sont chargés, ou de l'administration d'un pays, ou de gouverner un grand nombre d'hommes, peuvent y apprendre à connoître les précautions nécessaires pour la conservation de ceux qui leur sont confiés, & s'éclairer sur des soins importans qui sont une de leurs premières obligations."

1.1.3 The Improver and the Project

Throughout this discussion, particularly in the fourth chapter, I have relied on two concepts whose meanings are rooted in the seventeenth and eighteenth centuries, and can, consequently, do useful historical work. The most fundamental of these is the concept of "improvement", a historical term invoked by many historians of eighteenth-century England and Scotland as a defining characteristic of enlightenment—it is common enough to read of improving children's literature, improvements to commerce and industry, or urban improvement commissions, 427 of which were established between 1760 and 1799. [88] The Edinburgh *Medical Essays and Observations*, which we will discuss in detail below, constituted "a Plan calculated… for the Improvement of Physic."[89]

Several Edinburgh physicians, whose work extended to physiological considerations, drew parallels between nervous sensitivity and social refinement. This association implied that sympathy could be cultivated in imitation of the body's own faculties.[90] Pringle likewise bore witness to a generalized tendency towards the improvement of health and living conditions. He noted in his *Observations on the Diseases of the Army* that

> It is remarkable how much less the plague, pestilential fevers, hot scurvies and dysenteries have prevailed in Europe within this last century: a blessing we can

---

[88] Porter (1982), p. 13; Eastwood (2002), pp. 49-50.
[89] A Society in Edinburgh (1737), vol. 1, pp. xi-xii.
[90] Lawrence (1979), pp. 23-36,

> ascribe to no other second cause than to the improvement of everything relating to cleanliness, and to the more general use of antiseptics.[91]

In Pringle's account, less civilised ways of living, such as existed in the Turkish territories, produced many more outbreaks of epidemic disease.[92] Improvement, in this sense, may be considered one of the central features assigned to Enlightenment: "a widespread confidence in the ability of human beings to ameliorate their own conditions of life and to continue to do so for the foreseeable future."[93]

Improvement was a central feature of Enlightenment in both Scotland and England, though it took different forms in both settings. In Scotland, improvement was the prerogative of a Southern aristocratic elite of managers, led, from the early 1720s, by Archibald Campbell, Earl of Ilay, Third Duke of Argyll (1682-1761) who controlled channels of patronage on behalf of the Hanoverians.[94] Improvement was carried out institutionally through changes to the university system, through tariffs and subsidies, and the establishment of the Board of Trustees for Fisheries and Manufacturers (1727), the Royal Bank of Scotland (1727), and the British Linen Company (1746). It was also incubated among sociable philosophers and virtuosi in organizations such as the Honourable Society of Improvers in the Knowledge of Agriculture in Scotland (1723) and the Society for the Improvement of Medical Knowledge (1731).

In England, particularly in London—the largest city in Europe and the centre of British power—improvement was characterised by an emerging public sphere as well as by proximity to the

---

[91] Pringle (1752), p. 350.
[92] See p. 90.
[93] Jordanova (1997), p. 4.
[94] Emerson (2013), pp. 345-360.

most elevated networks of patronage.[95] Schemes proffering technical improvements emerged within a new public commercial space. As Porter said of the English Enlightenment, "The real intelligentsia was not chairbound but worked in a market place." Ideas were a trade and projectors extolled the merits of their schemes before a wide audience that included potential benefactors."[96] Those patrons whose sponsorship was essential to bringing these schemes to fruition were improvers.

In contemporary usage, "the improver" applied most frequently to those who improved their private estates through the application of philosophical knowledge about agriculture, husbandry, and industry. In this age of enclosures, in which traditional common lands were transferred to private landholders through acts of parliament, or in Scotland by agreements registered in courts, one typically improved one's condition by improving one's estate. Johnson's definition of the "improver" tellingly cited John Mortimer (1656?–1736) author of The *Whole Art of Husbandry, in the Way of Managing and Improving of Land* (1707): "Chalk is a great *improver* of most lands." Johnson also provided the broader sense of the "improver" as "One that makes himself or any thing else better."[97] Anchored in the propertied classes, the term evoked agency, credibility, and place. It was closely woven into the culture of British natural philosophy.

Pringle's contribution is usefully understood in view of the imperative to improvement that existed in Edinburgh and London, particularly in the patronage networks prepared to support an effort to improve conditions in the Army. A polite, well-connected scion of propertied Lowland Scots, Pringle's family and social connection guided him to the base of the patronage ladder.

---

[95] Nenadic (2010), pp. 232-233.
[96] Porter (1981), p. 5.
[97] Johnson (1755), vol. 1.

Further advancement required that he make himself useful and credible to his betters—a fact overlooked by historians who have read his career primarily against the intellectual history of medicine and chemistry. His account of military medicine was directed largely at improvements of value to his military superiors, particularly the prevention of disease through an understanding of the nature of contagious fever and its spread, as well as a strategic appreciation of the expected changes in the health of armies according to season and environment.

Chapter 2: Authority and Observation in Enlightenment Medicine

Though clients chose physicians thought to be skillful healers, these skills were believed to reside in a cultivated ability to observe the body and its environment, and to associate observations with a deep understanding of nature and its laws.[1] A grasp of natural philosophy, emphasising domains such as anatomy and physiology, distinguished university-educated physicians and surgeons from other practitioners in the eighteenth century medical marketplace. Among the physicians, it supported claims to effective diagnosis and advice on regulating one's life in order to promote health and longevity.[2]

These epistemic claims rested, to a significant extent, on a store of observation accumulated by colleagues and predecessors. The physician's expertise dovetailed with the self-improving culture of the eighteenth-century British cognoscenti among whom physicians plied their trade. As with the art connoisseur, who flourished in eighteenth-century Britain, the physician, trained in the Hippocratic tradition, cultivated the identity of an antiquarian and a humanist scholar, along with a reputation as a skilled and educated observer of subtle signs and cryptic clues.[3]

Stephen Shapin's argument that "free action" characterised the early modern understanding of power, trust, and the construction of knowledge, can be applied to the physician's domain as readily as to natural philosophy more generally. The free actor was considered to be

---

[1] Porter (1999), pp. 255-258.
[2] Jordanova (1999), p. 3; Cook (1990), pp. 398-399, 418-422.
[3] Brewer (1997), pp. 256-259.

unencumbered by obligations to others. Shapin notes that "Contemporary actors understood the gentleman's qualities, including the guarantees of his truthfulness, to be grounded largely in his placement in social, economic, and biological circumstances."[4]

Physicians formed part of the penumbra of genteel artisans and functionaries serving the elite.[5] They aspired to the status of gentlemen and were frequently skewered by writers, playwrights, and popular artists, for their ambitions.[6] If one wishes to understand them, however, it is worth noticing physicians who were widely considered credible within and beyond their own community. In Pringle's case, education, family connections and personal friendships provided the means to master genteel discourse. Although as a younger son he was obliged to secure his own fortune, this network of support meant that he was a step removed from the men who climbed their way from the surgeon's cabin or apothecary's shop to a university education and into the ranks of a college of physicians.

Pringle's social prominence permitted him to assist the civic improvers of eighteenth-century Scotland—many of them virtuosi—in their efforts to reinvent and reinvigorate the Scottish universities.[7] As we will discuss in the final chapter, Pringle's patronage appointment to a lectureship in moral philosophy gave him a mandate to inculcate both the classical tradition of Stoic civic virtue, and the Baconian methodology devised and promulgated by the Royal Society.[8] As with his university professorship, Pringle's involvement with the Edinburgh medical

---

[4] Shapin (1994), pp. 38-43.
[5] Porter (2001), pp. 139-140.
[6] Porter (2001), pp. 140-144.
[7] Emerson (2013), pp. 233-247.
[8] See p. 208.

community may be viewed in light of the wider effort to reconcile an early modern reading of the classical medical tradition with the new philosophy.

Apologists for the physicians' trade pointed to their cultivation of natural history, an emblem of gentility, requiring wide reading, leisure, and, among the wealthiest, the maintenance of libraries, collections, and gardens. Early modern physicians pursued knowledge of the world's landscapes, climates, and natural medicines while embarking on projects intended to derive empirical knowledge from an appreciation of nature's variety.[9] In Pringle's *Observations*, this involved a systematic attempt to observe the climate and landscape, and, in doing so, to discover the ways in which these various circumstances affected the body. In his experiments and his work with the Edinburgh pharmacopeia, this was based on an extensive knowledge of natural materials and their properties, as well as the existing cannon on pharmacology and the natural history of plants.

In the view of the early modern physicians, medicine's foundation in informed observation reached back to the Classical Greeks—particularly to the semi-legendary scholar Hippocrates whom the early moderns considered "the first great Improver of Medicine by Observation…"[10] As Gianna Pomata has demonstrated, however, the Latin noun "observatio" emerged from among a cluster of related synonyms only in the latter half of the16th century, while its widespread use within European philosophical culture was a product of the 17th. Over this period, the practice of gathering and sharing medical observations became established among

---

[9] Cook (1990), p. 414.
[10] A Society in Edinburgh (1737), vol. 1, p. vii.

physicians as a means to distinguish knowledge founded in accumulated experience from unwarranted theorising.[11]

John Pringle's career (and, no doubt, the careers of many of his peers) can be read as a bid to cast a reputation in this neo-Hippocratic mold. His *Observations* embraced this recent epistemic genre that had "incubated" within early modern medicine before being taken up by Baconian natural philosophy as a means to communicate personal observations of natural phenomena.[12] His published accounts, and his unpublished notebooks and letters, reflect the formative influence of a medical community for whom the sharing of observation was a central endeavour.

In 1748, the Scottish-born physician John Rutherford (1695-1779) prefaced a series of "clinical Lectures", delivered before the Royal Infirmary at Edinburgh, with a short dissertation on the differences between the "Diagnostical or Reasoning" physician and the quack. To Rutherford, the physician's legitimacy lay in his ability to observe the body and its environment based on education and experience, and to apply this knowledge to therapy. The quack, unable to understand the progress of disease and its varied causes, promised "an Infallible Medicine to cure each disease."[13]

Over the eighteenth century, Scottish medical men collectively explored new forms of observation for use in medical communication and pedagogy.[14] The English medical colleges at Oxford and Cambridge ignored clinical teaching over the first half of the century. In London,

---

[11] Pomata (2011), pp. 60-63.

[12] Pomata (2011), p. 63.

[13] Collection of Adam Austin, 1753-1765, AUA pp. 16-17, Royal College of Physicians of Edinburgh Sibbald Library. The lecture survives as part of a diverse manuscript volume at the RCPE. This is attributed to the Edinburgh surgeon turned physician Adam Austin (1738-1773). It was presumably transcribed during Austin's studies to obtain his physician's license.

[14] Porter, (2001), pp. 130-131.

practical experience was obtained through extramural lectures and in hospitals unaffiliated with the Universities.[15] Edinburgh and Glasgow, by contrast, cultivated clinical teaching in emulation of Leiden University, the model of medical education for reformers of the Scottish university system.[16]

The Edinburgh Infirmary was founded in 1729, in large part to permit the gathering of clinical observation by the Edinburgh medical community.[17] Over this period, physicians, surgeons, and other natural philosophers began to develop and adapt new methods of observation in areas such as meteorology and political arithmetic. In following Pringle, we see the Edinburgh community from which he emerged acquire newly-devised meteorological equipment in order to answer ancient Hippocratic questions about the relation between air, atmosphere, and health. Pringle subsequently took up this problem in his own work, founding it partly in a neo-Hippocratic understanding of the air.

The physician's renewed emphasis on observing nature (natural history) in accordance with new models of natural philosophy tended to raise the possibility of achieving cures via experience. This resulted in a fundamental tension within the discipline.[18] The quacks decried by Rutherford might well point to the sanction of public science in defending their empirically-verified cures. Such had been the case, for instance, in the mid-17th century when the Society of Chemical Physicians, whose members championed empirically-derived chemical medicines and eschewed

---

[15] Broman (2003), p. 465.

[16] Golinski (1992), p. 52.

[17] Emerson (1979), p. 157. Although Pringle was principally involved with physicians, the medical community in Edinburgh contained roughly equal numbers of physicians and surgeons; many, including Alexander Monro and George Young, trained as surgeon apothecaries, and their training included chemistry.

[18] Cook (1990), pp. 397-400.

university-based medical education, had launched an unsuccessful bid to end the privileges of the Royal College of Physicians of London.[19]

This tension may be assigned to a distinction between the relative importance of *medicine*, that is, effective cures, and *physic*, the physician's use of a philosophical knowledge of body and environment to maintain health through regimen. Rutherford contrasted the "Infallible Medicine to cure each disease" of the medical charlatan with the philosophical reasoning of the physician. The empiric, witnessing a few recoveries but lacking the knowledge and experience to interpret observations, erroneously concluded that he had discovered a universal cure.[20]

As we shall see in the following chapter Pringle cultivated an expertise in medicine, particularly pharmacy, and worked to enforce the physicians' eminence in this area by revising the official pharmacopoeia—the list of legally sanctioned medicines whose maintenance was the purview of the physicians. This expertise was on display throughout his work on army medicine, and particularly in his experiments which, though written as accessible reports according to the Society's convention, relied heavily on a physician's familiarity with pharmaceutical substances and the prevailing consensus about effects.

Pringle's work was, at the same time, an effort to interpose the physician, a medical manager whose authority lay in an understanding of natural philosophy, between the military officer and the men under his jurisdiction. In the preface to his *Observations on the Diseases of the Army*, he argued:

---

[19] French (2003), p. 191.
[20] Cunningham (1981), p. 86.

> It is easy to conceive, that the prevention of diseases cannot consist in the use of medicine, or depend upon any thing that a soldier shall have in his power to neglect; but upon such orders as shall either appear reasonable to him, or what he must necessarily obey.[21]

This was a clear recognition of the priority of physic over medicine, and of the physician's authority as a natural philosopher which lay at the core of the Hippocratic tradition. Pringle's medical claims were thus founded in his identity as a reliable, that is suitably trained, observer of the environment and the body.

The first part of this exploration of eighteenth-century medical observation focuses on two texts: Pringle's *Medical Annotations* and the *Medical Essays and Observations* published by the Society for Improving Medical Knowledge, better known as the Edinburgh Medical Society.[22] Perhaps the greatest testimony to the importance of observation to Pringle's identity as a physician is his *Medical Annotations*—a text in the early modern medical tradition of *observationes*.[23] This ten-volume medical commonplace book was meant as a gift to the Royal College of Physicians of Edinburgh. It provides an important view into the relationship between a medical community and one of its more eminent members, illustrating the association between medical authority and observational credibility.

If Pringle's *Medical Annotations* signifies an individual contribution to a community of observers, the *Medical Essays and Observations*, an early product of the Edinburgh medical community, represents its collective effort at gathering and promulgating observational information in all areas of knowledge deemed relevant to medical practice, from pharmacy to

---

[21] Pringle (1752), p. ix.
[22] Emerson (1979), pp. 157-158.
[23] Pomata (2011), pp. 59-64.

anatomy and pathology based on autopsies. It demonstrates the central place of observation in the shared identity of a particularly vital eighteenth-century medical community as a key form of epistemic communication. It also provides a basis for understanding observation of the air and climate as a point of intersection between physicians and the emerging culture of Baconian natural philosophy.

One very prominent example of the space shared by physicians and other natural philosophers not trained in medicine was the investigation of the air and climate in the pursuit of factors that might be seen to affect human health. This may be seen as part of a “neo Hippocratic” movement that investigated the environment using recently-devised technologies and methods. The Edinburgh medical community was led by students of the celebrated Leiden medical teacher Hermann Boerhaave, who like many others, held Hippocrates as an epitome of empirical skill.[24] Boerhaave’s desire to promote sharing of observations among physicians was reflected in the effort by the Edinburgh physicians and other medical men to gather meteorological data for the purpose of uncovering the laws that determine the association between air and disease.

Pringle’s work also may be understood, in part, as a contribution to this ongoing search. His focus on the army was not merely the result of circumstance. It defined a new observational framework that supported his claims concerning the relationship between putrid air and the body. Moreover, his status as Physician General permitted him to systematically observe, both personally and through trustworthy subordinates, the diseases that occurred over several years of campaigning. The result was a hybrid work—both a guide to the diseases of the army, and an overall interpretation of epidemic disease.

---

[24] Boerhaave (1983), pp. 72-73; Casteel (2007), p. 2; Rusnock (2002a), p. 138.

2.1 Observation and medical community

Shortly before his death in 1782, John Pringle presented ten leather-bound folio volumes to the Royal College of Physicians of Edinburgh (RCPE). This work may be considered a particularly large medical commonplace book—its contents accessible only through an index appended to each volume. 259 identifiable topics snake their way through the various volumes, beginning and ending according to no clear pattern except circumstances known only to the compiler. The *Medical Annotations* is encyclopedic in scope, the subjects limited only by some relevance to medicine. These range from "Theories and experiments upon the brain" to "The formation and growth of bones" to "Manner of living of the Bedouins or Wandering Arabs."

This text was meant only for Scottish physicians belonging to the RCPE. Thousands of pages of transcribed case histories in several hands (Pringle, wealthy and unwell, likely paid others to transcribe his notes) were interspersed with newspaper clippings and numerous private letters pasted directly into the text. In fact Pringle, who had energetically defended his few publications, requested

> the college to enter an article in their minute book of journal that they will not publish the whole or any part thereof or suffer the whole or any part thereof to go out of the library but allow them to be perused by those who are entitled to the use of their other manuscripts…[25]

[25] Kippis (1783), pp. lxii-lxiii.

There were, no doubt, several reasons for this stipulation. One may have been professional decorum. The text contained medical information on public figures, including the autopsy report of Douglas James, fourteenth earl of Morton (1702-1768).[26] It is also likely that, much as he destroyed his private correspondence, Pringle wished to manage his reputation by supressing his unedited writing.

Pringle's *Medical Annotations* was the product of a lifetime spent observing illness, both firsthand, and through collecting anecdotes from medical texts, learned colleagues, and other reliable witnesses. The bulk of this material consisted of case studies, autopsy reports, or parts of case studies, chosen to suit a particular topic. It contained a great number of excerpted letters from Pringle's personal correspondence. In places whole letters or other documents were pasted into the bound pages. This was, in other words, an inventory of experience accessible only to those physicians whose university education provided the necessary framework to extract meaning from its observational context.

In his lecture to the Royal Infirmary at Edinburgh contrasting physicians with quacks, John Rutherford maintained that the physician's own experience, supplemented by the accounts of reliable elders and peers, supplied the only reasonable basis for diagnosis and treatment:

> To compleat his Education he ought to have an Opportunity of seeing the same Disease in different Patients, that he may see whether the Rules he has in Theory will hold good in Practice, that so he may believe nothing but what he finds confirmed by and established upon facts, and as nothing will fit him better for Practice than to see the Prescriptions of older Physicians and what Effects they

[26] Pringle (c. 1765- c.1779), vol. 1, pp. 154-156.

> produce, and as example is stronger than Precepts, what he learns this way, he may properly call his own.. [27]

Pringle's *Medical Annotations* provided such observational examples, indexed and expertly selected, from which younger physicians could develop their diagnoses and publish their own treatises.

In this sense, Pringle's *Medical Annotations* would have been considered a contribution to the Edinburgh community of physicians that had helped him to found a lucrative London career. His rise to prominence within the London medical and natural philosophical communities testified to his skill in judgement and observation. Maintaining ties to his home community, for instance through his contributions to the *Edinburgh Pharmacopoeia*, he would have been among the top ranks of the Scottish medical men to establish themselves among the English.[28]

Local arrangements between practitioners, institutional circumstances, and customs, tended to dictate which therapies were available and who could administer them. No doubt Pringle had established closer ties to his fellow physicians in Edinburgh than he would in London. Moreover, the various communities of medical men focused on localized efforts aimed at accumulating observational evidence relevant to the local circumstances. The accumulation of local knowledge is especially evident in the *Medical Essays and Observations,* discussed below, in which the Edinburgh medical community explored local factors that contributed to prevailing diseases.

Pringle's ties to Edinburgh are evident throughout his *Medical Annotations*. For example, the papers of Dr. John Clerk (1689 - 1757), physician to the Edinburgh Infirmary who had advised

---

[27] Rutherford (1749), p. 18.

[28] See p. 110 for Pringle's pharmaceutical work.

Pringle when he first entered the Army, were cited throughout the *Medical Annotations*.[29] Clerk's papers were "written, at least finished, late in his life after a long and successful practice" and were given to Pringle by his son, Dr. David Clerk, as a present after his death. Similarly, the long entry on "Worms" opened with the testimony and opinions of Dr. George Young (1691-1757). Young had been an Edinburgh surgeon and MD. He was a frequent correspondent during Pringle's early career. In 1742, he had given Pringle his "M. D. notes" in what was an act of professional kindness not unlike Pringle's own gift of his Medical Annotations to the RCPE.[30]

Pringle's donation returned the observations of Clerk and Young to the community in which they had been made. The gesture, like the republication of medical lectures and notes of deceased figures, was a means of contributing to the medical identity of the local community. Two publications emerged from the work of local experts on chemistry and botany who taught the *materia medica*. *The Works of Robert Whytt, MD... Published by his Son* (1768), and Charles Alston's (1685-1760) *Lectures on the Materia Medica* (1770), published by John Hope, were dedicated to Pringle during the period of his ascendance in London—further indication of his status as an exemplary member and patron to the community.

Anecdotes, even whole letters, from Pringle's correspondence with highly-placed physicians at the courts and universities of Europe, included within the *Medical Annotations,* would have held particular value to later readers. Such correspondence provided a means for the medical elite to perpetuate their medical reputations by soliciting the best medical opinion available in service of their wealthy clients. In many cases these inclusions took the form of excerpts from his private

---

[29] Gordon (1985), p. 44.
[30] Pringle (c. 1765- c.1779), vol. 1, pp. 238-242.

correspondence, for instance, with the Swiss physician and naturalist Albrecht von Haller (1708-1777), a noted university lecturer and prolific author, or Gerard van Swieten (1700-1772), the personal physician to the Austrian Empress Maria Teresa whom Pringle had known since his student years at Leiden.

The long article on worms, for example, included a great deal of information about a case involving a nobleman of some stature who retained Pringle in 1760 after 15 years of consultations with other physicians had failed to relieve him of an unbearable itching in his "fundament."[31] In the process of resolving this difficult case, Pringle corresponded with Gerard van Swieten, Nils Rosén von Rosenstein, a medical professor at Uppsala and physician to the king of Sweden, Giovanni Battista Morgagni, a medical professor at Padua, and Johann Friedrich von Herrenschwand, physician to the King of Poland. Many of the resulting letters were pasted directly into the volumes of the *Medical Annotations*. During a period in which social status remained closely coupled to epistemological credibility, these letters and excerpts permitted Pringle to share prestigious opinion and anecdote with the Edinburgh community.[32]

The value of an observation was not, however, simply a function of the observer's status. The entry on worms included an anecdote provided by Lord John Berkeley, 5th Baron Berkeley of Stratton (1697-1773), a prominent politician who had suffered from worms for three or four years and was finally cured through a recipe given to him by his housekeeper which Pringle recorded verbatim in the text.[33] As in the case of major philosophical endeavours such as the

---

[31] Gordon (1985), p. 119. Gordon claims that internal evidence suggests the patient "may have been a member of the Earl of Bute's family or a member of the court. What this internal evidence might be isn't clear.

[32] Biagioli (1993), p. 16; Gordon (1985, pp. 99-142.

[33] Pringle (c. 1765- c.1779), vol. 6, p. 107.

Royal Society's History of Trades project, an early and abortive attempt to systematically study British industry, evidence from those beyond the philosophical community was valued, and even sought after, provided that it was sifted by gentlemen.[34]

Just as his education and philosophical reputation permitted Pringle an elite correspondence, his status within the Army meant that he could oblige others to gather observations on his behalf. This is evident throughout the *Observations on the Diseases of the Army*, which relied, in part, on reports from surgeons and officers. For instance, Pringle cited ten dissections of victims of hospital fever that he either assisted at, or which he "had the relation from those I could rely on."[35] The same is true of the *Medical Annotations*, which contains numerous reports from army physicians and surgeons deployed across the British Empire. These reports, which Pringle received after he had retired from army service, related mainly to his interest in diseases encountered in army hospitals as well as the prevention and cure of scurvy.

One notable example is that of Richard Huck (1720-1785, after 1777, Richard Saunders) who met Pringle while a regimental surgeon on campaign in Scotland during the Jacobite rebellion of 1745. Afterward he obtained his MD in Aberdeen and attended lectures in Edinburgh before serving as a military physician and surgeon in various locations in America until 1762. Throughout this period he sent Pringle detailed reports on conditions in the army hospitals there. In 1763 he began a tour of civilian hospitals in Europe instigated (and probably financed) by Pringle. Settling in London, he likely became a partner in Pringle's practice as well as a life-long friend. As a result of this relationship, Huck is the most cited source in Pringle's *Medical*

---

[34] Ochs (1985), pp. 129-135.
[35] Pringle (1750), p. 26.

Annotations. Huck also helped him compile his *Annotations* and *Book of Formulae,* an alphabetized list of medicines that was edited like the Annotations and cross referenced to it.[36]

For well-heeled officers and medical staff, army and navy service afforded an opportunity to travel and to forge sociable connections that often transcended political boundaries. Pringle established a long-lasting correspondence with Jean-Baptiste de Senac (1693-1770), his counterpart in the French Army during the war of the Austrian Succession, included his observations on dysentery in a later edition of his *Observations on the Diseases of the Army,* and had him elected to the Royal College of Physicians of London.[37] While living at Breda near the campaign's general hospital in Osterhout during the same war, he became acquainted with the family of the young Jan Ingenhousz (b. 1730) who later became a prominent physician and aerial chemist under Pringle's patronage.[38]

Pringle's personal efforts at medical observation were broadly related to those of the Edinburgh medical community for whom the gathering and assimilation of observations formed a key aspect of its identity and purpose. One example was the development of the pharmacopoeia, a document listing the permitted ingredients and preparations in use across the licensed medical trades within a particular medical jurisdiction. It represented, in theory, the common judgement and accumulated wisdom of the physicians. The pharmacopoeia was a notable effort to reach consensus on therapy in order to avoid differences of opinion that might damage the integrity of the College.

---

[36] Gordon (1985) pp. 60-61.The manuscript and edited versions of the *Book of Formulae* are listed under PRJ/2 at the RCPE Sibbald Library.

[37] Gordon (1985), pp. 127-128.

[38] Gordon (1985), p. 116.

Pringle was closely involved in the Pharmaceutical Committee of the Royal College of Physicians of Edinburgh. While in London, Pringle would take on an ever greater role in developing the *Edinburgh pharmacopoeia*. He contributed substantially to the 5th edition which appeared in 1756 and was largely responsible for the much-delayed 6th edition published in 1774. That year he commented that the new edition was "…perhaps as good as can be made in this Age by a Body where every individual has a title to propose things to be done in his way."[39]

As Physician General to the British Army in the Low Countries, Pringle also developed a dispensary to guide the supply and provision of medicine on campaign. In the process, he sought the advice of Dr. John Clerk, who was President of the RCPE (1740-44) and therefore in charge of the revisions to the fourth edition of the *Edinburgh Pharmacopoeia*.[40] This correspondence, some of which survives in Pringle's *Medical Annotations*, provides a glimpse into the balance of personal experience and established opinion through which medicines were assigned value. A letter from Clerk, which Pringle received in 1743 while on campaign in Germany, reads in part:

> Most of the modern authors reckon the great specific Ipecacuanha [which] is still given though it has lost most of its reputation. The reason for which, I take to be, that it is given in too small a dose. For in the ordinary one it needs the stimulus of tartar emetic which people are afraid of in that disease, but, in my opinion, without reason.
>
> I told you in my former remarks that I found the Vitrum antimonii ceratum an excellent anti-dysenteric, given in such a dose as to vomit briefly and at the same time work downward. From the few trials I have made I think it more effectual than any other emetic in that disease.[41]

---

[39] Gordon (1989), p. 11. Sonntag (1999), pp. 332-333.

[40] Gordon (1989), p. 7.

[41] Pringle (c. 1765- c.1779), vol. 1, pp 1-2; Gordon, (1985), p. 2. See p. 113 for further discussion on Vitrum antimonii ceratum.

Pringle's connections again served the collective process of evidence gathering. One finds him, for instance, pumping his correspondent Haller for his observations regarding various simple (i.e. uncompounded) medicines.

> I was likewise obliged to you for your medical hints; and of all things I beg you would continue to impart to me your observations on the effects of simple medicines: only I could wish you would be more particular as to the doses & times of giving them. I have not much experience of the fixed alkaline salts by themselves, tho' from my experiments, I find we may use them with great freedom, as having no septic quality, and from observing what large quantities are taken in soap, without showing any great degree of acrimony.[42]

Pringle's correspondence from London to the RCPE President, who was head of the Edinburgh pharmaceutical committee, survives in the RCPE archive. This made frequent reference to the opinions of physicians such as Linnaeus and Professor Rosen, while demonstrating his familiarity with the pharmacopoeias of various other European centres.[43]

Alongside existing collaborative efforts such as the pharmacopoeia, a new project emerged in the first half of the eighteenth century. The Society for the Improvement of Medical Knowledge (commonly referred to by historians as the Edinburgh Medical Society) was founded in 1731. Its main purpose was to publish a set of "medical essays and observations" in emulation of the *Philosophical Transactions* of the Royal Society as well as other European journals.[44] The establishment of the Edinburgh Infirmary in 1729 created an institutional setting for observing illness. The Infirmary also provided an opportunity and rationale for launching the journal. The *Medical Essays and Observations* appeared in five volumes (the fifth having two parts) between

---

[42] Sonntag (1999), p. 70.

[43] John Pringle to John Boswell, 8 November 1771, Collection of Sir John Pringle, PRJ/2. Sibbald Library, Royal College of Physicians of Edinburgh.

[44] A Society in Edinburgh (1737), vol. 1, p. ix.

1733 and 1744. They were evidently well-regarded with later volumes distributed by booksellers in Edinburgh, London , Dublin, Newcastle, Glasgow, Amsterdam, and Paris.

Like the journal of the Royal Society (to whom the effort was dedicated), the *Medical Essays* were intended to gather and disseminate reliable observations about nature in the belief that they formed the basis for deriving generalized knowledge in the form of "certain axioms." This ongoing process would inevitably contribute to a progressive and incremental amelioration of knowledge.[45] This was both a reassertion of medicine's currency in relation to other forms of natural philosophy as well as an attempt to promulgate recently-developed standards of reportage within the medical community.

These essays and observations were seen to "Promote the principal Part of Medicine, the Knowledge and Cure of Diseases, which chiefly depend on Observations of Facts that ought to be frequently repeated before any certain Axiom in Physick can be built on them:…" The reasoning behind the *Medical Essays* involved the same empirical scheme as would motivate Pringle's *Medical Annotations* almost fifty years later. The first volume's preface cited:

> .. a Necessity, not only to study and improve the Observations of those who went before us, but for the Physicians of every Age to collect others of their own Use, and the Advantage of their Successors; since very often they cannot be assisted by any older Writer..[46]

As texts, these compiled and edited observations were to be assigned a particular role within the medical literature. The volumes consisted largely of observations. These were typically case histories, though essays and observations on any of eight topics ranging from chemical

---

[45] A Society in Edinburgh (1737), vol. 1, p. vi-vii.
[46] A Society in Edinburgh (1737), vol. 1, p. vii.

experiments to anatomy were permitted.[47] Brevity would reduce the tendency to speculate, and serve as an encouragement to those "having neither Time nor Inclination to compose a Sizeable Treatise, who would communicate necessary and beneficial Observations to the World, if they had a proper Opportunity to do it in a Sheet or two."

Short, polished contributions provided "but a little field to cultivate" permitting authors to "treat the subject with much more Exactness, than when he lies under the Necessity of writing up to the size of the book... "[48] This synthesis of many minds would combine virtuous qualities "not so frequently to be found all conjoined in one Person", while avoiding the pitfalls of "vanity" and "interest" to which the author of a single treatise might be subject.[49]

Critically, the introductory volume presented detailed criteria that defined what reliable observation entailed. These were modeled on the established conventions regarding the gathering of observations premised on a distinction between observation and its theoretical interpretation.[50] The editors encouraged the "observations of facts" as the key to the insight into disease.[51]

> Histories will only be a clear and succinct Narrative of Facts, in which the Patient's Age, Sex, Constitution, former Way of Life, Diseases to which they have been subject, or any other Circumstances which serve to explain the present Case, are to be remarked. Of any manifest Cause of a disease has been known, it is to be mentioned. All the Symptoms, with the State of the Pulse, Appetite, Thirst, Sweat, Urine, Faeces, &c. are to be set down; and the Sequel is to be an exact Account of the Symptoms, Medicine prescribed, their evident Effects, and of the Event, whether into Health, some other Disease, or Death. If the Patient died, and a Dissection was allowed, the Parts preternaturally affected in their Situation, Texture, &c. are to be described.

---

[47] A Society in Edinburgh (1737), vol. 1, p. xv.
[48] A Society in Edinburgh (1737), vol. 1, pp. xviii-xiv.
[49] A Society in Edinburgh (1737), vol. 1, p. ix.
[50] Pomata (2011), p. 63.
[51] A Society in Edinburgh (1737), vol. 1, pp. vii-viii.

Codifying standards for observational reportage would have served much the same purpose among the medical sciences as it had among the broader spectrum of philosophical knowledge covered by the *Philosophical Transactions*—the dissemination of a conventional "literary technology" that permitted the effective virtual witnessing of an event. This was a step towards opening medical claims to the broader scrutiny of the natural philosophical community. Such standards were embodied, for instance, within Pringle's Copley medal-winning *Observations on the Diseases of the Army*.

Like the *Philosophical Transactions*, which sought at once to establish its London community as arbiters of knowledge, as well as to foster ties to competent savants in the provinces, the *Medical Essays* was an exercise in building community. Guidelines were provided for mediating between observers of similar status, encouraging those who had worked on the same case to respect each other's opinions. Contributors were given the opportunity to report anonymously on failures and mistakes. It also assisted the process of gathering evidence relating to the efficacy of pharmaceuticals—among eight subjects listed as suitable for publication were "Simple Drugs", that is uncompounded ingredients, "Compound Galenical Medicine", and "Chemical Operations and Experiments."[52]

The effort that produced the *Medical Essays* was led by the surgeon Alexander Monro, who had attended the lectures of the anatomist and man-midwife Dr. William Hunter (1718-1783) in London before studying at the Universities of Leiden, and Paris.[53] Monro contributed a great deal of material, and seems generally to have done much of the work, particularly after the

---

[52] A Society in Edinburgh (1737), vol. 1, p. xv.
[53] Wright-St. Clair (1964), p. 72.

publication of the first volume in 1732.[54] In receiving the Chair of Anatomy at Edinburgh in 1720, Monro had enjoyed the support of his powerful father, John Monro (c. 1670-1740), who had studied under the Herman Boerhaave, and who played an important (though often overstated) role in founding the medical faculty at Edinburgh University.[55] Alexander rented the house in which the Edinburgh Infirmary was first established. The effort provided an outlet for charity, the opportunity for clinical observations for medical students, and an opportunity to observe the illnesses characteristic of Edinburgh.[56]

Contributors to the *Medical Essays* came from a range of medical occupations. Those who identified themselves consisted of thirty-four physicians, twenty-eight surgeons, and several surgeon-apothecaries. They were mostly from Scotland and Northern England, though several contributed from London and across the empire. It was evidently a community based around the Scottish medical universities whose southern frontier was bounded, to a large extent, by an English Oxbridge monopoly. This community supplied the journal with more submissions than could be printed.[57]

In the interests of sociability and international prominence, the editors of the *Medical Annotations* did solicit contributions from abroad, though they were disappointed by the lack of response. In any case, the work was published in English rather than Latin. The desire for foreign input was also somewhat at odds with the local character of the project dictated by fundamental

---

[54] Emerson (1979), p. 158.
[55] Emerson (2004), pp. 194-200.
[56] Emerson (1979), p. 157.
[57] Emerson (1979), p. 157.

Hippocratic assumptions regarding the treatment of disease. As the editors noted early in the preface,

> … we [the British] have been favoured with very few medical Observations of our own; and on the other hand, our Climate, Way of Living, and other Circumstances, which ought to be greatly regarded in the Cure of Disease, are very different from most inhabitants of the Continent; to which may be added, that every Nation has its own prevailing Mode of prescribing.[58]

The identity of the Edinburgh medical community was, in this sense, delimited by the characteristics of place. The ancient Hippocratic text “On Airs, Waters, and Places”, describing the physical attributes of a place that influenced the health of its inhabitants, had distinguished between characteristics “common to all countries” and those “peculiar to each locality.” In doing so, it identified particular factors such as prevailing winds and climate, local bodies of water, foods and dietary habits, and other local circumstances, that a skilled physician must understand in order to take up practice in a particular community. When the first volume of the *Edinburgh Essays and Observations* appeared in 1733, it included as its first article a “Description of Edinburgh”, a brief overview of the situation, diet, topography (relating especially to damp, low lying areas and exposure to prevailing winds), local bodies of water, architecture—any circumstance that might influence the health of local residents.[59] Its purpose was to provide “particulars” which could, in the opinion of the authors, “influence the State of the Air, or occasion Diseases.”[60]

---

[58] A Society in Edinburgh (1737), vol, 1, pp .viii.
[59] A Society in Edinburgh (1737), vol, 1, pp. 1-7.
[60] A Society in Edinburgh (1737), vol. 1, p. xxii.

This Hippocratic perspective also provided a conceptual basis for several new forms of investigation being explored by the Edinburgh medical community. The investigation of the local air and environment represented a key point of intersection between university medicine and the culture of natural philosophy—a "Hippocratic-Baconian methodology" that attracted considerable attention over the seventeenth and eighteenth centuries.[61] Though long-established, the association between medicine's legendary founding figure and the methodology of the natural philosophers had been memorably articulated by Hermann Boerhaave.

[61] Rusnock (2002a), p. 138.

2.2 Hippocratic Thinking in Enlightenment Medicine

Pringle's admission as a fellow of the RCPE on Feb 4th 1734 followed a standard exam during which he was assigned two tasks: explain two medical cases given him by two members of the college, and explain two Hippocratic aphorisms to the satisfaction of the examiners. While the interpretation of Hippocratic writings continued to change substantially through time, the test of medical learning demonstrates the continued emphasis on the Hippocratic tradition within the early modern physician's practice, as well as the necessity for training in classical languages.

The classical humoral model of the body had been superseded by Pringle's day at the level of theory. Nevertheless, views regarding several fundamental characteristics of the body's internal economy remained essentially unchanged since the classical origins of Western medicine. While the early modern body had become, for most physicians of the late seventeenth and early eighteenth centuries, a hydraulic machine, it remained, like its classical ancestor, governed by fluid flows (over abundant or lacking), and fibres (tense or slack) which felt the tidal influences of weather and season.[62] This foundation in classical natural philosophy permitted the physician to regulate, and even cure, the body through managing traditional Galenic non-naturals of air and environment, food and drink, sleep and wakefulness, motion and rest, and the passions.[63]

As a result, certain characteristics acquired by Hippocratic medicine during the seventeenth and eighteenth centuries would have been unfamiliar to earlier generations. Some medical historians

---

[62] Bates (1981), p. 51; Broman (2003), p. 477.

[63] Cook (1990), pp. 410-411; García-Ballester (1993), pp. 105-115 . For a detailed explication of the origin of the "six non-natural things" in Galen's writing and their subsequent elaboration in Arabic and medieval European Galenism.

refer to a “neo-Hippocratic movement”, or a “Hippocratic-Baconian methodology”, to describe efforts to verify the longstanding Hippocratic emphasis on the role of the environment (particularly the air) using the tools emerging from Baconian public science.[64] Others have referred to the same phenomena using terms including “iatro-meteorology” (“Iatro” being a Greek prefix meaning healer, medicine, or healing), historico-geographical pathology, environmental medicine, or simply environmentalism.[65]

Aspects of the Hippocratic corpus emphasizing the importance of the environment to human health appear to have received particular attention in the seventeenth and eighteenth centuries. *On the Nature of Man* differentiated between diseases arising from the air, which affected large groups, and diseases arising from improper diet, which affected individuals.[66] *Airs, Waters, Places* and *Epidemics I* and *III* became the subject of particular interest because they emphasized the role of the environment in explaining individual cases of illness and outbreaks of fever.[67] Such books formed a small subset of a larger Hippocratic corpus whose overall meaning was far from self-evident. By the Renaissance, when the various works attributed to the legendary figure had been recompiled and disseminated in the Latin West, it became possible to access Greek texts belonging to the Hippocratic corpus and to enlist new Humanist interpretations of an “authentic” Hippocrates in support of various medical agendas.[68]

Over the early modern period, the founder of philosophical medicine remained the ultimate source of authenticity in a culture of feuding medical factions. For instance, Petrus Severinus

---

[64] Rusnock (2002a), p. 138.
[65] Riley (1987), pp. xv-xvi; Porter (1999), p. 46.
[66] Shackelford (2002), pp. 72-73.
[67] Rusnock (2002), p. 137.
[68] Shackelford (2002), 59-60.

(1542-1602), among the first generation of Paracelsus's followers, wrote the *De Concordia Hippocratiorum et Paracelsistarum* (1569) indicating consistencies between the Hippocratic and Paracelsian views of the body.[69] Severinus found *On the Nature of Man* to accord with the medical implications of Paracelsian matter theory. Few licensed physicians of the eighteenth century, who tended to venerate Hippocrates as a model of empiricism while denigrating Paracelsian theory, would have accepted this association. Nevertheless, no absolute consensus emerged on what meaning to give the corpus. A Hippocratic revival at Montpellier, which began in the late seventeenth century, led the vitalist Théophile de Bordeu (1722-1776) to cite Paracelsus in his attacks on proponents of mechanism, particularly the followers of Hermann Boerhaave.[70]

Boerhaave, the celebrated Sage of Leiden, had acquired a reputation as Europe's leading medical scholar during the first half of the eighteenth century. When Pringle travelled to Leiden in 1727 after a year at Edinburgh, it was to hear Boerhaave's lectures. He arrived towards the end of Boerhaave's 37-year tenure there, joining 1900 other students who would matriculate from the Leiden Medical faculty during Boerhaave's time there. The majority of his Scottish medical peers would be Boerhaave alumni—a Europe-wide medical fraternity, including all six of the teachers in the new medical faculty at Edinburgh, with which Pringle remained engaged throughout his life.[71] New medical centres in Vienna, Göttingen, Edinburgh, and Philadelphia,

---

[69] Shackelford (2002), 61-64.

[70] Williams (2002), pp. 160-170.

[71] Casteel (2007), pp. 45-46. These included Alexander Monro, the motive force behind the Edinburgh *Medical Essays*, and one of Pringle's teachers during his brief period at Edinburgh.

were all founded in Pringle's day on the successful (and lucrative) "Leiden model" developed by Boerhaave.[72]

Boerhaave's appeal was, in part, as an articulate propagandist for a medical methodology founded on the judicious application of experimental and observational knowledge.[73] Though recent scholarship has emphasised the value of his unpublished papers, his public appeal is well represented by eight public orations, widely disseminated and reprinted, that were delivered before an audience of students and faculty at various points over his teaching career.[74] They show the evident skill with which he recast the figure of Hippocrates as the discipline's founding Baconian, a precursor to Boyle and Newton, the most recent renovators of medicine.[75]

Boerhaave's efforts to frame Hippocrates as a model of empirical rigour lay at the foundation of his influential medical vision. His inaugural address on being appointed lecturer on the institutes of medicine at the University of Leiden in 1701 was entitled *De commendando studio Hippocratico*, "Oration to Recommend the Study of Hippocrates." In it, he invited the assembled students and faculty to contrast recent thinkers with medicine's founding Baconian.

> We should consult our memory and try to recall among so many thousands of authors but a single one who is both original in his argument and always keeps within the bounds of inviolable and unfettered truth. Only that Founder of our science excels in this admirable purity; only he is unshackled. He never obscures the course of a disease, nor does he spoil the native hue of health, by dubious fantasies about the four elements or about the four primary qualities which are supposed to have originated from the former.[76]

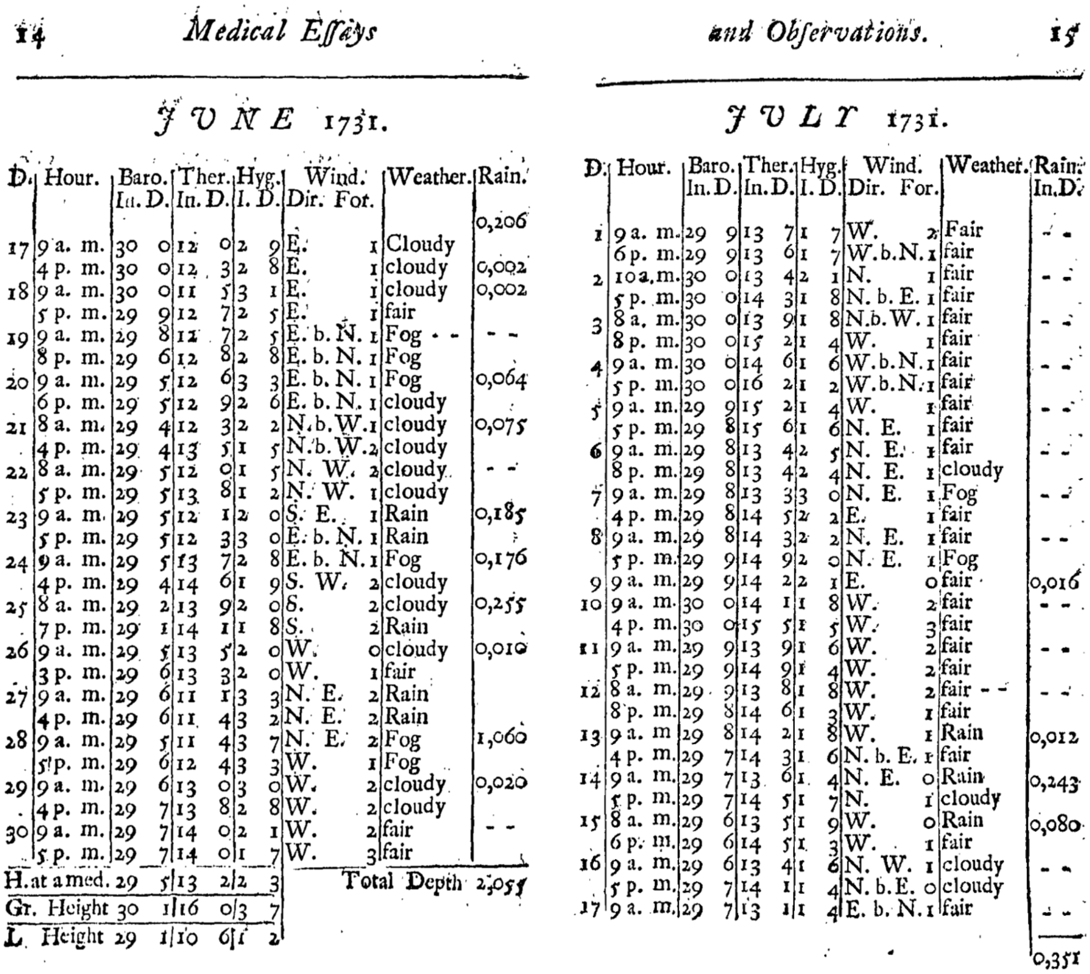
[72] Powers (2012), p. 2.
[73] Powers (2012), p. 7.
[74] Boerhaave (1983), p. 13-14.
[75] Powers (2012), pp. 101-103.
[76] Boerhaave (1983), p. 69.

Above all, this eighteenth-century instantiation of "Hippocrates the skillful observer" ought to be understood against the backdrop of an overall interest in natural history; a tendency towards gathering and compiling information about the natural world. This blending of a traditional Hippocratic focus on the natural environment, and new forms of observation promulgated by the Royal Society, lay at the foundation of the Edinburgh *Medical Essays and Observations*, as well as Pringle's own medical work. It was through supporting medical men such as Pringle that the Scottish authorities and patrons successfully imported Boerhaave's methodology into Edinburgh's medical institutions.

In keeping with Hippocratic doctrine, the medical men of Britain explored the unique medical circumstances within the areas under their jurisdiction. To the editors of the *Medical Essays*, the capital of this medical republic was Edinburgh. The recently-established Edinburgh Infirmary was to provide ample opportunity for observations that could be widely verified within that community. The Hippocratic "Description of Edinburgh" was followed by a description of meteorological instruments used to investigate the state of the air: a thermometer, hygroscope (hygrometer), barometer, rain gauge and wind gauge, checked twice daily. The results were recorded in tables prefacing each volume, followed by a traditional narrative account of the diseases that occurred during the year.[77] These were daily observations of the "medical year." The tables were followed by a narrative description of diseases, much as could then be found in many other medical texts and natural histories, including Pringle's *Diseases of the Army*. Indeed, the *Medical Essays* alludes to similar practices by "other societies" suggesting that such

[77] A Society in Edinburgh (1737), vol. 1,pp. 7-12. See "A Description of the Instruments"

meteorological record keeping was relatively wide-spread in the first half of the eighteenth century.[78]



JUNE 1731.

D.	Hour.	Baro. In.	D.	Ther. In.	D.	Hyg. I.	D.	Wind. Dir.	For.	Weather.	Rain.
											0,206
17	9 a. m.	30	0	12	0	2	9	E.	1	Cloudy	
	4 p. m.	30	0	12	3	2	8	E.	1	cloudy	0,002
18	9 a. m.	30	0	11	5	3	1	E.	1	cloudy	0,002
	5 p. m.	29	9	12	7	2	5	E.	1	fair	
19	9 a. m.	29	8	12	7	2	5	E. b. N.	1	Fog - -	- -
	8 p. m.	29	6	12	8	2	8	E. b. N.	1	Fog	
20	9 a. m.	29	5	12	6	3	3	E. b. N.	1	Fog	0,064
	6 p. m.	29	5	12	9	2	6	E. b. N.	1	cloudy	
21	8 a. m.	29	4	12	3	2	2	N. b. W.	1	cloudy	0,075
	4 p. m.	29	4	13	5	1	5	N. b. W.	2	cloudy	
22	8 a. m.	29	5	12	0	1	5	N. W.	2	cloudy	- -
	5 p. m.	29	5	13	8	1	2	N. W.	1	cloudy	
23	9 a. m.	29	5	12	1	2	0	S. E.	1	Rain	0,185
	5 p. m.	29	5	12	3	3	0	E. b. N.	1	Rain	
24	9 a. m.	29	5	13	7	2	8	E. b. N.	1	Fog	0,176
	4 p. m.	29	4	14	6	1	9	S. W.	2	cloudy	
25	8 a. m.	29	2	13	9	2	0	S.	2	cloudy	0,255
	7 p. m.	29	1	14	1	1	8	S.	2	Rain	
26	9 a. m.	29	5	13	5	2	0	W.	0	cloudy	0,010
	3 p. m.	29	6	13	3	2	0	W.	1	fair	
27	9 a. m.	29	6	11	1	3	3	N. E.	2	Rain	
	4 p. m.	29	6	11	4	3	2	N. E.	2	Rain	
28	9 a. m.	29	5	11	4	3	7	N. E.	2	Fog	1,060
	5 p. m.	29	6	12	4	3	3	W.	1	Fog	
29	9 a. m.	29	6	13	0	3	0	W.	2	cloudy	0,020
	4 p. m.	29	7	13	8	2	8	W.	2	cloudy	
30	9 a. m.	29	7	14	0	2	1	W.	2	fair	- -
	5 p. m.	29	7	14	0	1	7	W.	3	fair	
H. at a med.		29	5	13	2	2	3			Total Depth	2,051
Gr. Height		30	1	16	0	3	7				
L. Height		29	1	10	6	1	2				

JULY 1731.

D.	Hour.	Baro. In.	D.	Ther. In.	D.	Hyg. I.	D.	Wind. Dir.	For.	Weather.	Rain. In. D.
1	9 a. m.	29	9	13	7	1	7	W.	2	Fair	- -
	6 p. m.	29	9	13	6	1	7	W. b. N.	1	fair	
2	10 a. m.	30	0	13	4	2	1	N.	1	fair	- -
	5 p. m.	30	0	14	3	1	8	N. b. E.	1	fair	
3	8 a. m.	30	0	13	9	1	8	N. b. W.	1	fair	- -
	8 p. m.	30	0	15	2	1	4	W.	1	fair	
4	9 a. m.	30	0	14	6	1	6	W. b. N.	1	fair	- -
	5 p. m.	30	0	16	2	1	2	W. b. N.	1	fair	
5	9 a. m.	29	9	15	2	1	4	W.	1	fair	- -
	5 p. m.	29	8	15	6	1	6	N. E.	1	fair	
6	9 a. m.	29	8	13	4	2	5	N. E.	1	fair	- -
	8 p. m.	29	8	13	4	2	4	N. E.	1	cloudy	
7	9 a. m.	29	8	13	3	3	0	N. E.	1	Fog	- -
	4 p. m.	29	8	14	5	2	2	E.	1	fair	
8	9 a. m.	29	8	14	3	2	2	N. E.	1	fair	- -
	5 p. m.	29	9	14	9	2	0	N. E.	1	Fog	
9	9 a. m.	29	9	14	2	2	1	E.	0	fair	0,016
10	9 a. m.	30	0	14	1	1	8	W.	2	fair	- -
	4 p. m.	30	0	15	5	1	5	W.	3	fair	
11	9 a. m.	29	9	13	9	1	6	W.	2	fair	- -
	5 p. m.	29	9	14	9	1	4	W.	2	fair	
12	8 a. m.	29	9	13	8	1	8	W.	2	fair - -	- -
	8 p. m.	29	8	14	6	1	3	W.	1	fair	
13	9 a. m.	29	8	14	2	1	8	W.	1	Rain	0,012
	4 p. m.	29	7	14	3	1	6	N. b. E.	1	fair	
14	9 a. m.	29	7	13	6	1	4	N. E.	0	Rain	0,243
	5 p. m.	29	7	14	5	1	7	N.	1	cloudy	
15	8 a. m.	29	6	13	5	1	9	W.	0	Rain	0,080
	6 p. m.	29	6	14	5	1	3	W.	1	fair	
16	9 a. m.	29	6	13	4	1	6	N. W.	1	cloudy	- -
	5 p. m.	29	7	14	1	1	4	N. b. E.	0	cloudy	
17	9 a. m.	29	7	13	1	1	4	E. b. N.	1	fair	- -
											0,351

Figure 2. *Medical Essays and Observations, Revised and Published by a Society in Edinburgh*. vol. 1, pp. 14-15.

In studying these local characteristics, the Edinburgh Medical Society engaged in a set of instrumental practices shared with and array of philosophers across Western Europe. Whether organised by philosophical societies, or by provincial "amateurs" such as gentry and clergymen

[78] A Society in Edinburgh (1737), vol. 1, pp. x-xii.

engaged in meteoric reportage (accounts of unusual atmospheric events published in journals such as the *Philosophical Transactions*), these practices permitted the formation of local identity by "seeking visibility within the national republic of letters."[79] The provincial naturalist's study of local circumstances formed part of an effort to establish the regions upon the "cultural maps of the nation" while reflecting existing tendencies among local communities to found identity in the unusual and the exceptional.[80]

In this case, those involved with the *Medical Essays* were self-consciously taking up a project promoted by the Royal Society of London, aimed at understanding weather and climate—it is no coincidence that the *Medical Essays* were dedicated to the Royal Society and its President, the physician Hans Sloane. Early in its history, the Royal Society created the first of several major European observational networks whose purpose was to study the air and climate.[81] Boyle, Hooke, and several others drew up standard record-sheets for making meteorological observations that were provided in Thomas Sprat's *History of the Royal Society*.[82] The Society renewed its initiative in 1723 with a public appeal for meteorological data from its Secretary James Jurin which appeared in the *Philosophical Transactions.*[83]

As had been the case with the earlier effort led by Robert Hooke, Jurin's initiative was based on a standardized table. It attracted correspondents from across Europe, though the Royal Society was obliged to distribute standardized instruments made by the London instrument maker

---

[79] Janković (2001), pp. 3-6; OED Online. "meteor, n.1 and adj.1". June 2014. Oxford University Press. In its early modern sense, a "meteor' referred to a particular atmospheric phenomenon. Aerial meteors were classified by type: aqueous meteors (snow, rain, hail, etc.), luminous meteors (aurora, rainbow, etc.), and fiery meteors (lightning, shooting stars, etc.)

[80] Janković (2001), p. 7.

[81] Feldman (1990), pp. 147-148.

[82] Janković, (2001), p. 35; Golinski (2007) pp. 142-144; Rusnock (2002a), p. 142.

[83] Golinski (2007), p. 55.

Francis Hauksbee in order to collect results that were even remotely reliable.[84] Shortly after Jurin's appeal, the Leiden-trained physician and Royal Society member Francis Clifton introduced a similar table for producing a chronological record of disease.[85]

The vitality of this effort is evident in the numerous new meteorological tools developed by members of the Royal Society, many of which were employed by the Edinburgh medical men in gathering their data. Boyle's work on the weight and spring of the air included an improved baroscope (barometer) described in the 14th issue of the *Philosophical Transactions*. Also, beginning in 1662, Christopher Wren developed an automatic recording rain gauge which was often mentioned in Royal Society publications.[86] Improvements to this device were later suggested by Hooke. The Royal Society's study of air and climate also motivated the development of a standard thermometer (dubbed the "ancient standard"). This involved the collaboration of numerous early Society members under Robert Hooke's leadership.[87]

Instrumental approaches to exploring the air and its relationship to disease continued to evolve into the eighteenth century in search of a more efficient measure of air quality. In the 1750s, the French philosopher Alexander Savèrien (1720–1805) developed an instrument called the queynomètre as a means to test the relative salubrity of air. Savèrien's instrument recorded the volumetric density of an air sample using two mercury-filled columns separated by a valve on the assumption that dangerous vapours reduced the air's elasticity.[88] The eudiometer, a similar

---

[84] Rusnock (2002a), p. 142; Rusnock (2002b), p. 114. For several years the Society sent, at its own expense, thermometers and glass tubes used for constructing barometers to a network of observers.

[85] Rusnock (2002a), p. 122.

[86] Biswas (1967), pp. 95-98.

[87] Patterson (1953), pp. 51-53.

[88] Boantza (2013a), p. 383.

instrument which would occupy the attention of European natural philosophers during Pringle's tenure as President of the Royal Society, was to perform much the same function.

Meteorological record keeping as promoted by the Royal Society had no single purpose. Historians studying the theme of early meteorology find within it a number of themes, for example, an instance of an ongoing process of quantification, or a means for provincials to engage in the observation-centred natural philosophical discourse based in the metropolis.[89] The authors of the *Medical Essays and Observations*, like many others, saw meteorological instruments primarily as a means through which to explore the Hippocratic relationship between body and environment.

The Edinburgh medical men sought to clarify widespread Hippocratic reasoning which provided broad explanations for local characteristics. Reflecting a new awareness of atmospheric pressure, the English physician John Huxham (1692-1768) noted: “weighty atmosphere renders Persons, especially of a pretty firm Constitution more lively and healthy;—nor is there any Thing spirits up the heavy Dutch Vulgar more than a long continued sharp Frost, for they are then as alert as the most gay French.”[90] The English, living in an optimistic age, were thought to have inhabited a healthy climate.[91] Brisk temperatures and wind meant that fevers were not as frequent as in the tropics.[92]

Observations concerning particular local circumstances that affected the air were ubiquitous, for instance, in natural history writing. Sir Hans Sloane's two-volume natural history of Jamaica,

---

[89] Feldman (1990), pp. 145-156; Janković (2001), pp. 3-6.
[90] Huxham (1759), p. xv.
[91] Golinski (2007), pp. 57-64.
[92] Pringle (1753), pp. 8, 216.

based on observations gathered from his journeys between 1687 and 1689 to the West Indies, mentioned the noxious effects of the “tree-oisters” (presumably mussels) that fastened themselves to Mangrove trees growing by the water around Port Royal:

> They cause the Flux and Fevers when eat in excess, and taste somewhat like ours. When through any Accident these Oisters die, they corrupt, stink, and infect the Air and Wind, and are noisome to the places about them, on this account, the Land-Winds are thought to bring Port-Royal no good Air.[93]

Just as many hoped to discern “discrete patterns in their data” that might enable them to understand weather, they expected that such data gathering might help them predict patterns of disease.[94] In 1665, for instance, Robert Boyle communicated instructions for the "composing of a good Natural History." These were listed in his *General Heads for a Natural History of a Countrey, Great or Small* (1665) that provided a full list of details to be recorded when describing a place. The second of these, concerning the air, cited, among other primary considerations, factors associating air and health:

> About the Air may be observ'd, its Temperature, as to the first four Qualities (commonly so call'd) and the Measures of them: its Weight, Clearness, Refractive Power: its Subtlety or Grossness: its abounding with, or wanting an Esurine Salt: its variations according to the seasons of the year, and the times of the day; What duration the several kinds of Weather usually have: What Meteors it is most or least wont to breed; and in what order they are generated; and how long they usually last: Especially, what Winds it is subject to; whether any of them be stated and ordinary, c. What diseases are Epidemical, that are supposed to flow from the Air: What other diseases, wherein that hath a share, the Country is subject to; the Plague and Contagious sicknesses: What is the usual salubrity or insalubrity of the Air: and with what Constitutions it agrees better or worse, than others.[95]

---

[93] Sloan (1707), p. lxxii.

[94] Feldman (1990), p. 151.

[95] Boyle (1665-1666), p. 186.

Useful data were difficult to gather, however; instruments were unreliable and differently calibrated, while the time, care, and commitment necessary to make readings over a long period required a rare combination of labour and leisure.[96] Moreover, the optimism regarding the potential of meteorological instruments to produce medically useful information about disease was controversial, even among those who emphasised the role of the air in health and disease. Such was the case with the English physician Thomas Sydenham (1624-1689), whom Boerhaave praised as “the Light of England, a Phoebus in our art”, noting “whenever we contemplate him, the true image of the Hippocratic man is evoked in our mind.” Sydenham had, by the early eighteenth century, become widely known as the “English Hippocrates” for championing a simplified system of therapy, founded on systematic observation.[97]

Comparisons between Sydenham and Hippocrates owed a great deal to a similar interest in external or environmental cause.[98] His *Observationes Medicae* (1676) provided a chronological report of the prevailing medical "constitutions" in London over the fifteen year period between 1661 and 1675.[99] The air played a major role in Sydenham’s account, affecting the humors and the emergence of epidemic diseases.[100] Though he recorded detailed changes in weather over time, he preferred not to speculate on cause or to attempt to correlate disease with discernible meteorological phenomena. Rather, he believed epidemic disease to be the result of a morbific

---

[96] Feldman (1990), p. 149.
[97] Boerhaave (1983), p. 78.
[98] Riley (1987), pp. 1-3.
[99] Meynell (2006), p. 94.
[100] Riley (1987), p. 15.

material in the ambient air, understandable only insofar as its effects might recur over time.[101] He summarized his view as follows:

> The matter seems to stand thus: There are various general constitutions of years, that owe their origin neither to heat, cold, dryness, nor moisture; but rather depend upon a certain secret and inexplicable alteration in the bowels of the earth, whence the air becomes impregnated with such kinds of effluvia, as subject the human body to particular distempers so long as that kind of constitution prevails, which, after a certain course of years, declines, and gives way to another.[102]

It is notable, then, that among the several goals set out in the introduction to the first (1733) volume of the *Medical Essays*, the most straight-forward was an attempt to decide a point of difference between "two of the greatest and best Observators in Physick, Hippocrates and Sydenham":

> Hippocrates appearing to assign the different manifest Constitutions of the Air as the Causes of epidemic Diseases, and Sydenham affirming such Diseases to depend on some undiscovered Quality of the Air, and not upon any of the Sensible Changes in it.[103]

While the wording is somewhat obscure, the passage seems to hinge on the distinction between manifest (sensible), and "undiscovered" (and potentially undiscoverable). If the Hippocratic corpus was to be believed, then a detailed account of the changes in the weather would correspond to disease patterns. If, instead, Sydenham was correct, then the aerial causes of epidemic diseases, effluvia of unknown origin, would be undetectable using existing instruments. In that case, the meteorological register would have been proved useless, and the account of

---

[101] Porter (1999), p. 56.
[102] Sydenham (1749), p. 5.
[103] A Society in Edinburgh (1737), vol. 1, pp. xvi-xvii.

prevailing diseases would remain the only source of insight into the patterns of epidemic outbreaks.

The Edinburgh medical men also adopted Sydenham's aerial "constitutions", in so far as the concept applied to seasonal disease patterns.[104] The medical year, recorded in data tables with which the authors preceded each volume of the *Medical Essays* register, began in June because

> the vernal diseases had not then begun. Rather, are wore out, and a new Constitution is not begun; whereas if we had followed the Example of most other Societies, by beginning with January, we must have broke in upon the middle of the most violent epidemic Diseases that happen in this Place.[105]

Meteorology was not the only new methodology employed by the Edinburgh medical men in their efforts to understand the air-disease relationship. A one-page "Extract from the publick Register of Burials in Edinburgh" listed the number of deaths per month over the medical year covered by the meteorological register. By this point, mortality tables had been put to many uses, from calculating insurance annuities, to the monitoring population and infant mortality, in order to support various claims about what helped, and what hindered, the growth of the British body politic.[106]

Here, however, the tables were only of potential value as additional quantitative evidence from which an explanation relating climate to disease could potentially emerge through comparison—a common analytical approach in the Enlightenment.[107] The use of data of various kinds in search of a link between weather and disease represented "a significant break from traditional medical

---

[104] A Society in Edinburgh (1737), vol. 1, p. 37.
[105] A Society in Edinburgh (1737), vol. 1, p. xxiii.
[106] Rusnock (1999), pp. 64-64.
[107] Rusnock (1999), p. 56.

writing", one pioneered by physicians at the Royal Society beginning in the 1720s.[108] The careful study of records of birth and death, regularly kept by English parish clerks since the beginning of the seventeenth century, was another form of evidence that began to receive attention around the time of the founding of the Royal Society.

In Britain, the emergence of interest in the critical use of public data is associated with two figures who thrived during the interregnum and restoration and were closely associated with the early Royal Society. John Graunt (1620- 1674), was a London tradesman, whose work *Natural and Political Observations … upon the Bills of Mortality* (1662) examined records of birth and death across the London parishes (limited though he understood them to be) in order to find regularities. Graunt's patron William Petty (1623-1687), a physician and later public official under the protectorate and the restored monarchy of Charles II, would dub this practice "political arithmatick."[109] Petty, "the prototype of the English bureaucrat", was a committed Baconian with ambitions to establish the gathering of information as a tool of power.[110]

Political arithmetic was to influence emerging efforts to understand the relationship between air and disease because it established the use of tables for recording quantitative observations. This would become Hooke's model in leading the effort to gather meteorological observations for the Royal Society. Significantly, Graunt was conscious at the outset of the possibility that such information might be used to track seasonal outbreaks of disease. His introduction, a dedication to a member of the King's Privy Council cites "the many curiosities concerning the waxing and waning of Diseases, the relation between healthful and fruitful Seasons, the difference between

---

[108] Rusnock (2002a). p. 141.
[109] Rusnock 2002b). pp. 14-19.
[110] Schama (2001), pp. 236-237.

City and the Country Aire, &c."[111] Recorded deaths would remain a viable source of evidence concerning the effects of the environment on health throughout the eighteenth century. In 1774, such evidence would be used in defence of Pringle's own convictions about the putrid origins of epidemic fever.[112]

Record keeping was greeted as a natural improvement to Hippocratic medicine. The London Physician and Royal Society member Francis Clifton (d. 1736), a former student of Boerhaave, claimed in a pamphlet entitled *Tabular Observations Recommended as the Plainest and Surest way of Practicing and Improving Physic in a Letter to a Friend* (1731) that "The Great Lord Bacon has judiciously inculcated the Hippocratical method of improving Physick, by observation."[113] He kept his tabulated records of illnesses and his records of the weather in separate account books. In 1749 the Scottish-born physician Thomas Short (1690-1772) noted that "… tho' he [Hippocrates] wanted the Help of our late Mathematical Gauges for measuring the Gravity, Levity, Elasticity, Heath, Cold, Moisture, Dryness, &c. of the Air; yet he from his Senses, made more accurate Observations on it, and its Effects, than have been made since."[114]

Ultimately, the entire investigation into the relationship between air and disease rested on a narrative account of the observations gathered by physicians. Along with the meteorological register and register of burials, "An Account of the Diseases that were most frequent last Year in Edinburgh" provided a narrative account of the significant diseases observed over the medical year. For instance: "In the Year 1731, in the Month of June, many were seized with a Swelling

---

[111] Graunt (1662), Epistle Dedicatory.
[112] Price (1774), p. 96-98; See p. 233.
[113] Rusnock (2002a), pp. 139-141. Citing p. 4 of Clifton's pamphlet.
[114] Short (1749), x-xi.

on the Face, and Salivary Glands, which was not attended with a Fever or Redness of the Skin, and which was easily removed by a gentle Purgative or two."[115]

Thus conclusions about the effects of air on disease were to be based on several forms of evidence. The process of developing substantive claims would not be easy, however. A passage from the subsequent volume of the medical essays reveals the reluctance of the authors to draw conclusions after only two years:

> Several have desired we would make some application of this register to the account of epidemic diseases: We have put it in everyone's power to make a comparison; but, in our judgement, a much greater number of yearly observations are required, before any conclusions concerning the rise or return of epidemic diseases can be made from the state of the air.[116]

Hippocratic insights into the atmosphere produced by the natural philosophers—an understanding of the weight of the atmosphere, and instruments to measure its various properties—provided possibilities for new experiment. Yet these early steps towards instrumental data were fraught with challenges and ambiguity.[117] As Pringle's *Medical Annotations* suggests, anecdotes provided by medically trained and experienced observers continued to provide the hard core of reliable evidence.

Pringle's major work may be seen as a continuation of these earlier efforts. It did, however, offer considerable advantages that may account for its positive reception among natural philosophers. Pringle's elevated vantage point as Physician General on campaign in the landscape of the Low Countries offered an unexplored opportunity to observe disease. He

---

[115] A Society in Edinburgh (1737), vol. 1, p. 37.
[116] A Society in Edinburgh (1737), vol. 3, p. iv.
[117] Rusnock (2002a), pp. 143-144.

developed his extensive notes into an interpretation of putrid disease whose audience extended well beyond medical sphere.

2.3 Pringle's Observational Project

The observational foundation of Pringle's account of epidemic disease did not fully embrace the range of new approaches to exploring air and environment. It would, for instance, have been pointless for him to keep meteorological records given the constant movement required by army life. He did, however, gather observations concerning outbreaks of disease from across the medical canon. His approach was distinguished by a novel attempt to uncover the mechanisms of putrid disease using a program of observation to bypass some of the limitations faced by his Edinburgh colleagues.

Pringle's subject was diseases "such as are peculiar to a different [that is, non- British] climate, or to the condition of a soldier" by which he meant conditions that were particularly productive of putrid distempers, as opposed to the cool, and comparatively healthy, climate of Britain.[118] The army context permitted him to observe similar bodies living in similar ways (i.e. similarly subject to the Galenic non-naturals under conditions that were considered productive of putrid fevers). In fact, Pringle's philosophical claims were well-received in large part because he was able to demonstrate convincingly that military life provided ideal observational conditions under which to make claims about disease.[119]

The *Observations on the Diseases of the Army* was a wide-ranging text meant to convey information on disease to several audiences. It was, for instance, a general guide to army medicine and consequently discussed illnesses such as "the itch" that were not obviously

---

[118] Pringle (1752), pp. xi.
[119] Vicq-d'Azyr (1782), p. 60.

attributable to putrid effluvia. Its primary focus was, however, on clarifying the nature of a broad category of putrid diseases, particularly dysentery and “hospital” or “gaol” fever (typhoid fever), the “two great scourges” most relevant to army life.[120] Putrefaction was, in Pringle’s estimation, “… of all other causes of sickness is the most fatal, and the least understood.”[121]

Much like the schema developed by the Edinburgh physicians, Pringle’s account embodied similar reasoning by dividing prevailing diseases into broad categories according to season. The diseases of winter were inflammatory disorders such as “coughs, pleurisies, peripneumonies, acute rheumatisms, inflammations of the brain, bowels, and other parts, attended with a fever, lesser inflammations without a fever, and fevers of an inflammatory kind, where no part is so affected to give a name to the disease.”[122] The diseases of the summer and autumn were “bilious” after their traditional Hippocratic association with a surplus of bile. These deadly fevers, notably dysentery and hospital fever, were most associated with the putrid low-lying landscape of the Low Countries and formed the book’s core.

Pringle had spent his time in the Army during the War of the Austrian Succession mainly in the Low Countries. This was an area in which the British Army frequently campaigned in defence of Dutch allies and the King’s Hanoverian territory. In Pringle’s account, the characteristically marshy landscape, along with the local climate, resulted in frequent outbreaks of putrid diseases. As with the Edinburgh *Medical Essays*, the introduction to Pringle’s *Observations* began with the essential piece of context: an overall description of the landscape:

---

[120] Gordon (1989), p. 6; Cantile (1974), p. 29. … diseases such as measles, smallpox, and the plague, though assignable to the same cause, were not to be considered diseases of the army.

[121] Pringle (1752), p. 358.

[122] Pringle (1752), pp. 89-90.

> All this tract of the Netherlands being little higher than the level of the sea, or the rivers that pass through it, was once so much exposed to inundations from floods and high tides, that till dykes and drains were made, it was no better than a large morass; and even now, after incredible labour, the country is still subject to be overflowed by extraordinary floods, and other casual inlets of water. By the evaporation of this, as likewise the canals and ditches, in all which innumerable plants and insects die and rot, the atmosphere is filled, during later parts of summer and autumn, with moist, putrid, and insalutary vapours.[123]

Pringle identified two general categories of disease related to the climate and landscape in which the Army operated, "one comprehending those which are also common in Britain; and the other, such as are more peculiar to a different climate, or to the condition of a soldier." The former had been "treated of by several learned authors, in the hands of every physician, and occur in daily practice." These he gave only a cursory treatment. The latter "including the bilious and malignant fevers and the dysentery" were the proper subjects of his text.[124]

As in, for instance, Hans Sloan's natural history of Jamaica, Pringle's *Observations*, was a useful study of a strategically-important landscape for the assistance of administrators in the metropolis. They were, furthermore, intended to provide an indication of rates of disease relative to seasons so that officers might anticipate the inevitable reduction of their effective force over a particular season and avoid exposing their troops to unnecessary danger.[125] While not heavily mathematical, it thus shared with Graunt and Perry's political arithmetic the sense that observational data could be mined for predictive information in the service of state power.[126]

---

[123] Pringle (1752), pp. 2-3.
[124] Pringle (1752), pp. x-xi.
[125] Pringle (1752), pp. vi-vii.
[126] See especially Rusnock (1999) for an examination of political arithmetic and the state.

Given difficulties in deriving the general causes of epidemic illnesses from observations made in cities and towns containing people of every rank and circumstance, one appreciates Pringle's prescience in realising that the army was an ideal place to make medical observations with broader implications. Though implicit in Pringle's own writing, Vicq-d'Azyr, his eulogist in the *Histoire de L'Académie Royale*, seems to have understood this when he noted:

> He had the opportunity to observe widely over a multitude of men obliged to do the same work, breath the same air, take the same food, wear the same clothes, inhabit the same quarters, share the same vices and habits, what might be the effects of different constitutions of the air, of the seasons, of the temperature, of humid or cramped quarters, of different kinds of food and different diets, or finally of negligence and dirtiness. He could examine which illnesses, their causes separate or united, produced among the soldiers the hallmarks that distinguish the epidemics of the armies from ordinary epidemics, and maladies that are truly epidemic from those that we confuse with these because they attack a large number of individuals at the same time, and in the same place.[127]

In this sense, Pringle presented his work with the Army as a grand experiment in which he could account for several variables (season, climate, particular features of the local environment, diet and condition of the men). With the authority over treatment and hospital conditions, provided him by his station as Physician General, he had some control over the staffing of the General Hospital for the campaign and the provision of medicine.[128]

Pringle derived his claims partly from existing medical writing, partly from personal observation and the testimony of reliable observers such as officers and regimental surgeons. The first

---

[127] Vicq-d'Azyr (1782), p. 60. "Il eut occasion d'observer en grand sur une multitude d'hommes obligés aux mêmes travaux, respirant le même air, ayant la même nourriture, le même habillement, le même logement, les mêmes vices & les mêmes habitudes, quels pouvoient être les effets des différentes constitutions de l'air, des saisons, de la température, des logemens humides ou resserrés, des diverses sortes d'alimens & des différens régimes, ceux enfin de la négligence & de la mal-propreté. Il put examiner quelles maladies ces causes, ou séparées ou réunies, produisent parmi les Soldats, les caractères qui distinguent les épidémies des armées, des épidémies ordinaires, & les maladies qui sont vraiment épidémiques de celles que l'on confond avec les premières, parce quelles attaquent en même temps & dans un même lieu un grand nombre d'individus :"

[128] Canteel (1974), p. 80; Gordon (1989), p. 8.

section of his book consisted entirely of a chronological account of his medical observations. It was, he noted, “an abridgement of the medical journals, which I had kept of all the campaigns.” This was divided into eight chapters corresponding to specific campaigns, mostly in the Low Countries, but also in Germany and in Scotland where he had accompanied the army which put down the Jacobite rebellion.

These preliminary chapters formed the evidence for Pringle’s account of epidemic putrid fevers and their treatment. Essentially, they listed weather conditions, the local landscape, outbreaks of disease, and the circumstances faced by the troops—for instance, whether they were in barracks, on the march, or waiting in the holds of transport ships—a particularly dangerous situation. The first section of Pringle’s *Observations*, was thus very similar to the narrative account which followed the meteorological register in the *Edinburgh Medical Essays and Observations*.

Every outbreak of disease could be traced back to an incident in which a group was exposed to putrid vapours (confined in transports, waiting to disembark, encamped near low, marshy terrain), or suffered conditions that made them susceptible to putrid infections (billeted in damp basements, or forced to encamp in the wet after a long march). One such incident is notable for a passing mention of the last battle in which a British Sovereign (George II) led his troops into battle:

> On the 26th [June 1743], in the evening, the tents were struck; the army marched all night, and the next morning fought at Dettingen. On the night following, the men lay on the field of battle, without tents, exposed to a heavy rain; and the next day marched to Hanau, where they encamped in an open field and on good ground, but then wet; and they had no straw for the first night. By these accidents, a sudden change was made in the health of the army.

The days leading up to the battle had been hot, he noted. This had permitted “an uninterrupted perspiration” that had, up to that point, prevented significant outbreaks of disease. As a result of the army's exposure to the cold and damp, however, "the pores were suddenly stopped, the humours became putrid, and in that condition were turned upon the bowels, occasioning an epidemic dysentery." Eight days after the battle, 500 men were sick. A number of officers had also fallen ill through the putrid vapours resulting from the initial outbreak.[129] In such accounts (there are many like it throughout Pringle's chapters on observation), it is clear that Pringle, along with other eighteenth-century writers on fever, had adopted Sydenham's observational program, though not his doubts as to whether the aerial origins of fever could be discovered.

At several points in his book, Pringle described the role played by climate and environment in the spread of putrid disease. The following passage is from the introduction:

> They begin about the end of summer, and continue through autumn; being the worst when the atmosphere is most loaded with the effluvia of stagnating water, rendered more putrid by vegetables and animal substances that die and rot in it. At such times all meats are quickly tainted; and dysenteries, with other putrid diseases, coincide with these fevers. The heats dispose the humours to acrimony; the putrid effluvia are a ferment; and the fogs and dews, so common to those climates, stop perspiration and bring on fever. The more these causes prevail, the easier it is to trace this putrefaction of humours.[130]

To paraphrase: the body's humours are more or less disposed to putrefaction depending on the body's surroundings. The hotter and moister the surrounding environment, the greater the likelihood that putrid illness will develop. Moisture inhibits perspiration which is the main mechanism by which the body naturally disposes of putrid waste. Furthermore, a "close" (still) air polluted with the putrid vapour, from swamps and other sites of putrefaction, posed the further threat of introducing a "ferment"—contagion—into the blood.

---

[129] Pringle (1752), pp. 23-24.
[130] Pringle (1752), pp. 381-382.

As Pringle acknowledged, the understanding that putrefaction was fundamentally implicated in infectious disease reached back to the origins of the Western medical tradition.[131] The Greek noun *miasma*, derived from the verb *miano* (to stain) can be found within the Hippocratic corpus in its original context of an affliction to be purified by religious means. In other works, it becomes a pestilence carried by the air. The noun "putrefied", *anathumiaseos,* and "pestilential", *miasthentos,* are both derived from *miasma*. [132] Galen associated the putrefaction of the body with the inhalation of miasma, for instance in a passage from the sixth chapter of the first book of his *On the Differences between Fevers*:

> In *pestilential* constitutions (λοιμώδεις) the inhalation (of air) is the most important cause. For, if the fever is sometimes caused by the humours in the body that are susceptible to causing putrefaction, when the living being receives a slight impetus from the ambient air for the beginning of the fever, most often it is following inhalation that the fever starts, inhalation of the surrounding air which is polluted (μιανθέντος) by putrefied odours (σηπεδονώδους ἀναθυμιάσεως).The origin of putrefaction is either a mass of cadavers that have not been cremated, as normally happens during combat, or fumes from swamps or lakes during the summer.[133]

The prevailing early modern understanding of the body's relative susceptibility to the influence of putrid miasma remained little changed from Galen's explanation. Decades after Pringle published his experiments, the Edinburgh chemistry professor William Cullen (1710-1790) would acknowledge the doctrine "of as great antiquity as any of the records of physic now remaining" and "received by almost every school of medicine."[134]

---

[131] Pringle (1753), p. xiii; Pringle (1750), p. 17.

[132] Jouanna (2012), pp. 124-135. For a close study of the Greek concept of miasma and its effects upon the body.

[133] Jouanna (2012), p. 130.

[134] Cullen (1777), p. 41.

The explanatory parts of Pringle's text, separate from the observational data, relied heavily on existing testimony in which medical authorities from various times and places attributed epidemics to particular sources of putrid vapour. Galen witnessed epidemics among soldiers that he believed to have originated from unburied bodies decomposing in the field. More recently, the Dutch physician Forestus (Pieter van Foreest, 1521-1597) was noted to have attributed "a malignant fever breaking out at Egmont in North Holland" to a rotting whale washed up on shore.[135] The swampy country around classical Rome could account for outbreaks of fever in the outlying parts of that city.[136]

Political and religious meaning could be wrung from this system of causes. In Pringle's estimation, the appreciation of the causes underlying fever, like the acceptance of the natural evidence of Christianity, was synonymous with enlightened society. Christians, such as the Abyssinians, who inhabited the same climate as Muslims, suffered less from pestilential fevers:

> The religion of the Turks enjoins constant ablutions; and it is well known how much warm bathing, by relaxing the fibres, disposes the body to putrid diseases. In other points, the Turks are not reputed cleanly. Add to this, their abstinence from wine and all fermented liquors, (the great antidotes to putrefaction); the principle of fatalism, which keeps them from avoiding infection; and their ignorance of all learned arts, by which they might know how to prevent or cure these diseases.[137]

Pringle was not, however, committed to applying every observed outbreak of disease to a putrid origin. He was, for instance, among a number of London-based medical men to comment on an epidemic of influenza that raged in London "towards the end of the year 1775." The comments,

---

[135] Pringle (1752), pp. 334-335.
[136] Pringle (1752), p. 123
[137] Pringle (1752), pp. 342-343.

which were systematically gathered by Dr. John Fothergill in order to provide a complete account, appear in the sixth volume of the *Medical Observations and Inquiries* published in London in 1786—a work very much like the *Edinburgh Medical Essays and Observations*.

Fothergill had been trained at Edinburgh and had published in the *Medical Essays*. He had also published meteorological readings in *Gentleman's Magazine*.[138] His report on the influenza epidemic included comments on temperature, barometric pressure, and rainfall but he did not gather instrument readings systematically in tables. Pringle spent the bulk of his short account pondering the value of such data to understanding this outbreak:

> I think you do well to record the state of the weather; but I think the conclusion ought to be, that the sensible qualities of the air had most probably no share in producing this Epidemic, I should be tempted to say, that they had evidently no part, for we hear of the same distemper having been in Italy, France, and in the Low Countries; and, I doubt not, in other parts of Europe, had we inquired. But it cannot be supposed that the state of the atmosphere, either as weight, heat, or moisture, was the same every where. And in the same country have we not seen it rage in one district, or city, whilst others, at no great distance, were totally free? Yet between the sound and the sickly there could be no considerable meteorological difference. My conclusions, therefore, should be, that such Epidemics (of which there have been four in my remembrance) do not depend on any principles we are yet acquainted with, but upon some others, to be investigated.[139]

The comment seems to stand in contrast to his major work. Might Pringle, some thirty years after the first publication of his *Observations on the Diseases of the Army*, have renounced the close correlation between climate and disease outbreaks? I find this extremely unlikely. In the final chapter, we will examine Pringle's commitments over this period as President of the Royal

---

[138] Fothergill, John (1712–1780)," Margaret DeLacy in *Oxford Dictionary of National Biography*, ed. H. C. G. Matthew and Brian Harrison (Oxford: OUP, 2004); online ed., ed. Lawrence Goldman, October 2007, (accessed April 30, 2013).

[139] Fothergill, et al. (1786), pp. 348-349.

Society. We will observe, for instance, the extent to which he was prepared to enlist his supporters within the Society in defence of his earlier claims regarding the dangers of putrid miasma originating from swamps.

One could argue that, by the 1770s, British natural philosophers no longer relied exclusively on meteorological instruments to detect the conditions that might give rise to putrid distempers. As we shall see, a chemical discovery by Joseph Priestley, endorsed by Pringle's Royal Society, promised to detect the vapours themselves, whatever their origin. Pringle's understanding of putrid vapour encompassed notions of contagion via clothing and the exhalations of diseased bodies. Changes in the weather related primarily to the body's relative susceptibility to putrefaction.

In my view, this interpretation suggests a commitment to a monolithic explanation for the primary cause of disease—something that physicians of the period worked to avoid.[140] The physicians' reliance on observation represented, above all, a belief in the fundamental contingency of disease, which, like all bodily disorders, was subject to a variety of circumstances requiring experience and a knowledge of natural philosophy to interpret coherently. Pringle, for instance, collected reports of fever outbreaks in his *Medical Annotations*, but he arranged this information primarily by species of fever—miliary fever, intermitting fever, pestilential jail or hospital fever, hectic and slow fevers—all with their particular characteristics revealed through the numerous anecdotal reports that he carefully transcribed. He was, however, also compelled to discuss "Fevers in General" precisely because of the prevailing ambiguity surrounding the ontology of disease. He prefaced this entry with a revealing claim:

---

[140] Porter (1999), p. 259.

> I would observe in the first place that what one nation, or one physician, would call a nervous fever, a bilious fever, a putrid fever, or a malignant fever, another nation, or another physician, would give another name to, and assign to it a different cause; so that many fevers can only be properly distinguished by the symptoms, and by the treatment that it requires.[141]

Furthermore, Pringle was, in his private communication and writing, essentially agnostic about the overall causes of infectious disease. In his correspondence with Haller, for instance, he praised Haller's theory of illness, which existing medical historiography would consider "vitalist" and hence potentially at odds with Pringle's more traditional hydraulic/ chemical understanding.[142] Perhaps most revealing is a short entry in the *Medical Annotations* on "Causes of Contagious Disease." This begins with an extended paraphrase of Linnaeus' theory of contagion which was founded on animalcules—living creatures most evident in scabies, but which Linnaeus also believed to cause all manner of epidemics from smallpox and measles to yellow fever and the plague. Pringle's summary contains little commentary and expresses no skepticism about a view that was obviously contrary to his own published interpretation—he simply provided a record of the author's argument.[143]

Pringle's claims about disease were, I believe, bounded by two factors. The first of these involved the circumstances of his personal observations—the conditions that he had observed in the encampments, transport ships, and hospitals in the Low Countries and elsewhere. His particular expertise seems to have been on gaol and hospital fever which he had observed in detail and which could be readily assigned to putrid vapour. The physician James Sims (1741-1820), who published *Observations on epidemic disorders, with remarks on nervous and*

---

[141] Pringle (c. 1765- c.1779), vol. 1, p. 59.
[142] Broman (2003), p. 472.
[143] Pringle (c. 1765- c.1779), vol. 6, pp. 259-264.

malignant fevers (1773), claimed "Dr. Huxham on the nervous, and he together with Dr. Pringle on the putrid malignant or hospital fever, being the writers most read and in practice followed, if it shall appear that their methods of treating them are not well founded, the subject must be worthy of our attention."[144]

Pringle's response to such criticism suggests that he was particularly committed to those observations underlying the suggested improvements to military medicine. His work was, first and foremost, a program for preventing outbreaks of fever such as those encountered in a military context.[145] His assertions regarding the putrid origins of such fever, and the relationship of these diseases to the air and environment, were bounded by this agenda. Speculation about the origins of a Europe-wide outbreak of influenza did not materially affect his claims in this area.

Pringle used observational evidence primarily to support an explicitly chemical account of putrid illness. In February of 1752, about two months before his *Observations on the Diseases of the Army* first appeared in print, Pringle read the last of the seven papers recounting his experimental investigation into the process of putrefaction before the Royal Society. This earned him the Copley Medal for that year, inspiring a great deal of subsequent work that continued the investigation of putrefaction along similar experimental lines. Chemistry, particularly its assigned role in medical explanation, is an essential theme in understanding Pringle's efforts.

---

[144] Sims (1773), p. 238.
[145] See p.186.

Chapter 3: Chemistry and Experiment in Eighteenth Century Medicine

Educated observation was one form of evidence supporting Pringle’s conclusions. Experiment, specifically chemical experiment, was another. His “Experiments and Observations upon Septic and Antiseptic Substances” addressed the chemical processes of decomposition—fermentation and putrefaction. This permitted him to account for a remarkably broad complex of diseases, ranging from dysentery to the plague. Such diseases were, at a fundamental level, merely the outward manifestations of putrefaction taking place within the body at varying rates: “If the acrimony is great and sudden”, he claimed, “a fever or flux will ensue; but if the accumulation is slow, that the body grows habituated to putrefaction, a scurvy prevails.”[1] This chapter will discuss Pringle’s experiments, particularly the manner in which they appealed to physicians and other natural philosophers as a novel means to investigate longstanding beliefs about the nature of disease.

Putrefaction provided a bridge between processes taking place in the environment and the body’s interior as the mechanism through which such disease took hold and spread. The origins of this idea lay within Hippocratic medicine, though the process of fermentation had become associated with the iatrochemical tradition emphasising the role of the corruption of the humours. It entered the body as a “ferment"—a longstanding iatrochemical analogy synonymous with contagion. It

---

[1] Pringle (1752), p. 429. Pringle (1752), p. 10. In his pamphlet on the London outbreak of hospital fever he had, for instance, endorsed Mead’s interpretation of the “true plague” as resulting from “a high degree of animal substances in a sultry climate.”

produced an "acrimony", "resolving" first the fluids then the flesh.[2] The process had been studied during the Renaissance and early modern periods by a number of Continental medical writers.[3] Pringle's experiments were focused on revising and amending received views about the processes underlying this resolution.

Pringle presented his experiments as an exemplary Baconian investigation. He noted that putrefaction had been deemed worthy of investigation by Francis Bacon, referring to Bacon's *Sylva Sylvarum* (1626), essentially a natural history consisting of a loosely organized collection of observations published posthumously. He pointed to a particular passage in Century IV of that work that dealt broadly with phenomena related to changes taking place within matter, notably putrefaction:

> It is an *Enquiry* of Excellent use, to Enquire of the *Meanes* of *Preventing* or *Staying Putrefaction*, For therein consisteth the *Meanes* of *Conseruation* of *Bodies;* For *Bodies* have two Kindes of *Dissolutions;* The one by *Consumption,* and *Deficcation;* The other by *Putrefaction;* But as for the *Putrefactions* of the *Bodies* of *Men,* and *Liuing Creatures,* (as in Agues, Wormes, Consumptions of the Lungs, Impostumes, and Ulcers both Inwards and Outwards,) they are a great *Part of Physicke,* and *Surgery*.[4]

The scattered hints of Bacon's natural history—a text that Pringle had recommended to his Edinburgh students—therefore sanctioned Pringle's own investigations. Indeed Bacon's posthumously published natural history had been intended to provide the raw material for an "ordered system of axioms", a complete account of nature. Pringle's subsequent effort represents

---

[2] Pringle (1752), p.354- 355.

[3] Pringle (1752), p. xiii. Pringle lists: Fernelius (Jean François Fernel, 1497 – 1558, Platerus (Felix Plater, 1536–1614), Severinus Eugalenus (17th c), Sanctorius (Santorio Santorii, 1561-1636), and Senertus (Johann Senert 17th c.)

[4] Bacon (1626), p. 90-91; Pringle (1752), p. 367.

the continuation of Bacon's utilitarian project as refracted by the Royal Society—that is, stripped of Bacon's intricate methodology, but retaining the objective of establishing "matters of fact" about nature in order to advance learning and assist the state.[5] That Bacon's hints had not been systematically pursued was not, Pringle noted, "to be wondered at, considering how offensive such operations are."[6]

As Pringle rose in stature in London, the foulness of his chosen area of experimental inquiry became a target of satire. A discourse that he delivered on being appointed President of the Royal Society, for instance, received a mocking parody in *the London Morning Chronicle*, a journal that had previously declared him unfit for the position. Skewering Pringle's tendency to speechify, and to promote his own philosophical bona fides, "Johny P____'s Speech to the Royal Society" cited,

> My experiments made at the hazard of my life, and almost with the total destruction of my olfactory nerves, my mental and sensitive faculties upon the putridity of bodies; the stench of which contaminated corporeal rottenness has deprived me of the sense of smelling any thing, but the fragrant odour of your partial favour. [7]

For those willing to face putrescent odours, the relative simplicity of Pringle's experiments meant that these matters of fact could be readily reproduced. Indeed, Pringle expressed his hope that "however imperfect these sheets may be, I may hope they will serve as a foundation for

---

[5] Lynch (2001), pp. 19-25.

[6] Pringle (1752), p. 367; Johnson (1755), vol. 2. Given the widespread belief in the dangers of putrid vapors, Pringle likely mean "offensive" in the sense of "Causing pain; injurious", as well as the more common sense of "Causing anger; displeasing; disgusting."

[7] *Morning Chronicle and London Advertiser* ,November 24, 1772 and March 3,1773. Burney Collection of Newspapers. British Library/ GALE Digital Collections;

others to go upon…"[8] He did inspire a great deal of subsequent work which furthered various aspects of his investigation and often followed him in citing Bacon's early hint. The following is a list of work that I would consider to have employed Pringle's experimental method described below.[9] It does not include work such as that of Joseph Priestley which shared many assumptions and goals, but differed in its experimental approach.[10]

(1759) Johannes Baptista Gaber, "Specimen experimentorum circa putrefactionem humorum animalium," in *Miscellanea, philosophico-mathematica Societatis privatae Taurinensis (Dissertationes et opuscola varia.)* Vol. 1: 75-87 (Turin)—As well as a second paper from this author in the subsequent volume.

(1764) David Macbride. *Experimental essays on the following subjects:…*. (London).

(1764) Joseph Jacques de Gardanne, *Essais sur la putréfaction des humeurs animales*. (Paris).

(1766) Marie-Geneviève-Charlotte Thiroux d'Arconville,. *Essai pour servir à l'histoire de la putréfaction*. (Paris)

(1767) Barthélemy-Camille Boissieu, Toussaint Bordenave, and Guillaume-Lambert Godart. *Dissertations sur les antiseptiques, qui ont concouru pour le prix proposé par l'Académie des sciences, arts & belles-lettres de Dijon en 1767*. (Dijon)

(1771) F. L. F. Crell, "Some Experiments on Putrefaction." *Philosophical Transactions* 61: 332-344 (London)

(1771) William Alexander, *An experimental enquiry concerning the causes which have generally been said to produce putrid diseases. By William Alexander, M.D.* (London : printed for T. Becket and P.A. de Hondt, and T. Cadell,

Figure 3. A List of works employing Pringle's experimental approach to investigating putrefaction.

As a physician, Pringle cultivated knowledge of the materia medica and pharmaceutical preparations. This constituted a small facet of the overall culture of European chemistry, though its place within the institutional context of the university medical education had been growing since the seventeenth century along with that of anatomy and botany.[11] Chemistry was cultivated

---

[8] Pringle (1752), p. xv.

[9] See p. 102.

[10] Boantza (2013b). pp. 149-161. For an overview of Priestley's approach to experiment.

[11] Klein (2003), p. 534-536; Klein and Lefèvre (2007), pp. 22-28; Broman (2003), p. 467.

at Edinburgh to a much greater extent than at the English universities.[12] The roots of British chemistry as a public science may be traced to Edinburgh and Glasgow, culminating in the immensely popular teaching curriculums of William Cullen and Joseph Black (1729-1799).[13]

By focussing on putrefaction, Pringle was placing himself somewhat at odds with a recent tendency to de-emphasise chemical processes in the hierarchy of causes explaining physiology and disease. His chemically-oriented interpretation of disease followed an earlier generation of medical thinkers, of whom Boerhaave was a notable example, inhabiting a period in which natural philosophy was defined by various forms of mechanical explanations, and favoured mechanical and hydraulic metaphors for bodily processes. Physicians who supported a mechanistic understanding of the body defined themselves in contradistinction to the iatrochemical (chymical, or Paracelsian) movement which had favoured chemical explanations. In studying putrefaction, a concept of great importance to the iatrochemists, Pringle was implicitly challenging this mechanist perspective.

Finally, Pringle's experimental work was lauded for having opened up the relationship between air and disease to a new and promising method of investigation. We could compare it, for instance, to similar work on mineral water, also a traditional idea, which, beginning in the seventeenth century, had been subjected to chemical scrutiny in pursuit of the source of its efficacy.[14] As we shall see in the final chapter, elaborations of this investigation into putrefaction would prove an important factor underlying the Chemical Revolution in Britain. Here we will

---

[12] Golinski (1992), p. 52.

[13] Casteel (2007), pp. 272-273; Golinski (1992), pp. 11-12. Pringle was at Edinburgh University, but Glasgow had a vital place in public science; William Cullen and Joseph Black were perhaps the most distinguished professors who taught there.

[14] Coley (1982), pp. 129-133.

examine the origins of this later work in a particular aspect of Pringle's own experiment: speculation about the role of air in the symptoms and progress of disease.

3.1 Pringle's Experimental Account of Putrefaction

Francis Bacon's hints may have sanctioned Pringle's experiments on putrefaction, but Pringle provided a more restricted account than Bacon had envisaged in his *Sylva Sylvarum*. For Bacon, putrefaction was a manifestation of a broad phenomenon: "*Putrefaction* is the Worke of the *Spirits* of *Bodies*, which ever are *Unquiet* to Get *forth*, and *Congregate* with the *Aire*, and to enjoy the *Sunbeams*." Putrefaction could thus extend from the decomposition of metals to the emergence of "*Creatures* bred of *Putrefaction*."[15]

The purpose of Pringle's experiments was to refine the understanding of putrefaction, and the related process of fermentation, through the production of matters of fact that were acceptable to university-educated physicians and the much broader community of natural philosophers. The simplicity of Pringle's "material technology" meant that these claims were readily verifiable. He reported his efforts through the established Boylean "literary technology" involving a virtual demonstration through an experimental narrative—an account of his investigations through time—rather than a "structured presentation of facts."[16] His account proceeded from an examination of the relationship between alkalinity and putrefaction (Paper 1), to the investigation of substances resisting putrefaction (Papers 1, 2, and 3), to substances promoting putrefaction (Papers 3 and 4), to fermentation and putrefaction's relation to food and digestion (4, 5, and 6), and finally to the putrefaction of the blood and other fluids (paper 7).

---

[15] Bacon (1626), pp. 88-89.
[16] Klein and Lefevre (2007), p. 24; Shapin (1984), pp. 494-497.

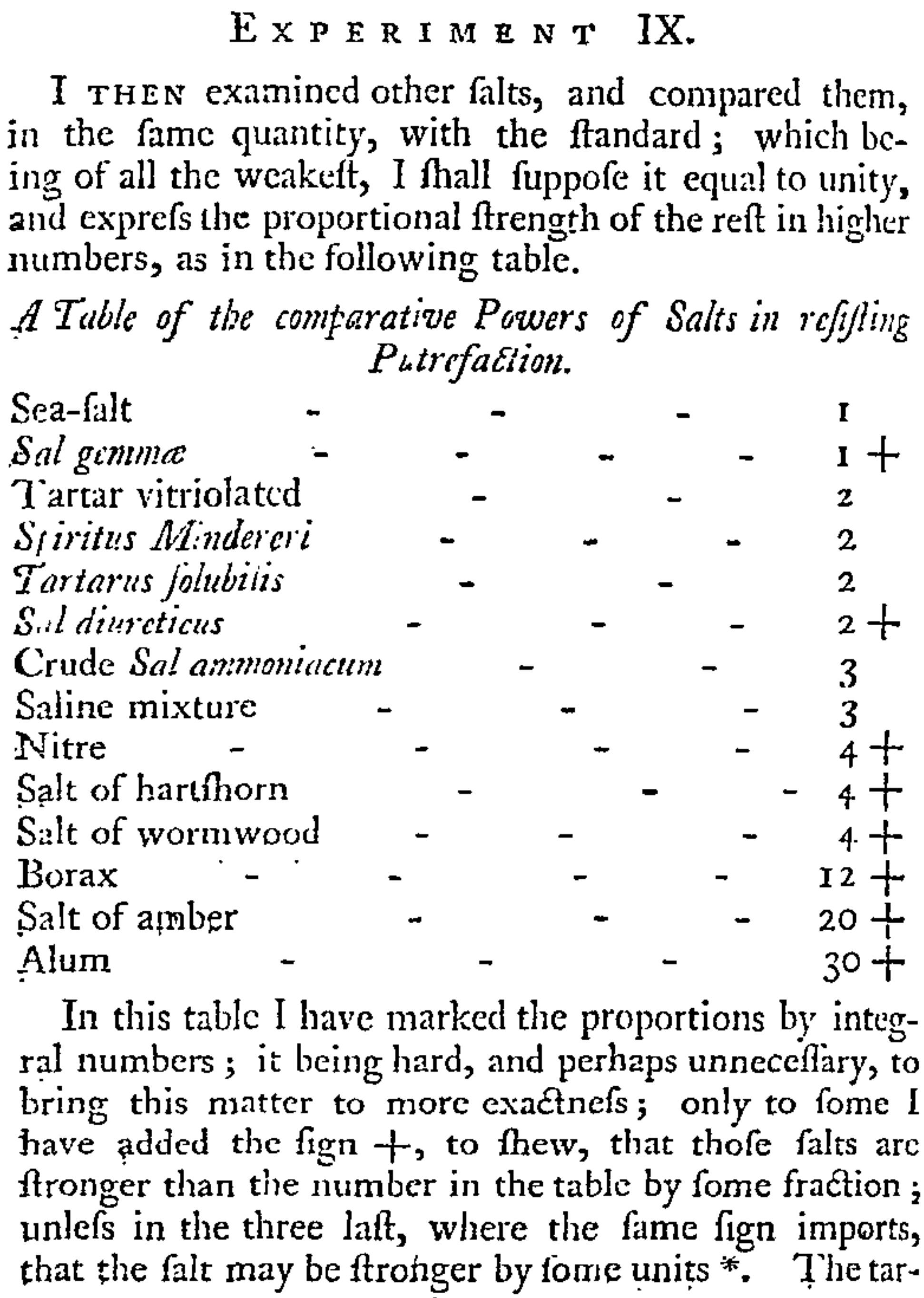
Unlike the broad understanding of putrefaction of Bacon and the earlier chymists, Pringle's experimental work was bounded by essentially medical domains: pharmacy (via natural history) and physiology.[17] While his experiments were accessible to the Fellows of the Royal Society and the readers of its journal, Pringle's status as a physician implicitly contributed to his reliability as a witness to the experimental phenomena that he created. His familiarity with prevailing views regarding pharmaceutical substances, theories of digestion and nutrition, and the course of disease throughout the body, was essential to the credibility of his experimental account.

The defining characteristic of his experiments was the pursuit of analogies to bodily processes through laboratory operations. Essentially, material was placed in vessels, sometimes sealed or kept at the temperature of the body, and closely observed as it was left to rot. The putrefaction or resolution of materials analogous to the flesh and fluids of the body provided the basis for his claims about putrid fevers. Blood was a key aspect of the body's economy; it could be observed to putrefy more readily than flesh or the other humors, and could be assumed to transmit the ferment elsewhere in the body. Other fluids such as bile (ox's gall), milk, urine, and saliva proved useful in clarifying several details—for instance in disproving the belief, supported by Boerhaave, that putridity was invariably associated with chemical alkalinity and, therefore, that alkaline substances could be dangerous promoters of putrefaction.[18]

As analogies to the body, Pringle believed his experiments to offer insight into the effectiveness of the existing pharmacopoeia. By testing the capacity of particular substances to serve as antiseptics when applied to putrefying flesh and fluids, one might uncover potential cures for

[17] Cook (1990), pp. 406, 414.
[18] Pringle (1752), p. 369-370.

diseases attributable to a putrid cause. To this end, Pringle provided a table listing the approximate antiseptic power of salts, a quantitative technique based on assigning a value of one to the observed antiseptic power of sea salt.



EXPERIMENT IX.

I THEN examined other ſalts, and compared them, in the ſame quantity, with the ſtandard; which being of all the weakeſt, I ſhall ſuppoſe it equal to unity, and expreſs the proportional ſtrength of the reſt in higher numbers, as in the following table.

A Table of the comparative Powers of Salts in reſiſting Putrefaction.

Sea-ſalt	1
Sal gemmæ	1 +
Tartar vitriolated	2
Spiritus Mindereri	2
Tartarus ſolubilis	2
Sal diureticus	2 +
Crude *Sal ammoniacum*	3
Saline mixture	3
Nitre	4 +
Salt of hartſhorn	4 +
Salt of wormwood	4 +
Borax	12 +
Salt of amber	20 +
Alum	30 +

In this table I have marked the proportions by integral numbers; it being hard, and perhaps unneceſſary, to bring this matter to more exactneſs; only to ſome I have added the ſign +, to ſhew, that thoſe ſalts are ſtronger than the number in the table by ſome fraction; unleſs in the three laſt, where the ſame ſign imports, that the ſalt may be ſtronger by ſome units *. The tar-

Figure 4. Pringle’s ranking of salts according to their antiseptic properties.

Pringle has been credited with coining the term antiseptic.[19] This was an important contribution to the medical lexicon.[20] The process of putrefaction/ fermentation, considered an aspect of disease since antiquity, had been given a corresponding medicinal virtue to counteract it. The *materia medica* could therefore be tested for this virtue, a process that could both help to refine the pharmacopoeia as well as to shed light on the physiological process of disease. It is hardly surprising that such a possibility was greeted eagerly by the Royal Society. The pursuit of antiseptic remedies was also to provide impetus exploring the medical virtue of newly-discovered airs—an investigation that contributed to the emergence of the Chemical Revolution. For a decade, from 1765 to about 1775, it seemed possible that the body's balance between health and disease might depend on an internal antiseptic economy.

Pringle's experiments also encompassed digestion, a process that the iatrochemists had associated with chemical fermentation.[21] He surveyed the decomposition of "alimentary mixtures" representing various dietary arrangements—an investigation that required a careful distinction between the processes of fermentation, associated with vegetable food, and putrefaction, mostly associated with animal food. Pringle noted that vegetable substances fermented much faster with the addition of a putrid ferment. He deduced that vegetable matter required some form of animal matter in the preliminary stages of putrefaction (or simply saliva, a weak substitute better suited to moderating the overall process) in order to be properly digested.

---

[19] Selwyn (1966), p. 269.

[20] The *Oxford English Dictionary* lists the first use of "antiseptic" (adj. and n.) to page 557 of the December 1751 issue of *Gentleman's Magazine*. This refers to a reprint of Pringle's first several papers on experiments into putrefaction that had been printed in the *Philosophical Transactions*.

[21] Tammone (1996), pp. 53-54, 73-74.

Fermenting vegetable matter, in turn, produced an acid that moderated the potentially dangerous course of putrefaction.

His observation that vegetables did not ferment as readily without meat, or at least milk—a liquid between animal and vegetable—drew him to several conclusions.[22] He considered a vegetable diet most appropriate for someone suffering from scurvy, whose saliva was in a state of putrefaction and would therefore assist digestion. A vegetable diet was appropriate to those who through "hard labour were able to subdue the viscidity of unfermented chyle"—in other words, the labouring poor. When their working days were over, such people could expect poorer health and shorter lives than those able to augment their diet with animal food.[23]

As noted, a number of forerunners shared similar reasoning; Pringle acknowledged several of them in his experimental accounts. Boyle investigated the action of putrefaction in his *Memoirs for the Natural History of Humane Blood* (1684). His chemical interpretation of the power of putrefaction to resolve the blood provided Pringle the basis for his controversial denial of the necessary relationship between alkalinity and putrefaction, while hinting at the need for a clearer distinction between fermentation and putrefaction.[24]

Stephen Hales, writing in 1739 on the unhealthy properties of "bad distilled sea water" as part of an experimental search for healthy drinking water at sea, placed pieces of fresh beef in common water with different quantities of spirit of salt (Hydrochloric acid) to observe the quantity necessary to preserve flesh from putrefying. Distilling sea water in the common manner, he

---

[22] Pringle (1752), p. 406. Milk as "considered as the juice of grass and various other vegetables, not fully assimilated into an animal nature…" One finds similar reasoning in Boerhaave's aphorisms concerning digestion and putrid decay.

[23] Pringle (1752), p. 407.

[24] Boyle (1684) pp. 76-77, 102-109; Pringle (1752), pp. 368-369.

reasoned, concentrated this acid which had the effect of "contracting and pursing up the fine Vessels and Fibres of the Body: whereby it brings on those inveterate and most incurable Obstructions and scirrhous Tumours, which are observed to be the Effect of drinking those unwholesome Waters."[25] Clearly many of the operations and much of the reasoning that characterized Pringle's investigation of putrefaction were familiar to contemporary philosophers.

Within a purely medical context, Boerhaave had, as Pringle acknowledged, explored the process of putrefaction within the body. His investigations had included a much-cited experiment that involved placing a dog and sparrow in a "sugar baker's" oven heated to 156 degrees Fahrenheit. The animals were observed to perish of a powerful putrid distemper as was evident by the foetid stench of their bloods and saliva. The effluvia issuing from these putrid fluids nearly killed a man assisting with the experiments.[26]

The importance of putrefaction to physicians may be inferred from the debate that followed Pringle's experimental conclusion that putrefaction did not necessarily result in alkalinity—an orthodox belief held, for instance, by Boerhaave.[27] Pringle's experimental conclusions were publicly questioned by two eminent European scholars. The first, a physician named Giambattista (Jean Baptiste) Gaber (1730-1785) published an article experimentally confirming the alkaline nature of putrid fluids in the journal of the Academy of Sciences of Turin in 1759 with a follow-up article in 1760.[28] A broader range of objections, some attacking Pringle's

---

[25] Hales (1739), pp. 14-16.

[26] Boerhaave (1735), vol. 1, p. 163.

[27] Pringle (1752), p. 357, 368-369; Boerhaave (1742), pp. 23-26; Boerhaave (1735), vol. 1, p. 462.

[28] Johannes Baptista Gaber, "Specimen experimentorum circa putrefactionem humorum animalium," in *Miscellanea, philosophico-mathematica Societatis privatae Taurinensis (Dissertationes et opuscola varia.)* vol. 1, (Turin : Augustae Taurinorum, ex typographia Regia, 1759), 75-87; Johannes Baptista Gaber, "Experimentorum de putrefaction humorum animalium. Specimen secundem in quo praecipue agitur de sedimento seri purulento ac

observations on the antiseptic properties of fixed alkaline salts, were advanced by Dr. Anton de Haen (1704-1776), professor of Medicine at the University of Vienna.[29] Pringle answered his critics in the third edition of his *Diseases of the Army* (1762), featuring a 24-page postscript rebuttal of de Haen and Gaber in which he acknowledged and "submitted to M. de Gaber's [sic] correction."[30]

Pringle's experiments consolidated these diverse observations and beliefs, offering a history of previous work on putrefaction, and a clearly-defined set of experimental practices through which his investigations could be expanded. He focused on clarifying perceived ambiguities, for instance, by refining the nomenclature through differentiating the processes of fermentation and putrefaction. He also addressed certain perceived inaccuracies, like the mistaken association between putrefaction and alkalinity, which had led to errors in therapy. In a sense, Pringle's investigation of putrefaction might be compared to the application of meteorological instruments to the atmosphere as a newly devised approach to studying contagious disease.

The precise role played by putrefaction within and among various illnesses remained largely confined to short passages describing symptoms and the results of autopsies in relation to particular diseases. This reluctance to generalize can, no doubt, be attributed to the primacy of

---

membrane pleuritica," in Mélanges de philosophie et de mathématique de la Société Royale de Turin pour les années 1760-1761. (Turin: À Turin, de l'Imprimerie Royale, vol. 2), 80-93. Later translated into English as: Jean Baptiste Gaber, "New experiments concerning the putrefaction of the juices and humours of animal bodies," in The annual *register, or a view of history, politics, and literature, for the year 1767* 2nd Edition (London: printed for J. Dodsley, in Pall-Mall, 1772).

[29] The criticism of Pringle's observation on antiseptics was made in (what became) the first volume of the *Ratio medendi in nosocomio practico.* The British Library has the second edition dated 1760. I do not know when the first volume appeared or whether the relevant criticisms appeared only in the second edition.

[30] Pringle (1761), pp. 428-433.

empirical evidence over hypothesis in the culture of natural philosophy; theoretical ideas were acceptable when they could be supported by observation. Their contingency was frequently acknowledged. Pringle adhered to this standard in an introductory passage discussing the diseases most readily assignable to a putrid cause, stressing the empirical basis of his reasoning:

> To this [account of malignant fever], as well as to the account of the bilious fevers and dysentery, I have subjoined my conjectures about their more subtle and immediate causes; tho' I am aware that an attempt of this kind may rather tend to weaken than to confirm my observations: as we but too frequently see the judgement influenced and perverted by such kind of theories. But the Reader may be assured, that not only the descriptions but the cure of all those diseases were long established, before I thought of assigning these causes; and which, indeed, have been sometimes first been suggested by the effects of the remedies.[31]

Empiricism was also valued over theory by physicians who esteemed the educated observer, aware of the contingency in disease and the variety of the pharmacopoeia. In instances such as Pringle's comments on the London influenza outbreak of 1775, one sees a reluctance to apply his reasoning regarding the putrid cause monolithically.[32]

Pringle's experiments encompassed few of the analytical techniques available to eighteenth-century natural philosophers for investigating medicines. He did not, for instance, use the distillation analysis that formed the basis of the chemical investigation of plant medicines and mineral water which had begun over seventy years earlier at the Académie des Sciences under the physician Samuel Duclos and the apothecary Claude Bourdelin.[33] He did perform certain operations such as testing for acids and bases using colour changing dyes and precipitation reactions, but he relied heavily on his senses. His conclusions, save for a table listing the relative

---

[31] Pringle (1752), pp. xii-xiii.
[32] Fothergill, et al. (1786), pp. 348-349.
[33] Boantza (2013b), pp. 69-76; Holmes (1989). pp. 63-64.

antiseptic power of salts, were generally qualitative.[34] His apparatus was simple; his experiments required little more than a vessel (open or closed as the experiment demanded) and a lamp furnace to maintain organic substances near the temperature of the blood for periods long enough to observe the process of decay.

Pringle's chemical expertise lay primarily in his familiarity with materials—not necessarily their preparation, but their variety and presumed effect upon the body. The title of his experimental account referred to "Septic and Antiseptic Substances" rather than specifically to putrefaction. It was largely concerned with the effects of pharmaceutical substances. Pharmaceutical knowledge was an area in which chemistry and the physician's skill overlapped considerably. The fact that Pringle explicitly emphasised the importance and accessibility of these accounts relative to the rest of the book (especially the third section) seems to demonstrate the shared importance of these materials between physicians and the broader community of chemical experimenters, trades people, and natural philosophers.

[34] Pringle (1752), p. 376.

3.2 Medicine, Chemistry, and Pharmaceutical Knowledge

Boswell's unpublished biographical notes on Pringle contain an anecdote about his own father, Lord Auchinleck (1707-1782), from Alexander Murray, Lord Henderland (1736-1795), who was Solicitor General from 1775 to 1783. Boswell's father had been among Pringle's close circle of Scottish friends and had worked to bring Pringle clients as he established himself in Edinburgh.

> He had Sir John called to a very pretty young Lady his relation who was very ill of the small pox and said to him "Preserve her beauty or take her life." Sir John with that patience and assiduity for which he was ever remarkable sat by her bedside and with a pencil touched her face from time to time with softening and healing unguents, and did preserve her beauty.[35]

The passage evokes (among other things) the association between the physician's skill and a kind of material knowledge that we associate with pharmacy. Recently trained at Leiden, where Boerhaave had done much to redefine chemical teaching, Pringle would have been familiar with Boerhaave's extensive investigation of chemical materials and operations as well as the purported effects of pharmaceutical substances upon the body. Pringle cultivated his pharmaceutical expertise through a long-term association with the Edinburgh Pharmaceutical Committee responsible for updating the official pharmacopoeia in use at Edinburgh.[36]

Pringle seems to have been widely regarded as a chemical authority. Several works on chemistry were dedicated to him.[37] Among these was an English translation of Lavoisier's *Opuscules* and a series of experiments on vegetables by Pringle's young protégé Jan Ingenhousz published in

---

[35] Boswell (1782), p. 2.
[36] Cowen (1957), p. 126.
[37] See p. 212.

1779. Both works are contributed to the development of aerial chemistry, the subject of the final chapter of this thesis. A volume containing the posthumously published lectures on the materia medica of Charles Alston was also dedicated to Pringle.[38]

Alston, a friend of Boerhaave, taught botany (closely related to pharmacy) at the RCPE beginning in 1725, and before that at the Royal Garden, Holyrood Palace. He was made secretary of the College in the same year. This responsibility involved him with the production of the *Edinburgh Pharmacopoeia*. Alston may be considered Boerhaave's most important Edinburgh disciple based partly on his determination to study every simple listed in the Edinburgh Pharmacopeia, partly on his application of chemical demonstrations to his lectures.[39] Pringle's work on the 1774 (6th) edition of the *Edinburgh Pharmacopoeia*, which pared down the list of simple ingredients, was, no doubt, a continuation of Alston's efforts.[40]

Eighteenth-century chemistry was practiced to a significant extent within a medical context. The colleges of physicians, the laboratories of the apothecaries, as well as a few institutions that supported the chemical study of the *materia medica*, such as the Jardin du Roi and the Académie des Sciences in Paris, operated within a context that may broadly be considered pharmaceutical. Pharmacy did not delimit medical chemistry, however, nor were the chemical interests and medical activities of practitioners somehow confined to medical concerns. Boerhaave's *Elementa Chemiae* (1732), the definitive chemical text of the period, provided a complete treatment of

[38] Alston and Hope (1770), pp. i-viii. For John Hope's introduction.
[39] Casteel (2007) pp. 268-273. A simple is simply an uncompounded ingredient in its natural form.
[40] Gordon (1989), 9-11.

chemical theory and practice drawing on all areas of chemistry's application such as metallurgy and other industries and crafts. [41]

In 1763, for instance, the Edinburgh medical professor Joseph Black wrote James Ferguson, an Irish physician and chemist, about his own chemical research into bleaching agents meant to improve Scottish textile manufacturing. The letter is notable for having cited Pringle's 23rd experiment into septic and antiseptic substances as evidence that "a mild chalky absorbent earth remaining in Cloth should dispose it to rot."[42] If utility provided a motive force behind chemical research, however, the solution to certain medical problems was considered particularly vital, a fact that is evident in the reception of Pringle's experiments.

Investigating medicine, and disseminating pharmaceutical preparations, had been an important aspect of the agenda of the Edinburgh medical community in which Pringle had spent his early career and which Joseph Black joined in 1752. Both were involved in editing the *Edinburgh pharmacopoeia*. Pringle's first publication, his only contribution to the Edinburgh *Medical Essays and Observations*, focused on *Vitrum Antimonii Ceratum*, (translatable as something like "glass of antimony in wax"), a compound medicine used to treat dysentery.[43] This was published in the first of the two-part fifth volume which appeared in 1742, though it was first presented in the form of a paper read to the Edinburgh Philosophical Society in February of 1738.[44] This preparation had been promoted by the Edinburgh Physician Dr. George Young who, insisting on candour, "published the Receipt in our Edinburgh News-papers, being under no Promise of

---

[41] Klein (2003), pp. 536-537, 541-542.

[42] Joseph Black to Dr. James Ferguson, Glasgow, 14 October, 1763. In Black (2012), vol. 1, p. 163.

[43] Pringle and Young (1747). pp. 162-169. Antimony has been widely used in medical preparations since the ancient world. For a broader history of antimony as medicine, including its use in early modern Scotland, see: McCallum (1999), pp. 44-46.

[44] Colin MacLaurin to John Johnstoun, May 9th, 1737, in MacLaurin (1982), p. 293.

Secrecy with regard to this, and being resolved never to make a Secret of any Medicine whatever."[45] The preparation was not elaborate or difficult; one simply stirred antimony oxide into melted beeswax over a slow fire for about half an hour.

Though Pringle's intention seems to have been to promote Young's preparation, he went to great lengths to appear impartial in the matter by reporting only the testimony of others. The preparation invited skepticism because it was a "specific" cure, that is, its virtue seemed related to its ability to counter a particular illness (dysentery), rather than to a particular property (purging, pain relief, and so forth) with which a knowledgeable physician might treat a variety of ailments. Powerful specific cures resembled what Professor Rutherford had identified as the quack's domain: "an Infallible Medicine to cure each disease."[46] In a short introductory apology that preceded Young's description of the medicine's preparation, Pringle pledged his "word of honour" to the assembled members of the Philosophical Society, that:

> I have suppress nothing of the bad Success of this Medicine communicated to me by any of my Correspondents: On the contrary, I have rather chosen to read to you their Letters in their own Hand and at Length, than to abridge or change their Expressions by any Compilation of my own.[47]

The first two case histories were taken from the papers of his uncle Dr. Francis Pringle, former President of the RCPE. These were followed by the further testimony of three surgeons and the physician Thomas Simson (1696-1764), Professor of Medicine at the University of St. Andrews. The latter were all letters of reply dated between Jan 2nd and Feb 6th of 1738, the month of

---

[45] Gordon (1989), p. 5; Pringle and Young (1747), pp. 163-164. The *Edinburgh Courant*, mentioned in the associated testimony, was apparently one of the newspapers in which Young published his recipe.

[46] Rutherford (1749), pp. 16-17.

[47] Pringle and Young (1747). p. 196.

Pringle's presentation to the Philosophical Society. Pringle had obviously prepared carefully for that day. [48]

His correspondence with the pharmaceutical committee of the RCPE reveals that his authority in this area came both from practice, as well as from a broad familiarity with various well-regarded pharmacopoeias—particularly that of London.[49] He may be associated with an effort to pare down the list of simple medicines and reduce the complexity of compounded medicines by identifying the source of their medical potency. In 1774 he wrote to Haller: "You will find a list of simples, small in comparison with that of the other pharmacopoeias and indeed of that of the last edition of their own pharmacopoeia."[50]

Pringle's authority in this area can be attributed to his work with the established medicines endorsed by the Colleges while eschewing the proprietary medicines and diet schemes upon which many medical fortunes were based. An opaque passage in Kippis' biography referring to Pringle's establishment in London notes: "If any little artifices are ever made use of, in the city of London, to excite popularity, and to promote medical practice, Dr. Pringle was the last man to adopt such artifices."[51] This could, no doubt, refer to various aspects of the physicians' trade familiar to an early modern reader, but almost certainly alludes to Pringle's refusal to countenance proprietary or secret cures.

---

[48] A Society in Edinburgh (1744), vol. 5, pp. 166-169.

[49] John Pringle to John Boswell, 8 November 1771, Collection of Sir John Pringle, PRJ/2. Sibbald Library, Royal College of Physicians of Edinburgh.

[50] Gordon (1989), p. 11.

[51] Kippis (1783), p. xv.

The physician's trade was, in one sense, broadly constitutive of chemical knowledge insofar as the pharmacopeia provided an official list of materials that apothecaries were obliged to have on hand, as well as a canon of approved compound medicines. One can see this process in operation in the notes that Pringle submitted to the President of the Edinburgh College of Physicians in preparation for the 6th edition of the *Edinburgh Pharmacopoeia*. Here one sees both the physician's role in establishing the materia medica, as well as the logic of utility that governed this aspect of the pre-Lavoisieran chemical nomenclature:

> Mercurius Sublimatus dulcis. The London calls it Merc. dulcis. Sublimatus. I incline to quarrel with both titles, for the word Sublimatus, which an inexperienced, or inattentive, apothecary's prentice reading, mistakes it for the corrosive Sublimate, & compounds accordingly. I imagine that several instances have occurred, tho' I only know of one; but that so [Strong?], as to show what damages may in this manner be incurred every day. Would it not therefore be better to call this preparation simply Mercurius Dulcis, to prevent all mistakes?[52]

The extent to which Pringle's pharmaceutical expertise was informed by the artisanal knowledge of apothecaries and other healers is evident in this passage. Further unpublished correspondence also reveals Pringle's reliance on the testimony of apothecaries in forming his views on the pharmacopeia.[53] His sources included highly-placed members of the trade such as Mr. Clarke, "Superintendent at the Apothecaries hall, and a person of great abilities in his business…" and Mr. Brande, "the Queenes Apothecary (and one of the best in this place)."[54] Like other well-regarded physicians, Pringle was often enlisted by apothecaries to provide a second opinion. He kept careful records of these cases which appear frequently in the *Medical Annotations*.

---

[52] John Pringle to John Boswell, 7-9 April 1772, Collection of Sir John Pringle, PRJ/2. Sibbald Library, Royal College of Physicians of Edinburgh.

[53] Gordon (1989), p. 10.

[54] John Pringle to John Boswell, 8 November 1771, Collection of Sir John Pringle, PRJ/2. Sibbald Library, Royal College of Physicians of Edinburgh.

Looking beyond the organized medical occupations, one can see that medical knowledge in general, and pharmaceutical knowledge in particular, was shared throughout broad segments of early modern society. In recent years, medical historians have reminded us that, despite the current near hegemony of university-trained and licensed medical practitioners, medicine in the early modern period was a relatively open market, with patients able to choose between a range of treatments.[55] Physicians focused primarily on serving the elite while most citizens living within the jurisdiction would have been diagnosed by others, particularly apothecaries. In London, the apothecaries were powerfully established having won the right to diagnose as well as prescribe in the Rose case of 1704.[56]

Proprietary or commercial medicines were common, even from licensed physicians.[57] James Boswell had, in his friend Pringle, the free counsel of one of London's most highly-regarded doctors in treating his gonorrhea, though he also consumed expensive nostrums such as Kennedy's Lisbon Diet Drink and Keyser's pills against Pringle's advice.[58] Prominent figures lacking formal medical training might endorse a particular cure or regime based on their own empirical investigations. The Irish philosopher and Anglican Bishop George Berkeley drew much attention to the use of tar water (essentially pine resin dissolved in water) as a panacea

---

[55] For recent description and critique of historical work invoking the concept of the medical marketplace see: Mark S. R. Jenner and Patrick Wallis. "1. The Medical Marketplace." In Medicine and the Market in England and its Colonies, c. 1450-c. 1850. Edited by Mark S. R. Jenner and Patrick Wallis. 1-23. New York: Palgrave Macmillan.

[56] Cook (1994), pp. 27-28. In the 1704, the House of Lords ruled in favour of the London apothecary William Rose, ending a lengthy court case that began when the Royal College of Physicians of London pursued him for practicing medicine without their license. This ruling essentially overturned the requirement of a university degree to diagnose and to prescribe medicine.

[57] Porter and Porter (1989), pp. 48-51, 105-106.

[58] Porter and Porter (1989), p. 109.

based on his own trials. The same empirical quality pervades the Methodist preacher John Wesley's *Primitive Physick* (1747).[59]

Many people made their own medicines. Household recipe books, whether published or containing collected family wisdom, were a first line of defence against common ailments before outside help was sought. Some practitioners of charitable kitchen physic produced medicine on a large scale using sophisticated apparatus. Indeed, given the prevalence of common ingredients in the official pharmacopeia, and the importance of diet in the writing of early modern physicians, one notices a considerable overlap between texts by university-educated medical men, and those meant for a general readership.[60] One finds, for instance, a wide-ranging medical discourse within the pages of *Gentleman's Magazine*, evidence of a broad audience for medical knowledge.[61]

In some instances, physicians and other natural philosophers might adopt medical knowledge from unlicensed healers. The case of Mrs. Stephens, which produced a great deal of scholarly interest in caustic alkaline materials as a potential treatment for bladder stones, is a case in which we see a proprietary remedy subjected to chemical study by prominent members of the philosophical community. In the late 1730s a healer named Joanna Stephens (d. 1774) gained considerable attention for selling a remedy for the stone. In 1738, David Hartley (1705-1757), who had first published an endorsement of Stephen’s medicine along with fellow Royal Society member Stephen Hales, led efforts to purchase the recipe for the sum of £5,000.

---

[59] Jameson. (1961), pp. 51-55. Wesley (1703-1791) went on to be one of the founders of Methodism; he initially published *Primitive Physick* anonymously; his aim in the book was to provide medical advice to those who could not afford physicians.

[60] Leong and Pennell (2007), pp. 134-137.

[61] Porter (1985), pp. 142-143.

When appeals in the newspapers failed to raise the specified amount, the British Parliament was convinced to provide the money—a process overseen by a lengthy list of public figures led by the Archbishop of Canterbury.[62] In March of 1740, the British Parliament released the £5,000 in return for Stephens's recipe which was duly disseminated in the local papers. It turned out to consist mainly of charred egg shells and snail shells, boiled herbs, and soap. In fact, we can see that Stephen's cure was similar to other compounded medicines of the day; most of its ingredients can be found in a contemporary official pharmacopeia.[63]

Once revealed, Stephens's medicine was readily adopted as an object of scientific inquiry. It led to interest in the possibility of refining an effective chemical solvent for the stone and was notably investigated by the English clergyman chemist Stephen Hales—a prominent figure among British natural philosophers.[64] In a lengthy official analysis of the cure released soon after it was made public, Hales concluded:

> I shall be glad if these researches prove of any Service in this most important Concern. I make no doubt but that considerable Improvements will be made in these Medicines by Physicians, whose proper Province it is, and who are best qualified to find out the means, how to use these Medicines with Safety, which have so strong a caustick Quality. I have herein been only acting the part of the naturalist, being excited thereto by the great Importance of the Subject, to the Welfare of Mankind; whom it has pleased GOD, by a surprising series of Incidents, to bless with the Discovery of a means to free themselves from one of the most formidable and calamitous Distempers...[65]

[62] Hales (c. 1740) pp. 38-39.

[63] Lewis (1748), pp. 13, 29, 32 60, 72, [76], 106. Soap, snails, honey, wild carrot, burdock, wild rose hips, ash tree seeds and egg shells can all be found in the contemporary *Edinburgh Pharmacopeia.*

[64] Wilson (2004). In 1755, Hales became Vice President of the Royal Society for the Encouragement of Arts, Manufactures, and Commerce (RSA).

[65] Hales (c. 1740), p. 33.

In 1752, Joseph Black, a medical student at Edinburgh University, began studying calxes (in this case carbonate minerals rendered caustic by calcination) in pursuit of a solvent for the stone. In doing so, he conducted chemical experiments that led to the identification of fixed air as the first species of air discovered to be chemically distinct from atmospheric air.[66] Having been liberated from its fixed state by the calcination of calcareous earths (carbonates), fixed air could be reabsorbed by applying the calcinated product to an alkaline solution (limewater), forming a precipitate. The loss and reabsorption of fixed air was verified by careful weighing. Writing to his father, in part to justify his prolonged university studies, Black wrote:

> Mrs. Stephens medicine is now generally laid aside as excessively acrid and nauseous.... The only useful ingredients in her composition were Soap & a quicklime made of egg shells but as Quicklime can never reach the bladder in Substance They give only Soap and Lime water.[67]

Although Black's experiments did not lead him to a useable solvent, his experiments involving fixed air opened promising new medical possibilities.[68] His dissertation, published in 1754, speculated that fixed air, though harmful to breathe, was beneficial when fixed naturally in food and consumed, whereupon it was incorporated into the fluids and tissues.[69]

The research that had been ignited by Stephens's remedy was still ongoing in 1757 when John Pringle passed along a letter on the subject to Thomas Birch (1705-1766), then secretary of the Royal Society. This had been sent to Pringle from the Edinburgh physician Robert Whytt (1714-1766), a Boerhaave alumnus who was also FRS. It was published in the *Philosophical*

---

[66] Donovan (1975), pp. 191-194; Black (1756), pp. 157-225.
[67] Donovan (1975), p. 174.
[68] See p. 141.
[69] Donovan (1975), pp. 191-192.

Transactions along with a second unrelated letter from Whytt. Whytt was committed to a cure for the stone involving limewater and soap, which he considered to have been the active ingredients in Stephen's cure. His first published investigations, begun around 1742, appeared in the fifth volume of the *Edinburgh Essays and Observations*.[70]

Whytt was eager to defend his earlier claim because the efficacy and safety of limewater had been called into question when it was partly implicated in Sir Robert Walpole's (1676-1745) death earlier that year.[71] He directed his arguments against a recent book by a Dr. Gottlob Caroli Springsfeld, whose own work promoted Carlsbad spring water as a cure for the stone.[72] Both Springsfeld and Whytt performed experiments in which they applied solutions to pieces of calculi and recorded their diminution in weight over time. They arrived at opposite conclusions about the power of Carlsbad water relative to soap and limewater. By the time Whytt's letter arrived at Pringle's Pall Mall residence for consideration by a medical authority with the Royal Society's committee, alkaline substances had, like many chemical materials, become the common property of non-medical chemical experimenters, physicians, and an array of tradespeople.

This wide-ranging conversation between experimenters is characteristic of the eighteenth-century study of medicine. Boerhaave encouraged his students to communicate their insights according to the literary technology developed, in large part, by Robert Boyle: privileging reportage of matters of fact over interpretation, eschewing theoretical commitments, and

---

[70] A Society in Edinburgh (1744), vol. 5, part 2, pp. 156-164.

[71] Roger French, 'Whytt, Robert (1714–1766)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004.

[72] Springsfeld's book was entitled *Commentatio De Praerogativa Thermarum Carolinarum In Dissolvendo Calculo Vesicae Prae Aqua Calcis Vivae.*

communicating to and among a growing audience of experimenters.[73] Within the secondary literature Boerhaave has risen from a peripheral place in the Lavoisier-oriented history of eighteenth-century chemistry, to become a significant transitional figure who redefined the teaching of chemistry at the university as part of his pedagogical reform of university medicine. He did so by promulgating a renewed method for teaching about chemical processes and materials.[74]

One perceives a tension, however, between Pringle's account of putrid disease and the explanations favoured by Boerhaave. In focusing on the process of putrefaction, Pringle's experiments recalled an older, chemically oriented view of the body that had been advanced by an earlier generation of medical writers—a view that, by the eighteenth century, had garnered considerable antipathy from university-educated physicians. Boerhaave publicly declared his hostility towards this earlier chemical movement, even while his own published and unpublished work was deeply concerned with chemistry. These differing views on chemistry's place within physiology—a key aspect of medical theory promulgated through the university—offer a useful glimpse into the shifting landscape of medical chemistry over the first half of the eighteenth century.

---

[73] Klein (2003), pp. 534-535; Shapin (1984), pp. 482- 484.
[74] Powers (2012), pp 196-197.

3.3 Chemistry and the Body in the Early Eighteenth Century.

The preface to Pringle's *Observation on the Diseases of the Army* contains a statement that is worth pondering for the insight that it offers into Pringle's overall epistemology. Pringle noted that, while earlier authors had turned to chemistry to explain disease, their inquiries had been "imperfect" and their hypotheses "weak."

> That the aliment ferments in the stomach was the opinion of the Chemists; but as they did not explain the manner how, and applied the term fermentation to divers operations of nature, scarcely analogous to that process, it was no wonder their theory was wholly rejected by some, and only admitted by others with many restrictions.[75]

Pringle was referring to what chemical historians call the iatrochemical movement that flourished in the seventeenth century. The iatrochemists (referred to in medical texts simply as chemists or chymists for their preference for chemical explanations for medical issues) had been a diverse group whose membership consisted of those who claimed a sophisticated knowledge of chemical operations, notably the apothecaries. They followed the example of the 16th century German-Swiss physician Paracelsus (1493-1541) in renouncing the university path to medical qualification, as well as the traditional "Galenic" pharmacopeia. Across Europe, groups of iatrochemists clashed with local colleges of physicians.[76] Over time, the iatrochemists succeeded in introducing chemical cures into the standard pharmacopoeias whereupon chemistry became, like botany, a secondary topic in medical education related to preparing medicine.[77]

---

[75] Pringle (1752), p. 406.
[76] Wear (1992), p. 120.
[77] Boerhaave (1983), p. 102.

Pringle's comment referred to fermentation rather than putrefaction. The former had held an important place within the systems of the iatrochemists as a "proto-model for all material changes", "the general factotum or do-all of early-modern science."[78] The iatrochemists took on fermentation as an explanation for various bodily phenomena, applying it analogically to processes as various as disease, childbirth, digestion, and metallurgy. This understanding is also evident in Bacon's natural history mentioned above. Pringle's investigation of putrefaction and fermentation required him to revisit and re-evaluate this existing idea.

Pringle's comment continues with the observation that recent mechanical writers, believing "a few of the mixed mathematical principles adequate to solve all phenomena," had lost sight of the chemical processes underlying fever. Having established his desire to address this lacuna in medical knowledge, Pringle made an interesting claim:

> This error did not escape the learned Boerhaave, who, tho' he retained the use of mechanics, yet revived and reformed the doctrine of acids and alcalies; and under these last comprehended all that he thought septic or putrid. But, as my celebrated Master had not time to ascertain every part of his doctrine from experiments of his own, it was no wonder some mistakes were made, and that the extent of these principles were not fully understood.[79]

Pringle was, in effect, contrasting his own belief in the importance of chemical explanation with the well-known views of Boerhaave. The passage is striking in its criticism of a respected medical figure—one, it might be added, who had signed Pringle's own medical doctorate.[80] The comment was civil. No doubt Boerhaave's numerous disciples regarded experimental natural philosophy to be a critical endeavor as had their "celebrated master." Pringle's book, and most

---

[78] Tammone (1996), p. xi.
[79] Pringle (1752), pp. xiii-xiv.
[80] Singer (1949), p. 131.

explicitly the appended experiments, embodied this critical spirit. Its purpose was to re-establish the chemical process of putrefaction as a vital concept by subjecting it to a rigorous investigation.

Pringle's claim that Boerhaave, as a mechanist, had used chemistry "too sparingly" brings to mind recent work exploring Boerhaave's theoretical commitments regarding medicine and chemistry. Much of the older secondary interpretation of Boerhaave's intellectual commitments has tended to define him monolithically as a mechanist.[81] Research by Rina Knoeff and John Powers, founded, in part, on unpublished manuscripts at the Military Medicine Academy in St. Petersburg, Russia, has clarified the long progress of Boerhaave's chemical teaching, and brought to light his alchemical interests and experimentation.[82] New scholarship has re-examined Boerhaave's *Elementa Chemiae* (1732), a textbook that he published late in life, which may be taken as his definitive statement on chemistry and its place in university education.[83]

This re-evaluation of Boerhaave mirrors the re-examination of Robert Boyle. Like Boerhaave, Boyle had long been reckoned a mechanist bent on bringing chemistry into the purview of mechanically-oriented natural philosophy before recent scholarship unearthed a powerful interest in esoteric aspects of chemical practice. In light of such work on two figures that greatly influenced chemical theory from the mid seventeenth to mid eighteenth centuries, Pringle's identification of Boerhaave as being among the mechanists who were insufficiently attached to

---

[81] Powers (2012), pp. 132-134.

[82] See: Rina Knoeff (2002). *Herman Boerhaave (1688-1738): Calvinist Chemist and Physician*. Amsterdam: Royal Netherlands Academy of Arts and Sciences, and John C. Powers (2012). *Inventing Chemistry: Herman Boerhaave and the Reform of the Chemical Arts*. Chicago: The University of Chicago Press.

[83] Powers (2012), pp. 146-147.

chemistry provides a means to situate his own work within the chemical conversations of his day.

Boerhaave established his reputation as a medical thinker before an audience, in textbooks, and in public orations that accompanied his various promotions and new responsibilities at Leiden. In his public pronouncements he tended to define his medical work in contrast to earlier practices. These rather Manichean public statements have contributed to his reputation as a mechanist. For instance, in his "Discourse on Chemistry", which he delivered upon being made professor of chemistry at Leiden (seventeen years after his discourse on Hippocrates mentioned in the previous chapter), his intention was to elevate chemistry from its esoteric origins into the domain of the "academical sciences."[84] He attacked Paracelsian iatrochemistry as grounded in unwarranted speculation that trespassed upon the domain of proper theology. Boerhaave, a committed Calvinist, believed, like many in his day, in a divine plan discernible in the laws governing the natural world. In this public address, he accused the iatrochemists of the "wicked sin" of representing "the Incorruptible Judge, the Supreme God as a servant and tool for their heinous ambition and cursed hatred!"[85]

Boerhaave believed that the achievements of early modern alchemy had led to overconfidence in the chemical art: "Glory and acclaim were lavished on these happy discoverers! But the pleasure felt at these successes dulled their minds! Forthwith they asserted that effects, similar to the ones discovered, existed in the human body and they postulated this as an unassailable fact."[86]

---

[84] Boerhaave (1983), pp. 210-212.

[85] Boerhaave (1983), p. 199. For a detailed treatment of Boerhaave's Calvinist religious commitments in relation to his understanding of natural philosophy, see Rina Knoeff (2002). *Herman Boerhaave (1668-1738): Calvinist Chemist and Physician.* Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen.

[86] Boerhaave (1983), p. 205.

Boerhaave insisted that chemical analogies ought not to be drawn between operations observed in the laboratory and those taking place within the body. “On what uncertain grounds”, he demanded, might chemical processes requiring “the most intricate, violent, and laborious feats”, be produced naturally in the “tranquil motion” of the body.” In Boerhaave’s account, the human body had been, for the iatrochemists, “a chemical laboratory, an arena in which the chemists could stage their games.”[87]

In his *Oration on the Usefulness of the Mechanical Medicine,* Boerhaave took aim directly at the iatrochemical doctrine of ferments by challenging the notion that fermentation was an extensive force throughout nature. Fermentation, he claimed,

> was thought to be so efficacious and far-reaching that the tiniest particle, when uniting with the proper ferment of any body whatsoever, would make that pregnant of abundant brood, so that it would then be able to attract the ferments of all other things, so as to create offspring of its own kind.[88]

Where chemistry provided the physiological model for the iatrochemists, the dominant understanding of the body came increasingly over the seventeenth century to be dominated by the “new mental world” of mechanical philosophy.[89] Boerhaave was, in some sense, a mechanist who believed the motion of the body’s fluids to be the prime factor in health and illness.[90] Pneumatics and hydraulics, the domain of the “mechanician” provided, for Boerhaave, a correct understanding of the effects and laws relating to the body’s interior flows. “Nobody can

---

[87] Boerhaave (1983), p. 206-207.
[88] Boerhaave (1983), p. 201-202.
[89] Bates (1981), p. 51.
[90] Boerhaave (1983), p. 132.

understand the workings of the vital humors who ignores the rules of the hydraulic engineers", he maintained.[91]

In support of his mechanical views, Boerhaave cited the example of a newly dead body, noting that the only thing distinguishing it from a living one was a lack of circulation. If the heart were only to resume its motion "then at once happy life returns, the sad spectacle of death is banished." Then, he demanded, "what ferment, effervescence, what aggressive salt, oil or spirit is created or destroyed in such a situation? Nothing is added or taken away except motion; yet life itself was lost and had been restored."[92] Of chemistry, he noted that one could gather "a very limited survey of isolated processes, in as far as they produce under some clearly defined conditions something that can be perceived by the senses."[93] Only mechanics could explain the principles underlying such processes. Yet these public attacks on the iatrochemical movement of earlier generations must be reconciled with Boerhaave's status as the foremost medical chemist of his day.

Having completed a degree in philosophy in 1690, Boerhaave began studying chemistry in 1691 or 1692 and soon after apprenticed himself to an apothecary. His early efforts involved attempts to create sophic mercury—an interest shared by Robert Boyle and Jan Baptist van Helmont whose work he studied and admired.[94] Boerhaave surveyed the works of his chemical predecessors in search of principles upon which to further the renovation of chemistry.[95] He first

---

[91] Boerhaave (1983), p. 105; See Casteel (2007), pp. 212-249 for an examination of eighteenth-century Dutch civil engineering and its relationship to public health.

[92] Boerhaave (1983), p. 107.

[93] Boerhaave (1983), p. 105.

[94] Powers (2012), pp. 57-62. For sophic mercury, see also Newman and Principe (2002), pp.119-128.

[95] Powers (2012), pp. 116-118. Provides a description of the record regarding Boerhaave's alchemical interests.

developed a chemistry course in 1702 as a lecturer in medicine which borrowed heavily from the earlier work of Johannes Bohn (1640-1718), professor of medicine at Leipzig.[96] He was given the chair in chemistry in 1718 and, for the next ten years, based his chemical lectures on demonstration experiments performed at the laboratory of Leiden University.[97] The culmination of this lengthy period of chemical study and instruction was the *Elementa Chemiae* which went through forty printings before 1791 and would remain an important text through the first half of the eighteenth century, well beyond the confines of the university classroom.

How then does one reconcile Boerhaave the avowed mechanist with his work on chemistry, particularly in light of Pringle's comment on the limitations of his chemical understanding? It may be worth considering the evolution of Boerhaave's chemical thinking. His most enthusiastic pronouncements on mechanical medicine were made at the highpoint for the mechanical understanding of the body around the first decade of the eighteenth century.[98] His early *Oration on the Usefulness of the Mechanical Medicine* (1703) provides a glimpse into the fin-de-siècle optimism surrounding a new chemistry shaped by the emergence of the mechanical philosophy. At some point, it has been argued, he was prompted to reconcile his mechanical understanding of the body with the chemical by the appearance of the 3rd and 4th edition of Newton's *Optics* which seemed to offer the possibility of a chemistry governed by mechanical laws.[99]

The distinction between "chemical" and "mechanical" is complex, however. If one is referring to chemical theory, then those, like Boerhaave, who admired Boyle's skeptical critique of

---

[96] Powers (2012), p. 68-69.

[97] Powers (2012), p. 11.

[98] Casteel (2007) pp. 200-202. Casteel maintains that a profound transition in Boerhaave's views away from the "non chemical approach" took place around 1711.

[99] Casteel (2007), pp. 197-198. Rina Knoeff and John Christie apparently cite the appearance of the 1718 edition of the Optics as reviving Boerhaave's interest in chemistry after a period of skepticism.

Aristotelian and Paracelsian matter theory, may be considered mechanists. Boerhaave publicly lauded Boyle's corpuscularianism as evidence that chemistry was "cleansing itself" of its own errors.[100] As has been widely noted, however, Boyle's skeptical chemistry was mainly a methodological resource for those wishing to undermine existing chemical claims.[101] Boerhaave's approach to chemistry in medicine reflected this skeptical ethos. He chided Franciscus Sylvius (1614-1672), his precursor in the Leiden chemistry chair, for not having allowed the chemical arts to be "the servant of medicine" but rather "her mistress."[102]

I suspect that the distinction between chemistry and mechanism is best characterized in terms of overarching physiological metaphors favoured by particular factions within the community of physicians at particular times.[103] Differences over which metaphor best explained the *overall* workings of the body most likely account for Pringle's view of Boerhaave's approach to chemistry. Supporters of mechanism, including Boerhaave, believed Harvey's explanation of the circulation of the blood to have fundamentally weakened the doctrine of ferments. Pringle acknowledged in his statement that putrid fever was "among the surest of any that were admitted, before the theory of circulation was known", after which "the notion of putrefaction" disappeared from the systems of important authors.[104]

Pringle's experimental focus on putrefaction, still closely associated with iatrochemistry, tended to favour chemical metaphors—a recent medical historian has classified his approach as "pneumatic iatrochemistry", though Pringle would not have described his own work in those

---

[100] Boerhaave (1983), p. 194.
[101] Powers (2012), p. 74.
[102] Boerhaave (1735), vol. 1, p. 56; Boerhaave (1983), p. 207.
[103] Broman (2003), p. 468. "Physiology" was a term coined in the 16th century.
[104] Pringle (1752), p. xiii.

terms.[105] Both he and Boerhaave lived at a time when natural philosophy had largely supplanted the “chemical cosmologies” of an earlier generation of chemical philosophers. Boerhaave used his public speeches to contrast his Calvinism with mystical and esoteric alchemical discourse.[106] Pringle simply regretted the careless use of the terminology surrounding putrefaction and fermentation.[107]

Boerhaave, despite his preference for mechanical or hydraulic metaphors when explaining disease, accommodated chemistry within the range of medical explanation.[108] The *Elementa Chemiae,* for instance, devoted a section to “The Use of Chemistry in Physic” in which he argued that the processes of the body could not be fully understood without the assistance of chemistry. He asked his audience:

> Would you understand the causes, modes, and effects of the degeneration of the humors in the animal Body? Would you know how the juices are vitiated, when they move too slowly, are perfectly at rest in their vessels, or run out of them, and stagnate in the cavities? Or would you form a just notion of the alterations, that the Oils, Salts, Spirits, and Earths, that are mixed with the Fluids undergo, when they circulate through the Arteries with too great rapidity? You must go to chemistry, and that only, for your information. [109]

Indeed, Boerhaave adopted chemical explanations for fundamental processes, notably including the putrefaction of the humors (which Pringle alluded to in his introductory passage).[110]

---

[105] McBride (1991), p. 167.
[106] Powers (2012), p. 25.
[107] Pringle (1752), pp. 368-369.
[108] Broman (2003), p. 469.
[109] Boerhaave (1735), vol. 1, p. 53.
[110] Pringle (1752), pp. xiii-xiv.

Pringle's vision of chemistry's role within the body was less bounded by mechanical metaphors and corpuscular theory.[111] It was more admitting of ideas that, a generation earlier, had been considered tainted by their association with iatrochemistry. By the second half of the eighteenth-century the prominent medical thinker, Richard Mead, one of Pringle's sponsors to the Royal Society, had retreated from his earlier enthusiasm for Newtonian chemistry. The decline of specifically mechanical explanations may be an indication that the hoped-for mechanical renovation of medicine had failed to materialize. By 1752 Pringle could reflect on the mechanists, as Boerhaave had on the iatrochemists, as a recognisable movement whose heyday had passed.

Nevertheless, one finds more similarities than differences in their approach to putrefaction. Both explored its role within the body through chemical experiment. Their conclusions were coloured, however, by their respective physiological assumptions. Where Boerhaave subsumed the chemical process of putrefaction within a framework based on physical blockages to circulation, Pringle saw its nature and degree as a key distinguishing factor between the various putrid illnesses and considered it directly responsible for symptoms.[112] Moreover Pringle disagreed with Boerhaave's assertion (shared, in large part, with the earlier iatrochemists), that substances necessarily became alkaline as they putrefied.[113] Pringle's experiments indicated that this

---

[111] Boerhaave (1983), pp. 137-137. For instance, a passage in Boerhaave's "Oration on the Simplicity of Purified Medicine" does precisely this. Despite the resulting production of "stagnant matter" in the last stage of disease, he considers these the mere phenomena of disease rather than the primary ailment.

[112] Powers (2012), pp. 109-111. For an detailed description of Boerhaave's views on putrefaction.

[113] Powers (2012), pp. 92-93.

assumption, which Boerhaave “had not time to ascertain”, was a great deal more subtle and contingent than previously believed.[114]

Even as Boerhaave composed his chemical textbook, a new area of investigation was taking shape that, by century’s end, would alter the nature of chemical study. [115] The study of the air, its relationship to solid matter, and its role within the body would also produce a great deal of medical speculation. While Pringle did not use the apparatus that was to define aerial chemistry in the coming decades, he did identify effluvium as a fruitful area of inquiry for those who did. Moreover, his putrefaction experiments provided a model that would influence the study of air over the coming decades.

[114] Pringle (1752), p. xiv. In the years following the publication of these experiments, Pringle would himself retreat from some of his claims on this subject in the face of contrary experimental evidence.

[115] Powers (2012), pp. 155-158.

3.4 Air and the Putrid in Pringle's Experimental Work

In Pringle's work, air existed both in its ancient form (the "corrupted air" of Hippocrates and Galen) as well as in a newer form that was becoming a vital field of chemical research. Pringle performed his experiments at a time when British philosophers were considering the implications of Stephen Hales's exploration of air's capacity to exist in a "fixed" state within living tissue and other solid material. Chemical processes, including fire and fermentation, could liberate this air, as Hales had demonstrated by using a pneumatic trough to gather air produced in his experiments. Hales was not the first to use the trough (a relatively simple instrument). Others, following his example, would explore the instrument's implications more fully. The experiments that he performed in his 1727 book *Vegetable Staticks* nevertheless raised considerable interest in using his methods to explore the air contained in solid matter.[116]

The notion of air as fixed within the body's fluids and tissues formed a significant aspect of Pringle's account of putrid disease, though a relatively small part of the text itself. His experiments showed, for instance, that pounded meat left to putrefy in a phial of water, would eventually float due to the release of fixed air, much as a drowned body would eventually rise to the surface. Likewise, the generation of air in the putrefactive process was, Pringle noted, a "fact sufficiently known", citing Hales' experiments (Hales had previously demonstrated the remarkable quantities of air present in animal substances such as hog's blood, tallow, and deer horn).[117] While all animal substances contained a "considerable quantity of air", more was

---

[116] Crosland (2000), pp. 83-84.
[117] Hales (1727), pp. 166-168.

liberated from putrefying flesh than from the fluids. This finding was deemed “agreeable to the general experiments of the excellent Dr. Hales.”[118]

In Pringle’s account, changes observed in the laboratory could be readily linked to the signs and symptoms of a putrid illness. For instance, putrefying serum and crassamentum, the two components of blood separated by putrefaction, were assigned to the appearance of ulcers, to the sores of dysentery, to the “flame coloured” urine of scurvy, and to the greenish cast of dead bodies in which the putrid blood had reached a dangerous state.[119] Air liberated by putrefaction was no less dangerous within the body than without and was similarly implicated in the signs of a putrid disease. He claimed that “every corrupted substance is not only offensive to the external senses, but to every nerve and fibre; as is evident from the nausea, spasms, palpitations, oppressions of the breast, dejection of the spirits and other symptoms consequent upon the admission of any putrid miasma into the blood.”[120]

Pringle also cited experiments involving the injection of air into the circulatory systems of living animals which caused a quick and violent death. A slower release of air could account for the symptoms of putrid scurvy. That individuals suffering from scurvy seemed to suffer more from quick changes in the weight of the atmosphere seemed to confirm “the looser connection of the air with the blood in scorbutic habits.”[121] In a letter dated 28 Oct 1762 to the Edinburgh physician Dr. Robert Whytt, Pringle noted: “…sure I am, or [next to sure] that air enters into the

---

[118] Pringle (1752), p. 227.
[119] Pringle (1752), p. 421.
[120] Pringle (1752), p. 430.
[121] Pringle (1752), pp. 428-429.

blood in an elastic state, that it remains there as such, & plays a thousand tricks, what we, ignorant of its laws, cannot account for."[122]

Pringle's speculation about air helps us to understand the early relationship between medicine and pneumatic chemistry. It begins to explain his relationship to many important figures associated with the emergence and development of the experimental investigation of air, notably Stephen Hales, Henry Cavendish, Joseph Priestley, Jan Ingenhousz, and Felice Fontana. These relationships illustrate the medical background to pneumatic chemistry—a context which the chemical historian's tendency to focus on the development of instruments and experimental practice does not fully explain.

The experimental investigation of the air by natural philosophers emerged much earlier than the familiar instruments of pneumatic chemistry. In addition to studying the atmosphere and weather (or, more likely, as a further component of the same broad inquiry), the virtuosi of the early Royal society investigated the properties of the air itself. As Schaffer and Shapin have shown, the experimental demonstration of the spring of the air formed one of the key epistemological debates surrounding the creation of the British scientific community.[123] In 1739, for instance, John Huxham (c. 1692-1768), an English physician and contemporary of Pringle, dedicated a work on fever to the Royal Society. Among the factors, listed in the introduction, which a physician should attend to when considering the effects of the air, were the following:

> The Air ought not only to be free from noxious Vapours, but of a just Degree of Gravity and Elasticity, that it may distend the Lungs sufficiently, and yet not oppress them by an Overload—for though robust Persons easily enough bear

---

[122] John Pringle to Dr. Robert Whytt, London, 28 Oct 1762, Letters of Sir John Pringle (1707-1782), MS.6867. Wellcome Library Archives and Manuscripts, London.

[123] Shapin and Schaffer (1985), pp. 155-156.

> either a very heavy, or light, Atmosphere, and are healthy on the Top of a Hill, or Depth of a Valley, the Infirm cannot well bear the Change, and therefore ought to be more careful as to these Matters…[124]

While Hales speculated on the meaning of air in relation to health, his work is typically cast as the beginning of a fundamentally new enterprise. According to this account, recently rearticulated by Frederic Lawrence Holmes, the chemical study of air became possible through Hales' development of the pneumatic trough. Pneumatic chemistry, closely related to physics and medicine, belonged to natural philosophy rather than specifically to chemistry. It did not take its meaning from trades such as metallurgy or pharmacy, nor was it defined by academics, but was practiced within the community of British natural philosophers. It was separate from the "pharmaceutical, mineral, and analytical chemistry" characterizing a "continental tradition" whose main focus was salt chemistry.[125]

Pneumatic chemistry, understood as a distinct area of experimental inquiry, is seen most clearly from the retrospective viewpoint of the chemical revolutions of the late eighteenth century: the struggle between the phlogiston theory supported by the English theologian Joseph Priestley, and the oxygen theory of Antoine Lavoisier and his French collaborators. Holmes argues that before Priestley, phlogiston theory, which posited a chemical principle underlying processes such as calcination, combustion, and fermentation, was characterized by orthodoxy—various theorists differed mainly "in their assertions about the underlying nature of phlogiston." Priestley's chemical work, beginning with his presentation of a series of experiments before John Pringle's Royal Society in 1772, transformed phlogiston into a different thing entirely.[126] The overthrow of

---

[124] Huxham (1759), pp. iv-v.
[125] Holmes (2000), pp. 737-738.
[126] Holmes (2000), pp. 736-737.

phlogiston by French chemistry, which involved the assimilation and reinterpretation of several of Priestley's key experimental findings, produced a synthesis between the continental tradition and British aerial chemistry.

Holmes's argument, it seems to me, relies on a clear distinction between Priestley's theologically-oriented matter theory, deemed characteristic of the autonomous, pluralistic milieu of natural philosophy, and an older "continental" chemical tradition promulgated, for instance, through the universities. Others, such as Henry Cavendish and Stephen Hales, who were independent philosophers without close ties to academia, are assimilated into the former category. Trained at the university and deeply knowledgeable in pharmacy, Pringle seems to fall quite clearly into the latter, especially since Holmes dubs William Cullen, Pringle's contemporary at Edinburgh, a continental chemist. Pringle's idiom was certainly the language of acids, alkalis, and salts, taught within the distinctly pharmaceutical framework of the medical college.

With this in mind, we may turn our attention to a remarkable passage in Pringle's experimental accounts. He held the common view that air was a basic substance into which other elements, such as putrid effluvia, might be mixed. Like other philosophers, then, he was faced with the implication that the air released during putrefaction was not air alone, but combined with some other putrid effluvium. Though he did not speculate at length on the chemical nature of this putrid substance, the following observation is rich in meaning:

> we may from thence conclude, that the effluvia issuing from corrupt substances chiefly consists of the phlogiston, or sulphur-principle; since these effluvia so readily unite with and volatilize the acids; as appears by the increase and particular change of the smell. But, it will be proper to remark, that from a simple putrid substance, the phlogiston does not rise alone, but combined with the saline parts of the body. For this principle, when single, is perhaps imperceptible to the

> smell, and when divested of these salts, is never so far as we know, pestilential. So that the deleterious particles of rotten substances seem to consist in a certain combination of the sulphurous with the saline principle, which not only become the most irritating to the nerves, but act on the humors as a putrid ferment in promoting their corruption.[127]

Pringle identified phlogiston with sulphur, precisely as Georg Ernst Stahl (1659–1734), the theory's originator, had defined it.[128] Stahl had developed the idea of a principle underlying combustion, in part, through an experiment involving the precipitation of sulphur using vitriolic (sulphuric) acid. Phlogiston was identified as a true sulphur principle along the lines of Paracelsus's theory of elements, whereas common sulphur was a compound of phlogiston and vitriolic acid. Phlogiston was "agile and volatile" and "elastic." It was associated with the smell of spirit of vitriol, the vapour of wine cellars, and various other aerial effluvia.[129]

Pringle appears to have been reasoning along similar lines in the passage quoted above. The effluvia he described had been produced by dropping spirit of vitriol onto a small piece of corrupted beef, as well as corrupted blood. Instead of "allaying the foetor", this "rather increased it", though the odour was "changed into such as arises during the precipitation of brimstone (by an acid) in a lixivial menstruum." His footnotes point to Boerhaave and to Stahl. Pringle maintained that phlogiston alone was harmless; deleterious putrid vapours consisted of a "certain combination of the sulphurous with the saline principle."[130]

Hales, who speculated on phlogiston in the period between Stahl and Pringle, also reasoned along similar lines. He did not, however, specifically invoke the phlogiston concept. Rather, his

---

[127] Pringle (1752), pp. 418-419.
[128] Chang (2002), pp. 48-49.
[129] Chang (2002), pp. 50, 45.
[130] Pringle (1752), pp. 418-419.

concern was for the relative elasticity of air—a property he believed proportional to its fitness for breathing. Elasticity as a property of air had come to the attention of philosophers following the discovery of atmospheric pressure in the seventeenth century. As a graduate of Cambridge, who flourished during Newton's ascendancy at the Royal Society, Hales's thinking about air was guided by the 31st query of the *Optics* which hypothesized attractive and repulsive forces underlying various observed chemical phenomena.[131] His *Vegetable Statics* made frequent reference to Newton's work. Associating air's elasticity with a fundamental repulsive force in nature, he noted:

> If all the parts of matter were only endued with a strongly attracting power, whole nature would then immediately become one unactive cohering lump; wherefore it was absolutely necessary, in order to the actuating and enlivening this vast mass of attractive matter, that there should be every where intermixed with it a due portion of strongly repelling elastick particles, which might enliven the whole mass, by the incessant action between them and the attracting particles.[132]

Such considerations shaped Hales's thinking about air. Processes known to render it unbreathable, such as a burning candle or an animal breathing in an enclosed vessel, filled the air with "acid sulphurous" particles, destroyed the elasticity of some particles, while clogging and retarding the "elastic motion" of others.[133] Prolonged breathing of a quantity of air was shown to diminish its volume—evidence of a loss of elasticity. In one notable experiment, Hales allowed rebreathed air to pass through several filters soaked in sal tartar (sodium tartrate) and sea salt ("strong imbibers of sulphurous streams") as well as white wine vinegar ("looked upon as a good anti-pestilential). Doing so nearly trebled the amount of time he was able to rebreathe the air

---

[131] Guerlac (2008), pp. 41-42.
[132] Hales (1727), p. 313.
[133] Hales (1727), pp. 272-273; Holmes (2000), pp. 738-739.

when compared to the same experiment without the filters. The diaphragms dipped in sal tartar also increased in weight, having absorbed the sulphurous fumes.[134] Hales's publication of 1727 had therefore assigned an experimentally derived chemical identity to the vapours produced by respiration.

Hales's discovery of the significant quantities of air fixed in solid matter inspired a great deal of speculation concerning the role of air in the body. Boerhaave investigated the ways in which air combines with matter and drew implications relating to the putrefaction of animal bodies.[135] Pringle's long-time correspondent Albrecht von Haller suggested that air, fixed within the body, was the "true cement", whose purpose was to bind the body's solid particles together.[136] In 1756, Joseph Black, discussing his experiments into alkaline earths, speculated that fixed air, though harmful to breathe, was beneficial when it formed part of food in its non-elastic "fixed" state. Once liberated by the digestive process it formed part of the fluids and tissues.[137]

Joseph Black's characterization of fixed air as a substance chemically distinct from atmospheric air, along with Pringle's notion of antisepsis, created interest in exploring the manner in which the chemical properties of air affected health. The natural philosopher William Brownrigg (1711-1800), with whom Pringle shared a long correspondence over the 1760s, and Pringle's London friend Henry Cavendish, both investigated the fixed air contained in mineral waters. Both attributed the widely acknowledged healing qualities of these medicinal waters, in part, to their aerial content. Both were awarded Copleys in 1766, Brownrigg for his work on the "Mineral

---

[134] Hales (1727), pp. 262-270.

[135] Kerker (1955), p. 47; Boerhaave (1735), p. 305.

[136] Macbride (1764), p. 28, citing Albrecht Haller (1757), *Elementa physiologiae corporis humani*, vol. 1, ch. 1, pp. 28; 235.

[137] Donovan (1975), pp. 191-192.

Elastic Spirit or Air contained in Spa Water", and Cavendish for his "Experiments relating to Fixed Air". Brownrigg also investigated "fire damps" and "choke damps", the flammable and suffocating airs occurring in mines. He presented his findings to the Royal Society in the early 1740s.[138]

The most thorough exploration of Pringle's concept of antisepsis using the tools and techniques of aerial chemistry came from the Irish-born naval surgeon-turned- physician David Macbride, whose investigation into putrefaction was entitled *Experimental essays on the following subjects: I. On the fermentation of alimentary mixtures. II. On the Nature and Properties of Fixed Air. III. On the respective Powers, and Manner of Acting, of the different Kinds of Antiseptics. IV. On the Scurvy; with a Proposal for trying new Methods to prevent or cure the same, at Sea. V. On the Dissolvent Power of Quick-Lime* (1764). [139] Subsequent editions were renamed *Experimental Essays on Medical and Philosophical Subjects*. The *Experimental Essays* promised a "new theory for explaining the immediate cause of that degree of putrefaction, which often takes place in the living body".[140]

Macbride's experiments built on Black's discovery of the unique properties of fixed air.[141] They were also a refinement of Pringle's earlier putrefaction experiments. Where Pringle's overriding purpose had been to clarify the processes of putrefaction and fermentation while establishing antisepsis, Macbride used this conceptual framework to further investigate Pringle's observations about air, noting: "It also appears pretty plain, from Dr. Pringle's experiments, that there is

---

[138] Tomory (2010), pp. 2-4. Tomory argues that Brownrigg's views on air, though not widely disseminated, may have anticipated Joseph Black in positing air that was chemically distinct from atmospheric air.

[139] Macbride (1764), pp. xii-xiii.

[140] Macbride (1764), p. ix.

[141] Coley (1982), pp. 129-133.

somewhat generated, or set free, during the first stage of the fermentation of animal and vegetable mixtures, which hath a power of correcting putrefaction."

Macbride's experiments, which he undertook in several "courses", incorporated a larger sample of alimentary mixtures, and described the stages of decay in greater detail than had Pringle, in order to describe the alimentary process of fermentation. As in Pringle's experiments these alimentary mixtures were placed in stopped containers and kept at body temperature while their "intestine motion" was observed. Macbride described the decomposition of various substances in a detailed series of tables that recorded his observations through time.[142]

[142] Macbride (1764), pp. 4-5.

Table I. Of ALIMENTARY MIXTURES.

Mixtures of	At the end of 6 hours.	At the end of 22 hours.	At the end of 30 hours.	At the end of 46 hours	After 54 hours.	At the end of 4 days.
(1) Bread and water.	Shews no ſign of inteſtine motion.	Still remains perfectly quiet.	Still at reſt.	Still at reſt.	Still at reſt.	A ſourneſs now perceivable.
(2) Bread, mutton, and water.	Fermentation fairly begun; ſmell of the mixture perfectly ſweet.	Fermenting now very briſkly.	Briſk; the ſmell of the mixture perfectly ſweet and a little pungent.	Briſk and ſweet; much froth at top.	Briſk and ſweet.	Fermentation appeared to be now very ne over; liquor ſweet, both to the ſmell and taſte.
(3) The ſame, with freſh juice of lemons.	In briſk fermentation; perfectly ſweet; ſmell of the lemon juſt perceivable.	Very briſk; immerſed a ſmall bit of putrid mutton in this mixture.	Briſk; no ſmell now perceivable in the bit of putrid mutton, but that of the mixture.	Still fermenting; the liquor clear and ſweet; removed the bit of mutton and hung it up to dry, it being perfectly ſweet.	Motion ſtopt; the bit of mutton dried and ſweet.	Diſtilled this mixture; an almoſt inſipi phlegm, with rather vinous, than an acid taſte, was the produce
(4) The ſame, with ſpinage.	In briſk fermentation; a heavy kind of ſweetiſh ſmell, not unlike that of the fenugreek ſeed.	Very briſk; ſuſpended a little bit of putrid mutton in the phial, ſo as not to touch the mixture.	Briſk; no ſmell in the bit of mutton, but that of the mixture.	Fermentation appeared to be almoſt over; liquor clear and ſweet; removed this, and the phial with lemon-juice, to a cool place, and corked them cloſe; hung up the mutton.	Motion ſtopt, the bit of mutton dried and ſweet.	The ſmell of this mixture, before diſtillation, was a little inclinable to the cheeſy, and the phlegm obtained by diſtillation had a ſmall degree of pungency, with the ſame rancid flavour.
(5) The ſame, with water-creſſes.	Motion not ſo briſk as in the two laſt, but conſiderably more ſo than in the ſimple mixture; ſmell of the herb but barely perceivable.	Very briſk; poured half an ounce of freſh ox-gall into the phial.	Not ſo briſk as in the morning; perfectly ſweet.	Liquor clear and ſweet; ſtopt the phial well, and removed it to a cool place; the mixture taſted a little of the gall.	Motion ſtopt.	This mixture was ſweet, with the fenugreek flavour.
(6) The ſame, with ſome *putrid* animal liquor.	Motion greater in this phial than in any of the others, with a thick ſcum and froth on the ſurface; not the leaſt ill ſmell to be perceivable, tho' the putrid liquor was exceedingly offenſive when firſt added.	Very briſk; tho' in the coldeſt place of all the phials. (Every one of the mixtures were now perfectly ſweet, and had loſt the peculiar ſmell of the herbs, &c.)	Briſk and ſweet.	Still in briſk fermentation, and ſweet.	Removed the phial, and ſtopt it cloſe; fermentation now almoſt over.	The mixture was now upon the turn; a little ſourneſs juſt perceivable.

To face page 5.

Figure 5. Table from David Macbride's *"Experimental Essays…* (1764), pp. 4-5.

Macbride's meticulous observations, permitted him to define several stages of fermentation, (sweet, sour, and putrid), and to associate these stages with the release of an aerial element, a "subtile gas", by the digestive process.[143] This aerial intermediary accounted for the interaction between fermenting vegetable matter and putrefying animal food that Pringle had observed in his experiments.[144]

> animal substances when alone, and the substance of vegetables when alone, do not part with the air without some reluctance; but that when the two are mixed

[143] Macbride (1764), pp. 9-11.
[144] Macbride (1764), pp. 4, 129.

> together, under certain conditions, that then an attraction begins, which presently throws off the air that so closely adhered to each of them in a separate state; and this air, in the moment of its extraction, resuming its elasticity, destroys the union of the minute particles, and, in producing an intestine motion, totally changes the nature of the body in which it was fixed, by allowing a new disposition and a different combination, to take place. [145]

Macbride therefore recast the septic/antiseptic relationship as essential to life by proposing an internal economy of antiseptic air. He argued that a "principle"

> forming the cement or bond of union, among the insensible particles, is to be held as the immediate cause of firmness and perfect cohesion in those bodies, wherein it enters the composition, and is to be regarded as the thing that prevents their dissolution or decay.[146]

A third course of experiments was devoted specifically to observing the production of air in various alimentary mixtures—a process that Pringle had not investigated. He showed, for instance, that the air given off from putrefying meat was chemically equivalent to Black's fixed air.[147] This aerial cement, a concept anticipated by both Hales and Haller, was believed to buoy up the tissues against the variable pressure of the air.[148] With the loss of fixed air

> the other constituent particles, the earthy, the saline, the oily or inflammable, and the aqueous, being thereby put in motion, immediately begin to exert their several repulsive powers, and run into new combinations, which first change, and at length destroy, the texture of the substance they formerly composed…

Following Black's discovery of the relationship between the release of fixed air and alkalinity, Macbride affirmed that putrid substances were necessarily alkaline owing to the loss of this vital

---

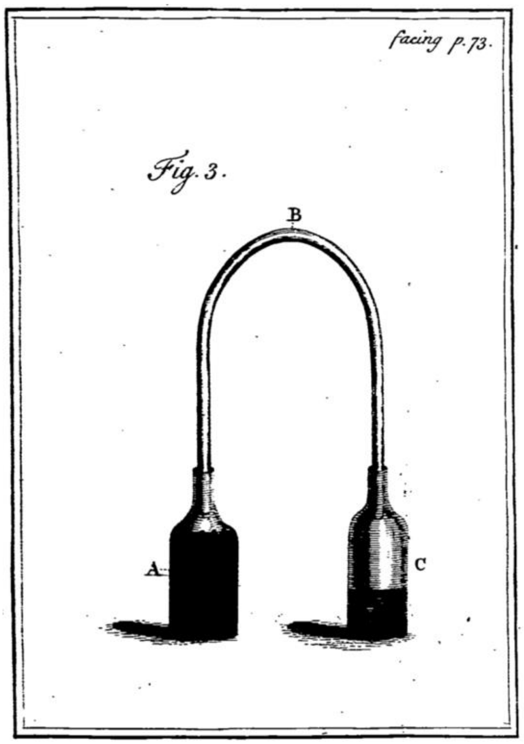
[145] Macbride (1764), p. 37.
[146] Macbride (1764), p. ix.
[147] Macbride (1764), pp. 70-72.
[148] Macbride (1764), pp. 65-66.

air.[149] In doing so, he added further evidence refuting Pringle's earlier claim that putrefaction did not produce alkalinity—a point that Pringle had earlier conceded in the third edition of his *Observations*.

Macbride's work extended Pringle's investigations of septic and antiseptic substances beyond the traditional pharmacopoeia and into the aerial realm by demonstrating, for instance, that the air given off from putrefying meat precipitated limewater and was thus chemically equivalent to Black's fixed air.[150] He also showed that fixed air was capable of retarding, or even preventing, putrefaction; he found, the most "sparkling and brisk" of the fermented liquids to be effective antiseptics.[151]

---

[149] Scott (1970), pp. 48-50. Macbride (1764), pp. 96- 97.
[150] Macbride (1764), pp. 70-72.
[151] Macbride (1764), pp. 143-147.



Macbride's experiment number 16. Two ounce phial (A) contained fresh mutton cut up into pieces and mixed with water. Phial (C) contained a drachm of Spirit of Sal ammoniac, a caustic liquid made by distilling quicklime with sal ammoniac (ammonium chloride). Left to putrefy for a fortnight, phial (C) was removed from the apparatus. A drop of spirit of vitriol produced a violent effervescence.

This experiment demonstrated that putrefaction meant the loss of fixed air which was absorbed by the caustic liquid in the second vessel. It reveals the extent to which advances in aerial chemistry permitted the study of antisepsis and putrefaction within the body.

Figure 6. Illustration from David Macbride's *Experimental Essays…* (1764), pp. 72-73.

Several years after Macbride published his experiments, Joseph Priestley would take his aerial investigation of the relationship between air and disease in new directions. The "Observations on Different Kinds of Air" (1772), for which he won the first Copley Medal awarded during Pringle's presidency, included a long chapter called "Of Air Infected with Animal Respiration and Putrefaction." This recounted a series of experiments into the chemical nature of putrid effluvium which he collected primarily from putrefying mice.[152] Like Pringle, he identified the "proper effluvium" primarily by its stench. When this work was revised and published as the *Experiments and Observations on Different Kinds of Air*, however, the following passage was

[152] Priestley (1772), pp. 188, 190.

added: "... thus air, which I at first distinguished by the name of *the putrid effluvia*, is probably the same with fixed air, mixed with the phlogistic matter, which, in this and other processes, diminishes common air."

Priestley's experimental work on air placed noxious effluvia amid a series of phlogistic processes including putrefaction, fermentation, respiration, calcination and combustion.[153] While his innovative experimentation using the pneumatic trough provided him a basis for his claims, this part of his doctrine, at least, seems to have confirmed a relationship that had already been considered. Pringle's speculation about the role of air, cursory and peripheral though it might have been, was simply an earlier contribution to an ongoing discussion.

Priestley's reasoning on phlogiston was closer to that of the natural philosopher Stephen Hales than to the "continental" theorists, Stahl and Pringle. He both elaborated and modified phlogiston theory with his experimental investigation into the nature of different airs, particularly, as Holmes points out, when he encountered inflammable and dephlogisticated air. His underlying reasoning, and more obviously the purpose driving his investigation, nevertheless had a great deal in common with that of his predecessors.

Characterizations of the emerging experimental interest in air that focus on the Chemical Revolution rightly identify a new set of experimental practices driving the study of air (though some pneumatic chemists, like Joseph Black, did not use the pneumatic trough). Despite Pringle's friendship with Hales and knowledge of his experimental procedures for capturing air,

---

[153] See p. 212.

he did not collect or study the air given off in his own experiments. On occasion, he would note that an experiment produced "some" or "a vast quantity" of air, but nothing more precise.[154]

When one frames pneumatic chemistry in terms of the problems and goals that drove it, one uncovers continuity in thinking about air and its fitness for respiration emerging much earlier than the pneumatic trough. As we shall see in the final chapter, the careers of Pringle and Priestley were intertwined to such an extent that one might consider the influence of Pringle's earlier association of phlogiston with effluvia on Priestley's experimental reasoning. To a historian focused mainly on the details of chemical experiment, Pringle (whom Holmes tellingly misidentifies as a surgeon) remains hidden in plain sight.

The following chapter will examine some of the common characteristics and motives of those who explored the relationship between air and disease. For an increasing number, natural knowledge promised a material reward, if only through an opportunity to advance oneself on the ladder of patronage.[155] Reputations could be made, and fortunes earned, through proposing or abetting efforts at improvement. Of particular interest are the cultural anxieties underlying "projecting", particularly the fear of self-interested, incompetent, and destructive innovation. Pringle, well-educated and well-connected, was in many respects, the antithesis of the projector, yet he also sought a public hearing for his effort to improve military medicine.

Pringle established his reputation in an area of widely-acknowledged importance—the problem of putrid illnesses that affected those who ran the ships and fought the wars that sustained and expanded the early modern state. One may trace the upward trajectory of his career in London

---

[154] Pringle (1752), p. 384.
[155] Porter (1982), pp. 69-82.

from the point at which he first established himself in the early 1750s as an authority on putrid illness by contributing to a well-established effort to understand and prevent outbreaks of fever.

Chapter 4: Improvement in Eighteenth-Century Britain

Considered together, the range of diseases attributed to a putrid cause constituted an area of great interest to the landed ruling class that continued to lead the Army and Navy, as well as the broader community for whom the military meant identity, prestige, jobs, and commerce. This chapter will explore the problem of putrid disease as it confronted natural philosophers in eighteenth-century Britain, above all, as an opportunity for distinction and advancement. The emergence of Baconian natural philosophy in the seventeenth century, which emphasized the value of natural knowledge to society, presented incentives to develop improving schemes, typically of value to those in the higher orders. The study of the relationship between air and disease appears alongside prominent areas of inquiry, including the search for a solution to the problem of longitude, or a solvent for the stone, that promised philosophical acclaim and financial reward.

Efforts to bring useful work to the public view in order to solicit the attention of patrons evoke the contemporary archetype of the “projector”—a figure of fun, at once incompetent and insolvent. Pringle’s interventions for preventing outbreaks of disease shared certain characteristics with the eighteenth century project in so far as they provided technical solutions to a problem of interest to his military patrons and were disseminated through the public sphere. Where a projector might seek a patent or pursue a prize, Pringle sought advancement in the Army and at court.

The stereotype of the projector points to the nature of philosophical credibility, especially access to patronage.[1] Pringle's place as a personal physician to the Duke of Cumberland lent legitimacy to his status as a witness among the philosophers of the Royal Society.[2] His work, presented in the form of a philosophical treatise, was greeted by the Royal Society as an exemplary Baconian case of experimental knowledge placed in the service of the public good.

Whereas in continental states such as Austria-Hungary, Prussia, and Sweden, medical bureaucracies were sanctioned by the state to improve the health of citizens through standardizing regulations, gathering data, and implementing hygienic reforms, similar initiatives in Britain functioned, like much of government, at the behest of local authorities and through commercial initiatives. This created a space into which mechanics and philosophers with improving schemes could insert themselves.[3] The British military provided an important setting for such efforts as an institution in which the governors exercised control over the bodies of the governed.[4]

Over this period, British finance and administration underwent institutional changes that permitted Britain to shoulder a greater burden of military commitments than any other power in Europe relative to its size. According to John Brewer's interpretation, Britain's military success was made possible by bureaucrats who managed "tax accounts, inventories of supplies, financial statutes, tables of revenue and trade, rules governing the borrowing of money and the purchase

---

[1] Biagioli (1993), pp. 58-59.
[2] Dear (1985), pp. 156-157.
[3] Porter (1999), p. 54-55.
[4] Nenadic (2010), p. 229-239.

of equipment."[5] While France bankrupted itself into revolution, Britain's credit remained good, and its citizens acquiesced to higher taxes than their continental neighbours. We may associate Pringle's rise within the military with this process of administrative evolution since he addressed an area of potential importance to the British Empire. He was, from this perspective, another Enlightenment technocrat employed in the service of empire.

Eighteenth-century historians have invoked the Foucauldian notion of "biopolitics"—the use of technology in the service of state power—in describing the emergence of certain eighteenth-century initiatives such as political arithmetic. Pringle's antiseptic measures could be viewed within this frame.[6] Much like the prisons of the 19th century, they formed part of an effort to discipline the bodies and habits of individuals as the Hanoverians sought to regularize the military. Likewise, Pringle's study of the impact of climate and environment promised a more precise and predictive understanding of the factors determining the health of individuals living in close proximity.

Pringle's efforts addressed a major problem facing British empire-builders. An army that spent significant time encamped in the field, in close quarters, or confined in transport ships, could expect to lose many more men to illness than to combat. A major outbreak could end a campaign. In 1741, a major attack on the port of Cartagena was hamstrung by fever among poorly provisioned British soldiers and sailors. Illness also claimed its Commander-in-Chief, General Charles Cathcart, 9th Lord Cathcart (1685/6-1740), and his physician George Martine (1700-1741), a prominent member of the Scottish medical community who had recently been

---

[5] Brewer (1989), pp. xiii, xvi.
[6] Rusnock (1999), pp. 50-51.

granted an honorary membership to the RCPE. Likewise, when an invasion under George Keppel, 3rd Earl of Albemarle (1724-1772), captured Havana from the Spanish in 1762, an epidemic of yellow fever killed thousands of soldiers, ending plans for an invasion of Florida.[7]

Along with camp diseases such as typhoid fever and dysentery, scurvy was also considered an epidemical fever of putrid origin.[8] No fleet could remain at sea for a significant length of time without suffering casualties from scurvy. During the Seven Years War, British soldiers in North America suffered enormous casualties every winter when supplies of fresh vegetables ran out. Scurvy was so devastating to military efforts that it was seen as a problem on the order of Longitude.[9]

Pringle directed his text, in part, to military officers who exercised great personal prerogative in directing and equipping their subordinates.[10] It reflected the priorities of a state run by a narrow elite with a virtual monopoly on government, whose energies were focused on advancement, fortune, and the demands of administering, defending, and increasing empire.[11] Eighteenth-century Britain saw a significant growth of its military, expansion of its empire, and nearly constant war that transformed it into a major European power over the period from about 1660 to 1760.[12] Consuming 80% of total government expenditures between 1688 and 1815, the military provided employment to the poor, meaning and money to the aristocracy, and secured a vast

---

[7] Kopperman (2007), pp. 63, 75.
[8] McBride (1991), pp. 158-159; Lawrence (1996), p. 83.
[9] Kopperman (2007), pp, 70-71.
[10] Guy (1985), pp. 137-152.
[11] Brewer (1989), xvii- xxii; Porter (1990), p. 120.
[12] Brewer (1989), p. xiii.

commercial empire that supported those in between—historians of the period commonly refer to as a “fisco-military” state.[13]

Even with the increasing bureaucratization of finance and the military, British institutions were dominated by aristocrats and the landed gentry who monopolised public offices, and controlled patronage, appointing allies and clients who jockeyed for position in the ranks beneath them.[14] Pringle’s role as a physician in the military straddled the characteristically indistinct boundary separating public office from personal allegiance that typified early modern patronage networks. His office was announced in the London papers as: Physician General to the Commander in Chief of his Majesty's Forces in the Netherlands.”[15] The nature of political authority in Britain dictated that attempts by Pringle and his allies to prevent fever within the military remained largely confined to the initiative of exemplary officers. [16]

His first military commission was a considerable one, carrying its own limited powers of patronage. While most medical men in the military entered as surgeon mates or surgeons, Pringle’s appointment in 1742 as Physician General to the British Army in the Low Countries gave him control over the management and provision of the hospital system for British forces under Stair’s command—16,000 soldiers went to campaign in the Low Countries in 1742. He shared overall control of the medical establishment with a medical board consisting of a Surgeon General and an Apothecary General, all of whom were part of the general staff of the Commander-in-Chief.

---

[13] Hellmuth (2002), p. 21.
[14] Porter (1990), p. 58.
[15] *London Evening Post*, July 20,1742, Issue 2293. Burney Collection of Newspapers.British Library/ GALE Digital Collections.
[16] Lawrence (1996), pp. 93-94.

Pringle became a medical authority on fever having negotiated several broadly-defined contexts: Enlightenment Edinburgh, where the intellectual background of his work on epidemic fever lay among the local medical community; London, where much authority to bestow credit on improving schemes rested with the Royal Society and the Royal College of Physicians of London; and the British Army, which facilitated the development of his project in an area traditionally associated with the crown and aristocracy.

In Scotland, where institutions were managed by a small group of aristocrats, many of whom were virtuosi, the pace of change was rapid due to the overhaul of public institutions, notably the universities. In England, the urban public sphere played a greater role, particularly in London, the centre of patronage for all of Britain. As with many Scots, military connections facilitated a move to London. Pringle's entry into the Royal Society in 1745, which preceded that move by several years, coincided with his attachment to Cumberland and the latter's victory over the Jacobite Rebellion—a victory shared by Pringle's Lowland connections . Pringle did not, however, become a notable figure in London until an outbreak of fever permitted him to demonstrate the value of his observations on disease to the London public.

Dramatic outbreaks of fever punctuated urban life in Eighteenth-Century Europe.[17] While the period between 1700 and 1830 did not see a major epidemic in London, smaller outbreaks were frequent.[18] A notable occurrence of gaol fever in 1750 permitted Pringle to couple his military observations to the reform of Newgate Prison from which the outbreak was believed to have

---

[17] Szreter (1988), pp. 18-33. For a detailed argument attributing declining mortality in the nineteenth century to the interventions of the public health movement.

[18] Hardy (1993), p. 65.

emerged. In doing so, he associated his existing project with a growing concern for the urban landscape that was developing among philanthropists and reformers in Britain's cities.[19]

As eager readers of the *Spectator* such as James Boswell knew, London coffee houses and periodicals provided a stage for public self-fashioning and self-promotion.[20] The episode involving Joanna Stephens's medicine was a public show of munificence led by philosophers. Whereas Stephens would have been considered an empiric, those, such as Stephen Hales, who investigated her newly-publicised cure did so as philosophers seeking the public's benefit. The affair unfolded in newspapers, tracts, and parliamentary debates. Contributors to the fund, including numerous London notables, were listed in the newspapers along with the amount donated. While the full £5,000 amount was not raised privately, the effort generated sufficient interest within parliament to purchase Stephens's secret.[21]

The well-to-do involved themselves in these public affairs for a variety of reasons. In some cases, inventions promised commercial advantage to oneself and the public.[22] In others, the goal was to establish a public reputation for the benevolent management of those subject to one's prerogative, for instance, to demonstrate one's suitability for public office, or simply to polish an already substantial public reputation.[23] By proposing such schemes, the philosophical intelligentsia, of whom Pringle became a prominent member, served the interests of the powerful. In examining the early stages of his career, we see the extent to which his work

---

[19] Lawrence (1996), p. 83-84.
[20] Brewer (1997), pp. 31-34. Levere and Turner (2002).
[21] Casteel (2007), pp. 257-258.
[22] Yamamoto (2012), pp. 378-378; 383-384.
[23] See, for instance, the various projects propose by Defoe relating for the care of pensioners, fools, and seamen. Defoe (1697), pp, 146, 178, 191.

reflected the circumstances of a lowland scholar willing to serve the ambitions and interests of Scotland’s London-appointed administrators.

4.1 The Improvement of Scotland

The transformation of Scotland from a relatively poor and underdeveloped country to a centre for commerce, manufacturing, and education, took place over a relatively short period from the end of the seventeenth century to the middle of the eighteenth.[24] It has been assigned a number of causes, from a response to the terrible famines of the 1690s and the financially disastrous and demoralizing Darien fiasco, to the loss of political autonomy following the Acts of Union in 1707, to the opening of new lands to exploitation by acquisitive Englishmen and Lowland Scots following the failed Highland uprisings of 1715 and 1745, to the more widespread use of coal in manufacturing after centuries of deforestation.[25] Here, I investigate the motives of those who managed this process, as well as John Pringle's prominent place within that process, particularly the effort to reform the Universities.

The early Scottish Enlightenment was planted and nurtured by powerful aristocratic managers, in large part through the renovation of civic institutions such as the Scottish universities. Scottish politics during the 1680s had seen many changes made by the Jacobite supporters of James II & VII. After 1688, these were displaced as Presbyterians were swept into public office. After 1714, all significant appointments, including those made to the universities, were either managed, or at

---

[24] Wood (2006), p. 183-185.

[25] Clow & Clow (1952), pp. xiii-xiv, 4-11; Schama (2001), pp. 388-393. Pringle was born in a period when the pitfalls of this "age of projecting" would have been alive in many Scottish memories—particularly those of the well to do. 1699 had seen the Darien debacle which had ended with the loss of much of Scotland's wealth. A scheme to found a trading colony in an imaginary kingdom of peace and plenty in the West Indies, promoted by the leaders of the Company of Scotland, had attracted vast investment. It ultimately lured over two thousand Scottish settlers to their deaths in a malarial swamp on what is now the Caribbean coast of Panama.

least approved, by politicians loyal to the Hanoverians.[26] Like Pringle's own family, the Campbells of Argyll benefitted from their loyalty to the new regime.

Archibald Campbell, Third Duke of Argyll was a force behind this process. He was, notably, a prominent figure within the Scottish community of virtuosi who cultivated astronomy, chemistry, and botany—Argyll may, for instance, have chemically investigated Mrs. Stephens's medicine even before her recipe was made public.[27] Argyll was, above all, a powerful patron. Following his death, a contemporary source estimated that "he at moderate computation settled fifty-four thousand individuals in civil and military employments."—a figure that is, surprisingly, within the realm of possibility.[28]

Argyll was also an "improver", both in the more conventional sense that he took a significant interest in developing new techniques of husbandry and agriculture through managing his own estates, but also in that his political power permitted him to develop mining, manufacturing, and trade across Scotland. In the ethos of the Lowland Scottish aristocrats who managed the country on behalf of London, those enterprises were closely related. In 1743 the introduction to *the Transactions of the Honourable Improvers in the Knowledge of Agriculture in Scotland*—one of only two societies to which the Duke belonged—claimed:

> … Trade and Commerce… can only flourish as Husbandry, the Foundation on which they are built, succeeds. Trade has indeed multiplied the Number of Rich, and made our Land-Estates infinitely more valuable; but still Husbandry must

---

[26] Emerson (2004), p. 186-187.

[27] Emerson (2013), p. 142.

[28] Emerson (2013), p. 349. Citing: Anonymous, 'A Letter to the Author of the North Britain… with a Striking Character of Lord BUTE and of Archibald, late Duke of Argyll' (London, 1763).

> furnish the Materials for Trades, as Husbandry is the Stock, and Trade only the Improvement of it.[29]

Argyll developed two Scottish estates. One of these, 1000 acres of boggy wasteland in Peebleshire dubbed “The Whim”, was a vast experiment in reclaiming marginal land for agriculture, trying new crops and stock, and organizing his workforce. It received much attention from the Honourable Improvers. He promoted a long list of like-minded figures involved in improving agriculture and industry to court and administrative positions.[30] He was also an accomplished botanist and kept several impressive gardens at his various properties. [31]

While the Scottish parliament up to 1707 had sought to promote trade throughout the early modern period, the seventeenth and particularly the eighteenth century saw a consolidation and intensification of these efforts, best exemplified by the Scottish mercantilist William Paterson’s pamphlet *Proposals and Reasons for Constituting a Council of Trade* (1701). Argyll had a major hand in creating the Board of Trustees for Fisheries and Manufactures (1727), a somewhat more modest body than Paterson had envisioned, which subsidized nascent industries and improvements to existing ones. Argyll was also involved in founding the Royal Bank of Scotland (1727), intended to expand the money supply.[32] The cornerstone of the improving efforts of the Scottish aristocrats involved the development of the universities. Pringle, as one of the many wealthy younger sons who did not inherit property, was among the beneficiaries of this process.

---

[29] Emerson (2013), pp. 239-242. Citing: Robert Maxwell. *Select Transactions of the Honourable Society of Improvers of the Agriculture in Scotland*. (Edinburgh, 1732), pp. iii-xvii.

[30] Emerson (2009), pp. 25-29.

[31] Emerson (2013), pp. 149-162.

[32] Emerson (2013), pp. 227-239.

As noted, the establishment of an expanded medical faculty at Edinburgh in 1726 was a deliberate effort to replicate the success of Leiden University where many of Scotland's elite had studied. This was itself a commercial endeavour to attract non-Anglican students from across Britain who would otherwise have spent their money in Europe. The appointment of the new professors was largely intended to inculcate practical knowledge in areas such as chemistry, botany, anatomy, and midwifery, which had hitherto been the purview of extramural teachers. Almost all appointments during a period lasting roughly from 1725 to1760 were controlled by Argyll's political faction.

The "ethos of improvement", which had taken hold in the late seventeenth century, was especially important to encouraging mathematics and the natural sciences generally.[33] This motivated the recruitment of the chemical professor William Cullen and his successor Joseph Black. Cullen had sought to establish chemistry as a subject appropriate for the gentlemanly improver, partly in order to "distance himself from suspicions that he was a projector, driven by private ambition or greed."[34] Both were paid by the Board of Trustees for Fisheries and Manufactures to work on sulphuric acid and sal ammoniac production, as well as on the development of bleaches and dyes for the linen industry.[35] Much the same was true of other powerful figures in Scotland during this period. Sir John Clerk, 2nd Baronet of Penicuik (1676-1755), hired the mathematical professor Colin MacLaurin—possibly another Argyll appointee—to design drainage and ventilation systems for his coal mines.[36]

---

[33] Wood (2006), p. 185.
[34] Golinski (1992), p. 36.
[35] Clow and Clow (1952), p. 177.
[36] Emerson (2009), p. 18.

Pringle's position as Edinburgh professor of "pneumatics" and moral philosophy is notable in this regard. The concept of "Pneumatics", difficult to define in modern terms, was grounded in the matter-spirit duality through which many early moderns understood divine beings to operate within the sensible realm. This distinction lay at the core of Boyle's apology for natural philosophy and was adapted by Newtonians to reconcile the implications of action at a distance with beliefs regarding divine agency.[37] It was also central to Priestley's heterodox theology, laid out in his *Disquisitions relating to matter and spirit* (1777), in which he attempted to collapse the dichotomy in favor of monism centering on divinely-created active powers.[38]

A contemporary survey of the Edinburgh University lecturers divided Pringle's course on "the pneumatics" into the following parts:

> 1. A physical enquiry into the nature of subtile and material substances as are imperceptible to the senses, and are known from their operations. 2. The nature of immaterial substances connected with matter; in which is demonstrated, by natural evidence, the immortality of the human soul. 3. The nature of immaterial created beings not connected with matter. 4. Natural Theology; or, the existence and attributes of God demonstrated from the light of nature. [39]

Pringle's professorship evidently centred on familiarising Edinburgh undergraduates with the principles through which British natural philosophy promised to circumvent the religious conflict that had characterized the previous century—an orderly cosmos created by a divine being whose existence was integral to natural philosophy.[40]

---

[37] Olson (2004), pp. 96-103.
[38] Brooke (1991), pp. 177-180.
[39] Henderson (1741), p. 373.
[40] Stewart (1992), pp. 7-10.

The connections between Pringle's lectures and the interests of Scotland's aristocratic managers are evident. While Pringle's family connections were doubtless essential in qualifying him for the position (the Pringles of Stichill were not among Argyll's political opponents in 1734) Pringle's appointment would have suited Argyll's political machine in other ways.[41] He was, for instance, a medical graduate of Leiden, an important pedigree for a ruling class educated in Protestant Holland. His Boylean natural religion mirrored the moderate and uncontroversial line preached by Boerhaave in his public addresses. His lectures transmitted the gospel of Baconian improvement embodied in the efforts of Scotland's virtuoso managers, notably including Argyll.

As with other newly appointed faculty, Pringle fulfilled his obligations, in part, through fostering the communities that furthered and promoted Scottish improvement. These were modeled on the Royal Society of London and pursued similar goals. We have noted, for instance, his involvement with the Medical Society, which was centred on members of the medical faculty and aimed, initially at least, at performing observations at the newly-founded Edinburgh infirmary. In 1737, Pringle was also among a small, elite group with whom the Edinburgh lecturer in mathematics, Colin MacLaurin (1698-1746), a prominent Newtonian, shared his plans to found a "society for promoting the Study of Natural Knowledge in this country and for the advancement of the Science… in imitation of those that have been established of late in most Countrys where learning is cultivated."[42]

Several virtuoso landholders also formed part of this group: James Douglas, fourteenth earl of Morton (1702–1768) (then known as Lord Aberdour, later President of the Royal Society),

[41] Emerson (2013), pp. 223-224.
[42] Colin MacLaurin to Sir John Clerk, 2nd Baronet of Penicuik, Edinburgh, May 5th, 1737, in MacLaurin (1982), pp. 71-72.

Charles Hope, first earl of Hopetoun (1681–1742), and Sir John Clerk. All belonged to a community of Edinburgh virtuosi and had formed part of a group that had observed the solar eclipse of 1737.[43] The involvement of such men in the various improving social clubs permitted physicians, lawyers, and other members of the client economy to mingle with their well-heeled patrons. Pringle's engagement with the clubbable atmosphere of Edinburgh high society led, whether directly or indirectly, to his connection to Lord Stair which brought him first into the Army then into London practice.

Pringle's connection to Stair, and consequently to the British Army, provided him access to patronage networks beyond Scotland, and ultimately the means to establish himself in London. In doing so, he was taking part in a well-established institution. An estimated 60,000 Scots served as mercenaries in continental armies over the seventeenth Century.[44] For well-connected Lowland Scots, military service was a very common path to advancement. Alexander Monro's ambitious father, John, had studied with and befriended Boerhaave while serving with the British Army in Europe before opening an apothecary shop in Edinburgh. After joining the Incorporation of Surgeons he quickly became Deacon, and later Deacon Convenor of Trades, on the town council.[45]

For those in the upper echelon of Lowland Scottish society, military service remained a means to exhibit traditional martial virtue. Over the eighteenth century, particularly following the union with England and the rebellions of Jacobites who sought in 1715 and 1745 to restore the Stuart dynasty, service in the British military was an entryway into the imperial British hierarchy. Both

---

[43] Emerson (1979), pp. 155.
[44] Emerson (2009), pp. 1-7.
[45] Emerson (2004), p. 184.

Argyll and his brother, John, served in the Low Countries as commissioned army officers during their youth.[46] During the Jacobite rebellion of 1715, John, then 2nd Duke of Argyll was made Commander-in-Chief in Scotland. Later, many Highlanders, displaced by the violence and appropriations that followed the final defeat of the Jacobite cause in 1745, would journey outwards to take part in the continental and colonial wars of the period.[47]

Pringle's own Scottish family had produced numerous officers. His brother Walter, an officer who also served with the Pragmatic Army in the Low Countries, was taken prisoner by the French at the Battle of Fontenoy in May of 1745. This appears in letters to Pringle's sister in Scotland, alongside the mundane quid pro quo arrangements through which John Pringle assisted various relations in their progress through the stations of military advancement.[48] In this respect, Pringle's experience as a Lowland accomplice of the Hanoverians was similar to that of many Scots of high and low birth who found employment within the military.

Pringle's bid to reform military medicine accordingly reflected both his martial identity as the son of a landed Lowland Scott, and his ties to the improving culture of Enlightenment Scotland as embodied in the newly-founded Edinburgh medical school.[49] His commission as Physician General was renewed under the Duke of Cumberland on Stair's retirement, though Pringle was put on half-pay in 1750 after the war had ended and the troops dispersed.[50] He remained on the Army payroll, however, and returned reluctantly to active service in England with the outbreak

---

[46] Emerson (2013), pp. 28-29.

[47] Schama (2001), p. 389.

[48] See "Letters of Dr. [afterwards Sir] John Pringle to Lady Hall…" GD206/2/551 Papers of the Hall Family of Dunglass, East Lothian, National Archives of Scotland, Edinburgh.

[49] Peterkin, A. and Johnston (1968), pp. xxii-xxiv.

[50] Kippis (1783), p. viii.

of the Seven Years War. He then oversaw the mustering of soldiers and, in 1757, accompanied one of several futile raids to the French coast.[51] It is notable that both Donald Monro and Richard Brocklesby, two army physicians who followed his example in publishing medical observations gathered during the Seven Years War, were also educated in Edinburgh and afterwards settled in private practice in London.

Pringle's work on army medicine served the martial interests of his Hanoverian masters, notably the Duke of Cumberland, who, along with his father King George II, controlled patronage appointments within the Army to an extent similar to the 3rd Duke of Argyll's command of patronage in Scotland. Pringle's work was also greeted by the Royal Society as an evidently useful inquiry that supported both the authority of physicians as well as the interests of natural philosophers generally. Consequently, as with other ambitious Scots of high status, the military provided the means to establish himself in London.[52]

Then the most populous city in Europe, as well as the commercial and political hub of Great Britain, London offered the greatest opportunities for transforming social connections into a fortune. As the home of the Royal Society, it was also the nexus of status and authority within natural philosophy and a locus of the English Enlightenment. His Royal Society membership would permit him to launch his bid to demonstrate the value of his investigations into epidemic fever upon the London stage.

[51] Gordon (1989), p. 6.
[52] Nenadic (2010), pp. 240-247.

4.2 John Pringle Makes Good in London

Between 1750 and 1752, Pringle established the basis for his climb up the social ladder towards the heights of London society. Over this period he created a place within the natural philosophical community as an authority on the relationship between air and disease by courting the support of influential figures within the Royal Society and the London medical community. By 1750 he was settled in London. He remained on half-pay while profiting from a period of peace following the signing of the Aix-la-Chapelle which ended the War of the Austrian Succession in 1748.[53]

Pringle enjoyed several advantages in his efforts to secure himself in the crowded medical marketplace of London. Years of service as Physician General to the armies in the Low Countries had earned him the patronage of the Duke of Cumberland.[54] He had been a member of the Royal Society since 1745. Among his sponsors had been Richard Mead (1673–1754), a leading London Physician and medical author. Pringle had married the daughter of an eminent and well-connected English physician.[55] Such advantages were among those which enabled him to forgo what his biographer referred to as the "little artifices" made use of in London "to excite popularity and to promote medical practice."[56]

Aside from an article on dysentery published in *the Edinburgh Medical Essays*, however, Pringle had not published any significant work of his own. His chief concern therefore was to transform

---

[53] Kippis (1783), pp. xiv-xv.
[54] Gordon (1989), p. 6.
[55] Kippis (1783), pp. lxiii.
[56] Kippis (1783), p. xv.

his collected notes into a substantial contribution to natural philosophy. To this end, 1750 also saw the beginning of his experiments into putrefaction, the first of which he delivered to the Royal Society on the 29th of May. That same month an opportunity presented itself that permitted him to introduce his project to the London public when a fever swept through the Old Bailey courts, claiming the life of Lord Mayor Sir Samuel Pennant (1709-1750), two judges, one alderman, and several others—a remarkable toll that attracted considerable attention among London office holders who had frequent commerce with the poor and sick. Attention was immediately drawn to the conditions at Newgate prison.[57]

Pringle immediately set about preparing a document that would apply his understanding of conditions in the army to the disaster at Old Bailey. His fifty-page *Observations on the nature and cure of Hospital and Jail fever*, priced at one shilling, was published within the month. Pringle's pamphlet took the form of a letter to his London patron, Richard Mead, an established authority on fever, a prominent fellow of the London College, and a long-time member of the Royal Society's Council. Mead had performed trials of smallpox inoculation on prisoners at Newgate prison and so presumably had connections to the judicial administration.[58]

As the disease was still running its course, Pringle noted that "every body is inclined to listen to the subject, those whose special business it is to take care of jayles and other publick places, which neglected, produce malignant and contagious distempers, may have more material whereby to judge of the danger arising from them."[59] Mead had encouraged Pringle's pamphlet, which cited Mead's approval of the *Observations on the Diseases of the Army*. The hastily

---

[57] Griffiths (1884) pp. 439-440. This account mentions a further forty dead in the outbreak.
[58] Guerrini (2008).
[59] Pringle (1750), p. 1-2.

published document on the Old Bailey outbreak was a gesture whose expedience Mead would have appreciated.

In 1720, at the request of the Secretary of State, Mead had quickly written a *Short Discourse Concerning Pestilential Contagion and the Methods to be Used to Prevent It* in response to an outbreak of plague in Marseille. This had gone through seven editions in a single year. Mead was already supporting the physician Richard Brocklesby who had dedicated an essay on cattle fever to him in 1746. Brocklesby would gather observations on disease outbreaks during his tenure as Physician General to the Army in Germany during the Seven Years War, and, in 1764, would publish a major work on the reform of army medicine.[60] Mead was also backing a ventilator that the inventor Samuel Hutton was pitching to the Navy. This was a machine meant to prevent outbreaks of fever by removing foul air from the confines of a ship.

Pringle’s pamphlet drew a close analogy between the diseases that he had observed on campaign with the Army, and the outbreak at the prison—an example of the relevance of observations made in the landscape of the Low Countries. His definition of hospital and jail fever presented in his letter to Mead illustrates the extent to which the causes identified while in the Army might be applied to an urban context through an overall etiology of fever.

> This fever is proper to every place that is the receptacle of crowded men, ill aired or kept dirty; or what is the same, wherever there is a collection of putrid animal streams, from dead or even diseased bodies. When a person is confined in such places he will run a hazard of falling into this distemper proportional to the time he stays there; whether he draws in the poison with his breath, or swallows it with the saliva. And upon this account, jayls and military hospitals, are most obnoxious to this kind of pestilential infection; as the first are kept in a constant state of filth

---

[60] Selwyn (1966), p. 269; Heberden, Ernest. “Brocklesby, Richard (1722–1797).” Ernest Heberden In *Oxford Dictionary of National Biography*, edited by H. C. G. Matthew and Brian Harrison. Oxford: OUP, 2004. Online ed., edited by Lawrence Goldman, May 2009.

> and impurity; and the last are so much filled with the poisonous effluvia of sores, mortifications, dysenteric and other putrid excrements. And as to ships, besides the number of men, and confined air, as an additional ferment, the corruption of the bilge water, is not only a main cause of the sea scurvy, but often concurs in crowded ships, to raise a fever of the hospital or jayl kind. Moreover, by opening the bodies of those who have died of very putrid distempers, and holding the head too long over them, a fever has been caught of the same nature.[61]

"Gaol" or "jail" fever was so-named because jails, in particular, were such efficient breeders of disease that "the very breath of cloaths of malefactors will spread the infection."[62] Two years later, when the letter was incorporated into a chapter of the *Observations on the Diseases of the Army*, Pringle would consider it to have been "hastily published".[63] It nevertheless established him as an authority on the outbreak at Old Bailey.

By the end of June, Pringle had published his letter to Mead and had presented the first of his experiments on putrefaction before the Royal Society. In October a committee of London aldermen sought the help of the Royal Society to "inquire into the best means for procuring in Newgate such a purity of air, as might prevent the rise of those infectious distempers." Pringle had, by this point, established himself as an obvious candidate for the task.[64] Stephen Hales was also chosen for his widely-recognised expertise on air and his promotion of mechanical ventilators, which had already been installed in a number of prisons and hospitals.[65]

Hales was widely recognised for having introduced the pneumatic trough to chemistry, and for having used that instrument to reveal the surprising quantities of air "fixed" in seemingly solid

---

[61] Pringle (1750), pp. 8-9.
[62] Pringle (1750), p. 10.
[63] Pringle (1752), pp. x-xii.
[64] Pringle (1753), p. 42.
[65] Clark-Kennedy (1929), pp. 190-191.

matter.[66] He first presented these findings in his 1727 book *Vegetable Statics* which established his credentials as an authority on air and its relationship to life. A parson from a well-to-do family, Hales was, like Boyle, a moralist and a virtuoso for whom experimentation formed part of a broader effort to edify society.

On the advice of Pringle and Hales, Newgate Prison received a new windmill-powered ventilator of Hales's design to replace an earlier ventilating system that had been worked by hand. The large windmill mounted on the roof of the prison drove a piston mechanism that drew foul air out of the wards through a system of branching wooden trunks. These trunks contained sliding shutters that could block off each part of the network so that sufficient suction could be provided to ventilate portions of the prison as required.[67]

Pringle's approval was a foregone conclusion. Pringle had already endorsed Hales's instrument in his 1750 letter to Mead. When his *Observations on the Diseases of the Army* appeared in 1752, he promoted it as a useful means to remove putrid air from large hospitals and barracks.[68] Finally, he produced a glowing report of the good effects of the ventilator at Newgate that was read before the Society in 1753 and published in the *Philosophical Transactions*. In 1776, as President of the Royal Society, he could still find occasion to praise Hales's invention.[69]

---

[66] Crosland (2000), pp. 83-84. It should be noted that Hales used the pneumatic trough as means remove impurities from the air that he collected. Later experimenters made more sophisticated use of the instrument.

[67] Clark-Kennedy (1929), p. 202.

[68] Pringle (1752), pp. 190-192.

[69] Kippis (1783), p. 19.

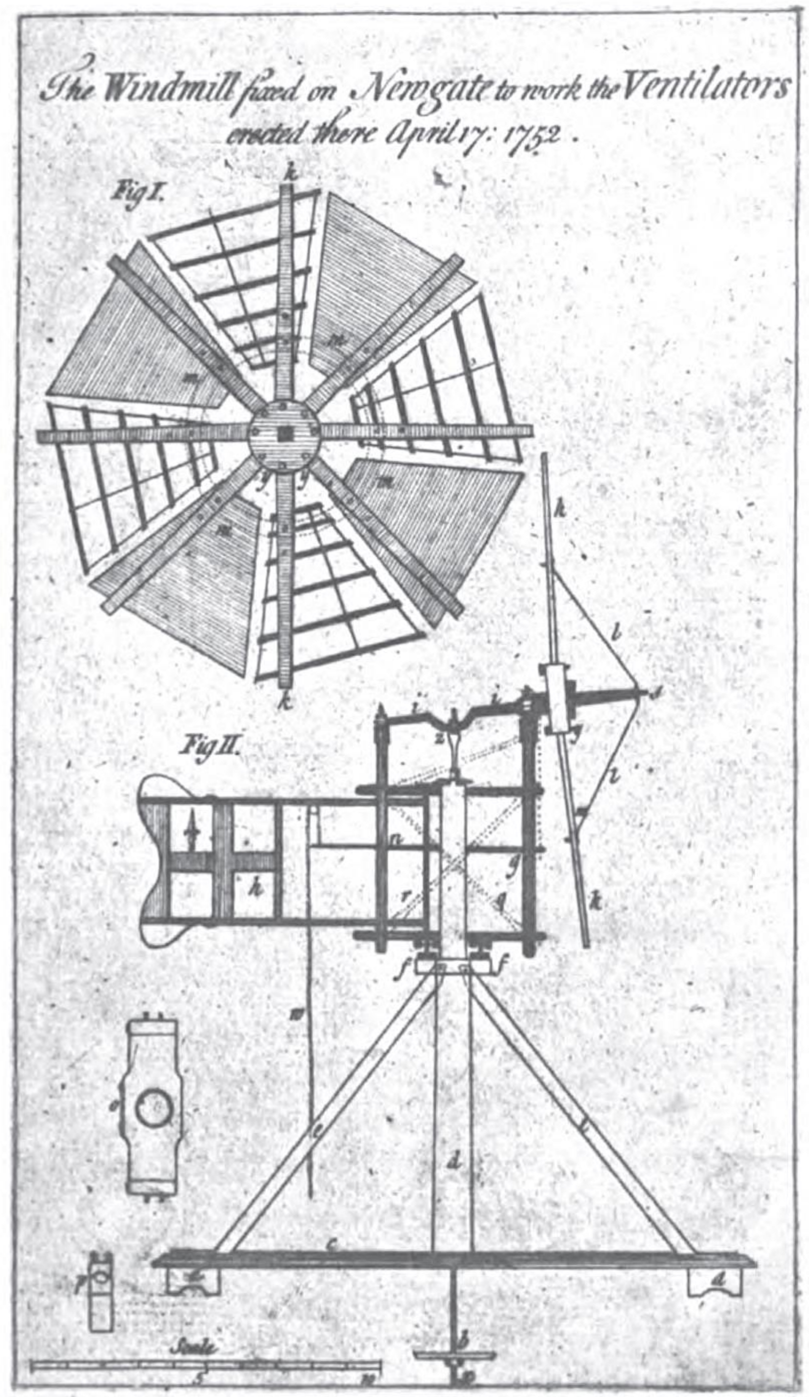


Figure 7. Illustration of the windmill powering the Hales's ventilator installed at Newgate. Arthur Griffiths, *Chronicles of Newgate* (1884), p. 442. Digitized by The Internet Archive. This image was first published in the *Gentleman's Magazine*, vol. xxii. p. 180 (1752).

"An Account of Several Persons Seized with the Goal-Fever, Working in Newgate; And of the Manner, in Which the Infection Was Communicated to One Intire Family", written by Pringle and published in the *Philosophical Transactions* in 1753, recounted a visit by Pringle and Hales to Newgate Prison in order to inspect the installation of Hales's ventilator. Pringle's report of the spread of a "true gaol fever" that broke out during their visit would not have been out of place in the Edinburgh *Medical Essays and Observations.*

As in his letter to Mead and his *Observations on the Diseases of the Army,* Pringle traced every case back to a point at which the victim was exposed to putrid effluvia. In one instance, a worker spent time in a room in which the wooden planks of the old ventilation system had been stored. Pringle recounted the disease's course as it spread by means of contagious vapours through the worker's family, to his son, daughter, wife, sister-in-law, and mother-in-law.[70] Another incident involved a young apprentice who was forced by older journeymen to "go down into the great trunk of the ventilator" in order to retrieve a wig. The concentrated effluvia issuing from the jail nearly choked him and soon brought on a putrid fever. Two men who helped him out "were both set a vomiting so violently as to bring up blood."[71]

While stressing the immediate and violent effects of concentrated effluvium, Pringle's account also underscored the effectiveness of Hales's ventilator which, at the time of their visit, was already operating in some wards. These ventilated areas were much less offensive than those still without them. Though the prisoners had suffered some sickness when the machine was first put

[70] Hales (1755-1756), p. 52.
[71] Pringle (1753), pp. 48-49.

into action, they soon recovered and thereafter remained healthy.[72] All of this served to edify the Royal Society, whose endorsement of Hales and Pringle had evidently been justified. It was also, no doubt, of assistance to Hales who was then locked in a lengthy seesaw battle of influence to see his ventilator adopted by the Navy. Though his rival, Thomas Sutton, was less well ensconced among the natural philosophers, his design was supported by Richard Mead for whom the reform of the air was obviously an abiding interest.[73] Hales had Pringle's report republished in *The Gentleman's Magazine*.

Pringle's work on army medicine may be understood as a contribution to a longstanding medical concern. Putrid vapours were widely understood to cause epidemic disease, and certain emergency preventative measures such as quarantine had been in place across Europe. As Pringle was fond of noting, the promise of examining the air "to teach men to choose their dwelling for better health" had been proposed by Francis Bacon. [74] Similar sentiments may, however, be found in antiquity. Vitruvius stipulated that buildings be constructed with an eye to the local environment, including air and climate, to ensure health.[75]

The condition of the air was the prerogative of the powerful, which made its management a subject for seekers after patronage. In 1661, the virtuoso John Evelyn (1620-1706) addressed the restored Charles II directly in his *Fumifugium, or The Inconveniencie of the Aer and Smoak of London Dissipated*, a pamphlet that offered the new monarch a symbolic means to represent his authority and benevolence by literally clearing the air of London. If Evelyn's account is to be

---

[72] Pringle (1753), p. 44.

[73] Zuckerman (1977), pp. 230-234; Clark-Kennedy (1929), pp. 151-169. This remains the most complete account of the ventilator controversy.

[74] Kippis (1783), p. 28.

[75] Evelyn (1661), p. 4.

understood literally, the London air was truly dreadful, creating intolerable conditions even within buildings. Addressing the King, England's foremost patron and a profligate dispenser of cash to his favorites, Evelyn wrote:

> Your Majesty who is a Lover of noble Buildings, Gardens, Pictures, and all Royal Magnificences, must needs desire to be freed from this prodigious annoyance; and which is so great an Enemy to their Luster and Beauty, that where it once enters there can nothing remain long in its native Splendor and Perfection: Nor must I here forget that Illustrious and divine Princess, Your Majesties only Sister, the now Duchess of Orleans, who at her Highness late being in this City, did in my hearing, complain of the Effects of this Smoake both in her Breast and Lungs. I cannot but greatly apprehend, that Your Majesty (who has been so long accustom'd to the excellent Aer of other Countries) may be as much offended at it, in that regard also; especially since the Evil is so *Epidemicall*; indangering as well the Health of Your Subjects, as it sullies the Glory of this Your Imperial Seat.[76]

Evelyn's short tract proposed a number of measures to alleviate this epidemical atmosphere. These included moving noxious industries that depended either on burning sea coal or polluted the air through rot (brewing, dying, soap and candle making, lime burning, animal processing) away from centres of habitation.[77] The scheme had the potential advantage of providing employment to "thousands of Able Watermen" to transport goods into the city.[78] Finally, Evelyn, an avid naturalist who had elsewhere promoted the cultivation of trees for use in shipbuilding, proposed that the grounds surrounding the city be planted with "fragrant and odiferous" flowering shrubs to "tinge the Aer upon every gentle emission."

---

[76] Evelyn (1661), Epistle pp. 2-3.
[77] Evelyn (1661), pp. 15, 21.
[78] Evelyn (1661), Epistle p. 17.

The regime of Charles II lacked the funds for such a grand scheme, and there were legal issues too, as Evelyn well knew.[79] Nevertheless, his plan represents, in certain respects, an early attempt by Baconian virtuosi to link the power of the crown to a virtuous concern for the lungs of His Majesty's subjects. While the enlightened despots of the Continent might willingly sponsor large-scale efforts well into the eighteenth century, monumental undertakings such as Evelyn's would not have interested the governments of the Protestant rulers who replaced the Stuarts in the Glorious Revolution of 1688. Under the Hanoverians, who took power in 1714 following the death of Queen Anne, the center of culture shifted from the court to London itself. George II, under whom Pringle served in the Low Countries, despised philosophy.[80] The Hanoverians would, however, readily patronize improvements that might benefit commerce, imperial administration, and especially the military.

In 1762, the Scottish-born jurist Henry Home, Lord Kames (1696-1782) dedicated his *Elements of Criticism* to his patron George III, claiming:

> To promote the Fine Arts in Britain has become of greater importance than is generally imagined. A flourishing commerce begets opulence, and opulence, inflaming our appetite for pleasure, is commonly vented on luxury, and on every sensual gratification: selfishness rears its head; becomes fashionable; and infecting all ranks, extinguishes the *amor patriae*, and every spark of public spirit.[81]

Amor patriae and public spirit were essential to the self-definition of the Hanoverian regime. They also suited the values of Baconian improvement promoted by the Royal Society. In 1776, the same Lord Kames dedicated a work on agricultural improvement to Pringle as President of

---

[79] Brewer (1997), pp. 14, 19.
[80] Brewer (1997), pp. 3-25; See p. 212.
[81] Brewer (1997), pp. 24-25. Citing the dedicatory preface to volume 1.

the Royal Society.[82] The problem of the air and contagious disease would prove a similarly fertile area of investigation for those, like Pringle and Hales, seeking recognition and patronage for work that was both patriotic and beneficial to the citizens serving in the Hanoverian military.

New approaches to this age-old problem, reflecting the improving ethos of the philosophical societies, began to emerge in the seventeenth century. From the inception of the Royal Society, English Baconians sought to clarify the vague but venerable association between air and epidemic disease. Figures such as Thomas Sydenham had argued for systematic observation of the air while the political arithmeticians pushed for careful record keeping to track mortality across the population. As noted, the search for insight into this relationship through tabulating data from newly-developed meteorological instruments emerged early as a priority within the Royal Society.

The development of the mechanical ventilator provided a different approach to the problem of putrid air. In the 17th century, Denis Papin (1647–1712?) and John Desaguliers (1683-1744), both Huguenots, prolific projectors, and members of the early Royal Society, developed machines for clearing the dangerous "damps" out of mines and preventing the premature rotting of a ship's timbers. The effort was taken up in the eighteenth century by several others, including Stephen Hales, who worked at first with Desaguliers. Hales, as we will see, developed the ventilator into a solution for outbreaks of fever, notably scurvy, on board navy ships—a patriotic effort that would inform Pringle's own attempts to preserve the health of soldiers and sailors.

---

[82] See p. 206.

Most of Pringle's interventions were intended to relieve foul air, the prime cause of epidemic disease. In fixed camps, when straw bedding was not often replaced, tents were to be aired out to prevent damp and rot. Clothing was to be kept clean and tents separated from each other to prevent the buildup of a confined and moist air loaded with effluvia. Sources of putrid vapour, especially privies during dysentery outbreaks, were to be kept to the periphery of the camp and frequently covered with layers of dirt. The sick were to be separated from the wounded and regimental hospitals were to be established in large, airy buildings such as barns and granaries.[83] Perhaps most importantly given Pringle's emphasis on the landscape, areas in which putrid vapours accumulate, particularly marshy terrain, damp basements, and crowded ships, were to be avoided whenever possible.

Other measures addressed the body's susceptibility to putrid infection under various circumstances based on the age-old Galenic doctrine of the non-naturals. The British army, unlike many European counterparts, provided regular supplies while on campaign. Nevertheless, diet was at other times largely the responsibility of the soldier. A conscientious officer might attempt to ensure that proper food was available at reasonable prices, that vegetables were available over the hot summer months, and that the men were encouraged not to squander their pay on alcohol.[84] Men might be made to take exercise in the cool of the morning to brace the fibres and to prepare the body for the afternoon heat. When in the field, bedding, a blanket, proper coats, and sufficient fuel were essential to regulate the temperature of the body.[85]

---

[83] Pringle (1752), pp. 126-128.
[84] Pringle (1752), pp. 135-139.
[85] Pringle (1752), pp. 115-116.

Pringle's measures were easier to apply on board ship where life was more subject to regulation. As we will see, the ability of enterprising physicians and naval captains to conduct what amounted to experiments on their men in the interests of preventing naval scurvy was significant, though it had its limits. Detailed instructions still survive for regulating the routines of soldiers on board naval transports according to Pringle's principles.[86] His presumed influence upon naval medicine has, consequently, received considerable attention from medical historians.[87]

It is not clear precisely where Pringle drew the distinction between his work as the Physician General to the Army in Flanders, and the broader implications that his observations of army life held for studying fever generally. His suggestions relating, for instance, to the proper nature and equipping of the regimental and general hospitals came directly from the responsibilities of his office. His observations were recorded throughout the campaign and were clearly part of his life-long proclivity for note gathering that ultimately produced the *Medical Annotations*. In February of 1743, he wrote to Andrew Mitchell, then Undersecretary of State for Scotland, that "I have hitherto given great application to the studying garrison diseases and I have wrote all my observations. If I can see a campaign and keep my health, I flatter myself that I may have a work useful to the public."[88]

In 1752, nearly a decade later, the *Observations on the Diseases of the Army* was published. Its subsequent acclaim had much to do with the support of eminent English philosophers including Mead and Hales, with whose assistance he had earned a reputation as an expert on the improvement of the air. This process culminated in November of 1752 when the Royal Society's

---

[86] See p. 212.
[87] See especially: McBride (1991), pp. 158-158; Lawrence (1996), pp. 85-86.
[88] Gordon (1985), p. 132. Citing British Library manuscript Add. MS 6861 f. 190.

Copley Medal was awarded to him for his putrefaction experiments. The rules of the award limited it to work published in the *Philosophical Transactions*, as Pringle's first three papers had been.

In all likelihood, however, the award recognized the overall utility of Pringle's project which had been laid out in the first edition of the *Observations on the Diseases of the Army*, published only several months earlier. The Copley Medal showed the Society's endorsement of the project, formally establishing Pringle's bona fides as an experimental philosopher. The *Observations*, with its appended experiments, could be shown to have been founded on evidence freely provided to the public and accepted for publication by the highest authorities on experimental philosophy.[89]

Ultimately, efforts to improve the air and prevent disease represented a bid for authority within military medicine on the part of physicians, aimed at the interests and objectives of those who controlled the institutions of British power. As Pringle and his allies intended, it was received by the London establishment, both as a benevolent gesture and as a useful contribution to the operation of the military-commercial state under the Hanoverians. Pringle's work may be seen against a broad backdrop of attempts to gain attention for various projects that had become a familiar feature of British public life in the seventeenth and eighteenth centuries.

---

[89] Sher (2006), p. 211.

4.3 Patronage and Credibility

Amid the clamour of mechanics and inventors seeking their fortunes in eighteenth-century London, a reputation for detachment from material gain, joined to a paternal desire to benefit the public, was valuable in promoting a claim to useful knowledge. John Pringle's status as a client to the Duke of Cumberland tended to reinforce the epistemological credibility of his medical opinions, and certainly eased his way into institutions of credit such as the Royal Society and the Royal College of Physicians of London.[90] He defined his work primarily in terms of service to the state and the public good rather than as commercial opportunity. Yet, if we recognize his work as an attempt at improvement, founded in natural philosophy, vetted by the Royal Society, and requiring patronage to be realized, then his circumstances upon arriving in London appear similar to those of many other aspiring philosophers.

Pringle was scrupulous in cultivating a reputation as a disinterested philosopher whose work benefited all nations and men. He encouraged his young friend James Boswell towards the same ideal.[91] Yet if we consider Pringle's *Observations* in light of its implications for his patronage prospects, then we can see that he could not, like the archetypical Boylean virtuoso, truly disavow interest in his knowledge claims.[92] What was Pringle's tract on the Newgate fever, for instance, if not one of the "little artifices… made use of, in the city of London, to excite

---

[90] See Biagioli (1993), pp. 17, 20. For the relative epistemological legitimacy of different branches of knowledge.
[91] See p. 211.
[92] Shapin (1994), p. 180.

popularity, and to promote medical practice”, which Dr. Pringle was purportedly the last to adopt?[93]

In reality, even the well-born and well-connected were obliged to distinguish themselves within an existing culture of London strivers. Under the Hanoverian peace (c. 1715- c.1739), presided over by the masterful statesman Sir Robert Walpole, the grandees of Britain had turned to the commercial increase of their fortunes and the improvement of their estates. [94] It was an auspicious period for mechanics and philosophers seeking to earn their fortunes through improving schemes. Potentially useful knowledge, whatever its form, could be placed in service of personal fortune. Work that did not advance the draining of mines or the bleaching of cotton might prove invaluable to a wealthy patron seeking a practical outlet for philanthropic interests.

Somewhat earlier, the London-born writer Daniel Defoe (1660-1731) had declared himself to be living in a “projecting age” which had begun in the 1680s. He attributed this phenomenon to the recent strangulation of trade brought on by French privateers which had placed great pressure on men of business, forcing them to innovate.[95] He presented his thoughts on the matter in *An Essay on Projects* (1697), the bulk of which was given over to a veritable cornucopia of his own improving ideas, ranging from an insurance system for injured sailors to an academy for women.[96]

---

[93] Kippis (1783), p. xv.

[94] Schama (2001), p. 356.

[95] Defoe (1697), pp. 1, 6.

[96] For a detailed examination of Defoe’s understanding of projecting see: Kimberly Latta (2009). “Wandering Ghosts of Trade Whymsies.” In *The Age of Projects*. Edited by Maximillian E. Novak. 141-164. Toronto: University of Toronto Press.

With the increasing prominence of a London-centred urban public sphere defined by commercial interests, "projectors", as those who proposed improving schemes were known, became increasingly common in the literature of the seventeenth and eighteenth centuries.[97] Defoe's *Essay* was, in large measure, an apology for self-interest. It argued for a distinction between the sensible and the dishonest.[98] Such a distinction was not recognized in the social parody of his literary contemporary, Jonathan Swift (1667-1745), whose *Travels into Several Remote Nations of the World*… (1726) mocked the philosophical societies from which many improving schemes originated.

Having left the floating island of Laputa for the earthly city of Lagodo, Swift's protagonist, Captain Lemuel Gulliver, found it blighted by the misguided efforts of projectors. Forty years earlier, an unnamed group had gone to the floating kingdom (a mocking parody of the Royal Society) and returned with a "very little smattering in mathematicks, but full of the Volatile Spirits acquired in that region." Upon their return, they established an Academy of Projectors, which was imitated in every town. Their extravagant promises produced only ruin and confusion. Gulliver's host in Lagado was among the few substantial citizens who had ignored these schemes. Such men enjoyed flourishing estates for having preferred "their own Ease and Sloth before the general Improvement of their Country.[99]

Projectors and their patrons were indeed conspicuous within the Royal Society at the turn of the eighteenth-century. Presided over by Newton and his disciples, the Society was a vital arbiter of epistemological credibility, providing a path to legitimacy for exceptional strivers from the lower

---

[97] Brewer (1997), p. 3. See the whole of Chapter 1: "Changing Places: The Court and the City."
[98] Defoe (1697), pp. 11, 32-33.
[99] Swift (1726), pp. 57-61. See also Marjorie Hope Nicolson (1976).

orders. A public reputation for expertise in Newtonian mechanics, along with the fellowship in the Royal Society that typically accompanied it, was one criterion that separated the legitimate improvers from unscrupulous projectors. Newtonians such as William Whiston (1667-1752), Willem Jacob 's Gravesande (1688 - 1742), Denis Papin, John Theosophilus Desaguliers, John Keil (1671-1721), and David Gregory (1659-1708) all rose from middling circumstances to varying degrees of fame through lecturing and publishing on natural philosophy.[100]

These efforts were typically underwritten by wealthy grandees such as the aristocratic James Brydges, first Duke of Chandos (1674-1744). Chandos retained Desaguliers as a go-between and a technical advisor on various innovative schemes, few of which proved profitable. Desaguliers provided, for instance, machines for drainage and ventilation to be used in the mines that Chandos had established on various leased properties.[101] This relationship provides an example of the value of British grandees to the Royal Society.[102]

The special status granted the gentry provided the founders of the Royal Society with a means to mediate personal testimony by adopting the early modern association between property, status, and disinterestedness.[103] Sprat's *History of the Royal Society* offered a hedge to its less-established members. The Society's gentlemen would moderate the interests of its less-established Fellows:

> though the Society entertains very many men of particular Professions; yet the farr greater Number are Gentlemen, free, and unconfin'd . By the help of this, there was hopefull Provision made against two corruptions of Learning, which

---

[100] Stewart (1992), pp. 102-105.
[101] Stewart (1992), pp. 217-220.
[102] Shapin (1994), p. 190.
[103] Dear (1985), pp. 152-157.

> have long been complain'd of, but never remov'd: The one, that knowledge still degenerates to consult present profit too soon; the other, that philosophers have bin always Masters, & Scolars; some imposing, & all the other submitting; and not as equal observers without dependence.[104]

Patronage (in principle) liberated its subject from commercial concerns by easing the corrupting search for present profit.[105]

On the other hand, mechanical competence of the kind embodied and promoted by the Newtonian lecturers made it possible to "assess the credibility of many a mechanical claim..." through providing "a firm foundation for the mechanical measuring of strength and work." [106] This proved useful to the government as well as landholders and industrialists. In the reign of Queen Anne, new mechanical inventions brought before the Privy Council in search of government patronage were vetted by the Royal Society, though it would not play a lasting role in monitoring patents.[107]

In the 1690s, Defoe had identified the military as a venue particularly receptive to innovation.[108] Projects promoting solutions to longitude and the prevention of fever—two of the most significant problems to which British natural philosophers turned their attention in the eighteenth century—emerged during a period in which the British "fiscal-military" state was developing.[109] Eighteenth-century historians are familiar with the public attention garnered by the problem of Longitude following an act of parliament in 1714 that promised a substantial award to an

---

[104] Spratt (1667), p. 67.
[105] Stuart (1992), p. 177.
[106] Stewart (2008), pp. 372-375.
[107] Stewart (1992), p. 175; Gascoigne (1999), p. 172.
[108] Defoe (1697), p. 3.
[109] Brewer (1989), p. xviii; Nenadic (2010), p. 239.

individual or group able to accurately determine longitude at sea. The prevention of fever received comparable attention, for similar reasons, over roughly the same period.[110]

Both problems provided opportunities to harness the interests of British public science to the expansion of commerce and empire. This was a venue for “empowering the intelligentsia” through testing the “effects of power and knowledge on the disciplined subject.”[111] Pringle’s efforts to prevent infectious disease may be understood in these terms. The second chapter, directed primarily at officers’ concerns, addressed the regulation of soldiers’ daily routines in areas such as exercise, food, the consumption of alcohol, and cleanliness. A later text by the army physician Richard Brocklesby cited an exemplary British regiment

> where all the regulations of its interior orders, and the hidden springs of all its movements and actions, were so well contrived, and the mechanism was ever so exquisitely adjusted, that the whole system, containing 900 human forms, appeared at all times, in their tents, their hospitals, under arms, and on the march, to be actuated and put in motion, merely at the volition, and by the command of the noble Colonel, Lieutenant Colonel, and Major, each in his department co-operating with one mind, to effect that intire, beautiful, and harmonious arrangement, the like of which, in its interior, as well as exterior appearances, I almost despair ever to see completed again in this country.[112]

The physician was to be an accomplice to the aristocratic leaders of the military. Physicians, Brocklesby argued, might alleviate “a great part of the mischiefs which generally have attended the concomitants of war” provided that they were invested with the authority to practice their skills. Such authority would also permit them “to control the overweening assiduity of practitioners, who, instead of relieving the patient, too often have been the means to forward

---

[110] Stewart (1992), pp. 192-197.
[111] William Clark, Jan Golinski, and Simon Schaffer (1999), p. 21.
[112] Brocklesby (1764), pp. 7-8.

many diseases."[113] While providing a guide to preventing and treating the diseases of military men, Pringle's promise of a means to predict the diminution in military strength due to seasonal cycles of disease placed the physician's grasp of natural philosophy in service of the state.

Changes to the administration of the military over the second half of the eighteenth century rendered it less receptive to the schemes of outsiders, in part because less information was placed in the public domain where it could be incorporated in the improving schemes of outsiders. When the radical Birmingham physician, Thomas Beddoes (1760-1808) requested medical data from the army in 1808 to assist his efforts to develop pneumatic medicine, his requests were ignored.[114] The eighteenth century military physicians such as Pringle and Brocklesby were, in effect, powerful insiders within one of the very few institutions under which it was possible to earn a living as a natural philosopher.

Efforts on the part of natural philosophers to assist the military were also moral and patriotic. In 1743, Stephen Hales described his mechanical ventilator as "…of vastly more Consequence to Navigation, than the Discovery of Longitude; as being a Means of saving innumerable more Lives, than that would do."[115] He claimed to have undertaken his ventilation project after having learned of an outbreak of fever in 1740 among troops embarked at Spithead while awaiting their departure for America.[116] Those who sought to address the dangers of putrid air could point to the costly expedition of George Anson (1697-1762) to the Spanish Pacific between 1740 and 1744

---

[113] Brocklesby (1764), p. 9.

[114] Thomas Beddoes to the Secretary of War 12 November 1808; MS DD DG 43/69. Cornwall Record Office.
John Pringle to Mrs. Calderwood, 9 March 1754, Papers of the Hall Family of Dunglass, East Lothian, GD206/2/554/ National Archives of Scotland, Edinburgh.

[115] Hales (1743), pp. v-vi.

[116] Clark-Kennedy (1929), pp. 151-152; Hales (1743), pp. ix-x.

which lost 1051 out of 1995 sailors, mostly from scurvy. When the expedition limped home laden with Spanish treasure, few survived to enjoy it.[117]

Those who faced the problem of longitude could likewise point to the debacle of 22 October 1707 when a British fleet under Sir Cloudesly Shovell (1650-1707) ran aground on the Isles of Scilly due to errors in navigation while returning to Gibraltar after operations against the French in the Mediterranean. Almost two thousand men were killed in the accident, including Shovell himself.[118]

Natural philosophers might invoke such incidents in search of support from the public and the British grandees. The improvement of public institutions provided a venue for well-to-do placeholders seeking a project upon which to found a reputation for care and good governance under the public eye. This was inevitable in a patronage society where public office and personal prerogative were inseparable. Gestures of benevolence were important during a period, beginning with the long-lived Walpole administration, when government was widely perceived to be guided by the interests of factions among the landed oligarchy.[119]

The expansion of the military, trade, and the government financial apparatus, created many more offices with which patrons could reward their clients. Meanwhile, under Walpole's "robinocracy", public officials from jailers, to bureaucrats, to army officers, treated their public responsibilities as private property from which to turn a profit.[120] As the value of public offices

---

[117] McBride (1991), p. 159.
[118] Stewart (1992), pp. 184-185.
[119] Holmes and Szechi (1993), pp. 12-13.
[120] Carpenter (2002), pp. 475-476.

increased, so too did their cost. This process tended to further consolidate power within a narrow political elite.[121]

The vast prerogative of the office holder further blurred the distinction between public and private property.[122] Over the eighteenth century, a number of bureaucratic institutions, from the Navy Board, to the Post Office, to the Board of Trade, came to be dominated by family dynasties.[123] Chandos, a skillful courtier, earned £600,000 from the position of Paymaster General of the Forces, which he held from 1705 to 1713.[124] As Desaguliers' patron, he gave him a position as rector of Stanmore Parva in Middlesex, the first of several clerical positions that Desaguliers would gather over his career.[125]

Office holders could (and were often expected to) supplement official salaries through fees and other perks, appoint deputies, and treat their positions as profitable sinecures by paying others to perform their duties.[126] Though criticism of the social order never truly became a threat, even in the years surrounding the French Revolution, simmering resentment took the form of riots against particular injustices (usually local) as well as giving rise to frequent satire. The Beggar's Opera, set in the London slums and a prison, featured a parody of Walpole himself in the guise of the cynical Peachum the Thief-taker.[127]

---

[121] Porter (1990), pp. 108-110.
[122] Brewer (1989), p. 82.
[123] Brewer (1989), p. 81.
[124] Porter (1990), p. 59.
[125] Stewart (1992), pp. 217, 225-227, 230-231.
[126] Porter (1990), pp. 122-123.
[127] Schama (2001), pp. 366-368; Porter (1990), p. 16.

Beyond the Poor Laws, the British government offered little support for those at the bottom of society, who lived in agrarian poverty or in crowded urban slums. Philanthropic gestures took the form of local, often personal, initiatives. In 1681, for instance, Sir Stephen Fox, a wealthy treasury commissioner, had purchased a property in Chelsea which became the Royal Hospital at Chelsea for infirm soldiers.[128] Chandos was governor of a foundling Hospital, among other official duties and sinecures. The Reverend Stephen Hales, pamphleteer against liquor and distributor of Bibles to the New World, also launched philanthropic initiatives. These provided opportunities for the well-to-do to burnish the image of a ruling order clouded by the systemic use of public office for personal profit.

The lower orders passed most firmly into the care of the state when they entered the military. Improvements to conditions within the military invoked the traditional responsibilities of the aristocracy. Hales's several publications on the subject of ventilators stressed their capacity to improve the health and comfort of those subject to institutional confinement, particularly those who faced the danger of naval scurvy. He called the attention of his readers to

> that valuable and useful part of mankind, those, who occupy their business in great waters; whose welfare I have long had at heart, and endeavoured to promote by various ways; especially by finding means to procure them fresh salutary air, instead of the noxious, putrid, close, pestilential air, which had destroyed millions of mankind in ships.[129]

"There is no doubt", his preface stated, but that the project would "fully answer your Lordships tender Care and Concern for the Welfare of Navigators…"[130] While Pringle was less effusive in

[128] Cantile (1974), p. 41.
[129] Hales (1755-1756), pp. 332-333.
[130] Hales (1743), p. iv.

his philanthropic rhetoric than many of his contemporaries, he gestured in this direction when he characterised his *Observations* as an attempt “to draw from the calamities of war something that may be useful to the public.”[131]

Concern for the welfare of soldiers could demonstrate gentility and personal benevolence as well as a concern for the welfare of the public. The introduction to Pringle’s *Diseases of the Army* features an anecdote that one finds repeated in every reference to his life and work. Referring to the establishment of regimental hospitals near the battlefield, he recounted:

> Till then, it had been usual to remove the sick a great way from the army; whereby many were in a manner lost before they came under the care of the physicians; or, what was attended with equal bad consequences, if the hospitals were nigh, they were for the greater security to be frequently shifted according to the changes of the camp. But the Earl of Stair, my late illustrious patron, being sensible of this hardship, before there was any action in Germany, proposed to the Duke of Noailles, of whose humanity he was well assured, that the hospitals on both sides should be considered as sanctuaries for the sick, and mutually protected.

The Duke consented, and soon after sent a party to occupy a village that held the British hospital. Not wishing to “alarm the sick”, he sent word to the British that his troops were under strict orders not to approach the hospital.[132]

The passage is notable both as an instance of the paternal responsibility of the aristocrat, and because Pringle is implicitly understood to have brokered the agreement on behalf of his patron. As Stair’s client, he decorously assigned him the credit for having approved it. Describing the arrangement less than a decade after the event itself, Pringle noted that “tho’ it has been broke through since, yet we may hope that in a future war, the contending parties will make it a

---

[131] Pringle (1752), p. xv.
[132] Kippis (1783), p. x.

precedent."[133] Clearly this had been understood as an arrangement between gentlemen rather than institutions.

Pringle's proposed changes to the military received a hearing because, by the time that he settled in London, he had won the backing of a singularly powerful patron, the Duke of Cumberland. Until his military disgrace in 1757, when the French occupied Hannover during the Seven Years War, Cumberland was well placed to implement Pringle's proposed improvements to army medicine. The royal court, though curtailed under the Hanoverians, remained a venue through which the Royal Family regulated the social hierarchy of the aristocracy, and to a diminishing degree, the government.[134] The Hanoverians, in particular, regarded the army as a venue for the performance of royal authority—George II's decision to lead his army into battle at Dettingen was a case in point. Cumberland was wounded during the battle.[135]

Although the Army and the Navy changed significantly over the eighteenth century, with the medical examination of recruits, the use of barracks, and standardization of uniforms, rations and equipment, they also remained within the purview of the aristocratic caste and subject to individual authority[136]. Sea captains remained "laws unto themselves" the spoils of their voyages partly distributed among the crew as incentives to bravery. Recruitment, supply, and regulation of the soldiery, generally took place within individual regiments.[137]

---

[133] Pringle (1752), pp. viii-ix.
[134] Smith (2005), pp. 24-26.
[135] Guy (1985), pp. 89-91
[136] Canteel (1974), p. 59.
[137] Porter (1990), pp. 119-120.

Though regimental officers increasingly came from the middle classes, the army remained dominated by a traditional aristocracy—an "international officer caste."[138] Those who purchased a commission or raised a regiment often saw it as a means of entry into circles of power and patronage centred on the government and court.[139] As elsewhere in the Georgian state, abuses of position were rife.[140] Nevertheless, personal prestige and commitment to the traditional order meant that the military was also a source of patriotism and pride across the various ranks of society.[141] James Boswell, the eldest son of a Scottish laird, coveted a commission in a London guards regiment, though his father refused to sponsor his ambitions. Those familiar with the army, including Pringle, doused his hopes.[142]

The King was a martial figure whose personal prerogative extended over the military. Commissioned officers were servants to the King, who could advance or dismiss them at will.[143] Pringle's period of active duty under George II coincided with the high water mark of Hanoverian management of the British military. It was George II's interference in the command of the army in Flanders that led Pringle's first patron, the Earl of Stair, to resign his command in 1744. Kippis noted the extent of Pringle's personal attachment to the Earl. Despite being in overall charge of the military hospital,

> He offered to resign with his noble patron: but that generous and liberal minded commander not permitting him to think of it for a moment, he was obliged to content himself with testifying his respect and gratitude to his Lordship, by

---

[138] Brewer (1989), p. 47; Porter (1982), 114.
[139] Nenadic (2010), p. 232.
[140] Guy (1985), pp. 88-89, 108-110.
[141] Porter (1990), p. 7-8.
[142] Nenadic (2010), p. 232; Boswell (1950), p. 275.
[143] Guy (1985), pp. 19-21.

> accompanying him forty miles on his return to England; after which he took leave of him with utmost regret.

Pringle was "thus deprived of the immediate protection of a nobleman who knew and esteemed his worth."[144] He continued to serve in the army, however, and soon after received a commission from the Duke of Cumberland that made him again Physician General to his Majesty's forces in the Low Countries and Physician to the Royal Hospitals.

Cumberland took a strong interest in reforming the army, as had the first two Georges. In so doing, he acquired a reputation as a meddlesome German martinet.[145] This process of reform tended to mirror changes taking place in the government insofar as it involved curtailing the purview of individual office holders, and eliminating opportunities for profiteering, while strengthening and standardising administration. Cumberland, in particular, sought to impose discipline on the officer corps. Pringle's reforms may have appealed to Cumberland's sense of order. As Brewer has noted, the slow transformation of public offices, from a hierarchy of personal dependence to committee-run establishments, tended to favour "orderly and precise men who were industrious rather than innovative."[146] Pringle, and others in his circle, inhabited a liminal period during which credible and well-connected insiders might receive a hearing from a military hierarchy that was undergoing a process of reorganization led by its royal patrons.

Despite powerful support, such efforts were not necessarily expected to extend beyond the efforts of enlightened individuals. Brocklesby claimed to "almost despair ever to see completed

[144] Kippis (1783), pp. xi-xii.
[145] Guy (1985), pp. 31-35.
[146] Brewer (1989), pp. 82-84.

again in this country" the exemplary machine-like regiment that he had observed.[147] While the hospital arrangement between Stair and Noailles might, like Pringle's hygienic measures, be understood as an important precedent, neither Pringle nor any other contemporary seem especially surprised that the arrangement was abandoned when the combatants left the field.[148]

As a result of his military connections, Pringle settled in London having acquired two positions which were near sinecures: a half-pay salary from the army and a place in Cumberland's household as a personal physician. These offices may be seen to constitute a kind of indirect literary patronage, permitting the author to publish without commercial commitments to publishers and booksellers which, in Pringle's estimation, compromised gentility.[149] It is likely that Pringle's place among Cumberland's retinue lent philosophical credit to the effort to impose regularity and discipline upon the army. Such measures had defined Cumberland's career as a military commander.

Even when such initiatives gained traction, however, their implementation was limited by personal spheres of influence. All of Cumberland's reforming initiatives were resisted by officers and soldiers jealous of their traditional prerogative. This encompassed, no doubt, the expense and bother that certain measures (the cleaning of clothes and replacing of bedding) would have entailed. In 1756, after numerous trials, Hales' ventilator eventually won out over his rival as the navy's preferred design and was ordered "to be put into the whole fleet." It does not appear to

---

[147] Brocklesby (1764), p. 8.

[148] Gordon (1989), p. 6. Charles Gordon, who was probably most familiar with Pringle's unpublished correspondence, cites "ill health and disenfranchisement with the War Office..." as motivating Pringle's retirement from the Army in 1758. The basis for this claim, and its possible connection to Pringle's efforts at reforming the hospital system, remains unclear.

[149] Sher (2006), p. 203-209.

have been widely adopted.[150] An address that Pringle delivered before the Royal Society in 1776, lamented the fact that, twenty years after the formal adoption of Hales' ventilator:

> the credit of this ventilator is yet far from being established in the navy. What wonder then, if Captain Cook, being so much otherwise taken up, should not have had time to examine it, and therefore avoided the encumbering his ship with an apparatus he had possibly never seen used, and of which he had at best received but a doubtful character?[151]

The success of those who had developed projects aimed at combating epidemic disease, of whom Pringle was a notable example, inspired further work in this area over the second half of the eighteenth century. As a prominent member of the Royal Society with numerous contacts within the army, and with royal patronage, Pringle was well-placed to support these efforts. In doing so he gained clients willing to support his interests. Perhaps most importantly, this subsequent work turned towards the methodologies and instruments of pneumatic chemistry in order to investigate putrid effluvia, the presumed vehicle of contagion. As a result, the medical investigation of the relationship between air and disease played an important role in launching the Chemical Revolution.

---

[150] Clark-Kennedy (1929), pp. 168-169.

[151] Kippis (1783), p. 191; Zuckerman (1977) p. 234.

Chapter 5: Sociability and Influence.

Pringle's growing stature as a public figure in London over the 1760s and 1770s is evident in a number of ways, not least through the remarkable list of published works dedicated to him beginning in 1767—I have so far found twelve. He also acquired a significant reputation abroad; his early biography lists various memberships in foreign clubs and institutions, ranging from the obscure (the Medical Society of Hanay) to the very famous (the Académie des Sciences). As with the book dedications, these began to accrue in the 1760s, becoming far more frequent during his tenure as President of the Royal Society.

<u>Books dedicated to Pringle during his life.</u>

(1767) George Armstrong. *An essay on the diseases most fatal to infants*.(London)

(1768) Robert Whytt. *The Works of Robert Whytt, MD... Published by his Son* (Edinburgh)

(1769) William Buchan. *Domestic Medicine; or, The Family Physician…*(Edinburgh)

(1770) Charles Alston and John Hope (ed.) *Lectures on the Materia Medica*.... Vol. 1.(London).

(1771) William Alexander, *An experimental enquiry concerning the causes which have generally been said to produce putrid diseases.* (London)

(1772) John Gregory, *Lectures on the duties and qualifications of a physician*. (London)

(1773) Johann David Michaelis, *Epistolae de LXX hebdomadibus Danielis* (London)

(1776) Antoine-Laurent Lavoisier, Thomas Henry (trans.) *Essays physical and chemical*… (London)

(1776) Lord Kames, Henry Home. *The gentleman farmer..* (Edinburgh and London)

(1778) Albrecht von Haller, *Bibliotheca anatomica*. Vol. 2. (Zurich and London)

(1779) Jan Ingenhousz, *Experiments upon vegetables*... (London)

(1779) John Mudge, *A Radical and expeditious Cure for a recent Catarrhous Cough*. (London, Exeter, Plymouth).

<u>Continental memberships accrued by Pringle during his life.</u>

(1763) Holland Society of Sciences

(1766) Royal Society of Sciences at Göttingen

(1776) Royal Academy of Sciences at Madrid

(1776) Society at Amsterdam for the Promotion of Agriculture

(1776) Royal Academy of Medial Correspondence at Paris

(1776) Imperial Academy of sciences at St. Petersburg
(1777) Société Royale de Médecine
(1777 Academy of Science at St. Petersburg
(1777) Society of Antiquaries at Cassel
(1778) Royal Academy of Sciences in Paris
(1778) Medical Society of Hanay
(1778) Royal Academy of Sciences and Belles Lettres at Naples

Figure 8. A list of books dedicated to Pringle as well as memberships in foreign societies granted to him.

Pringle's growing prominence among his philosophical peers was the result of his steady rise within several important institutions. In this chapter, I situate Pringle within three major venues through which natural philosophers might establish their reputations: the crown, the Royal Society, and the armed forces. In my view, such an account provides a plausible case for Pringle's influence, specifically his capacity to assist others and, consequently, to advance the study of air. This study was to form part of the basis for the Chemical Revolution.

As institutional sources of power and credit, the royal court, the Royal Society, and the military, were closely interwoven. For instance, Cook's voyages, the most high profile British scientific enterprises in the second half of the eighteenth century, were essentially the product of a partnership between the Crown, the Royal Navy and the Royal Society. Though largely conceived within the Royal Society, they depended on naval expertise; on several occasions, the Royal Society found their decisions overruled by the Admiralty. The King personally intervened to see that these expeditions were financed.

The royal court was a traditional source of legitimacy among philosophers, one which provided access to vital patronage and diplomatic channels upon which scientific networks were often based.[1] As a member of the court penumbra, particularly following his appointment as Physician in Ordinary to the Queen in 1764, Pringle appeared with increasing frequency in the London journals, for instance, in attending the 1766 inoculation of the Royal Family in the company of the other physicians and surgeons, or at the state funeral of Princess Louisa Anne in 1768, where he was listed among the "Servants to her Royal Highness."[2]

Pringle's advantage as a courtier lay, in part, in his cultivated network of philosophical correspondents who were themselves involved in foreign courts and universities.[3] In 1767, he and Franklin dined at the table of the King of France. There he met with his long-time correspondent, the King's physician Jean-Baptiste de Senac, also a Leiden alumnus and foreign member of the Royal Society. Such connections point to the diplomatic functions of these court philosophers that we will see illustrated below in Pringle's correspondence with Albrecht von Haller.[4]

The Royal Society provided an important aspect of Pringle's identity as a man of letters. Many prominent foreigners who visited the capital appear in the Royal Society's minute book as Pringle's guests. In 1774, Omai, a Pacific Islander brought to England on Cook's second voyage, patronized by the celebrated naturalist Joseph Banks, appeared at two meetings as Pringle's guest. Visitors were also likely to have been guests at Pringle's fashionable Pall Mall residence and to have attended his Sunday Evening Conversations with others among Pringle's close

---

[1] Biagioli (1993), pp. 58-59.

[2] *London Evening Post*, Mar 3, 1768, Issue 1350; *Lloyd's evening Post,* May 23, 1768, Issue 1698. Burney Collection of Newspapers.British Library/ GALE Digital Collections.

[3] Kippis (1783), pp. xcii-xcv. Addresses Pringle's foreign connections.

[4] Sonntag (1999), pp. 17-19; See p. 252 below.

associates at the Royal Society. Part of Pringle's appeal as President was certainly his wide circle of correspondents among European philosophers and literary figures.

Pringle's influence within the military, a doorway to patronage and power for the eighteenth-century Scots, was less public though equally significant, and, like his prominent place within the Royal Society, closely related to his royal connections. As his status grew within the several institutions that we will examine, so too did his ability to promote the work of others. This, likewise, gave less established figures an incentive to undertake work that would advance or defend Pringle's investigations into the relation between air and disease.

A Fellow of the Royal Society since 1745, Pringle was elected to the Royal Society's Council in 1753, 1763, and 1770.[5] Whether or not he was a council member at a given point, he was always close to those who were. His access to the inner sanctum of the Royal Society rendered him a modest asset to the court, while his intimacy with the royal family served the Society's interests and probably told in his favour during his unanimous election to the presidency. Both made him a person worth knowing. For instance, he provided his friend Albrecht von Haller with extensive details about Cook's first voyage well before the first accounts appeared in print.[6]

Pringle influenced the course of inquiry relating to his field of interest through his ability to assist others. We will examine several examples below and, in the process, trace the elaboration of Pringle's work on putrefaction. I do not wish to speculate on the precise motives of those he assisted in pursuing their experimental investigations. They were, no doubt, complicated. Yet, Pringle had, by the 1760s, acquired the power and connections to make things happen. It seems

---

[5] Kippis (1783), pp. xxxi-xxxii.
[6] Sonntag (1999), pp. 53-54.

evident that there were several experimenters willing and able to take up the opportunities that he provided.

We might begin by citing two contrasting instances of his help, one rather more benign than the other. Pringle had encouraged Jan Ingenhousz to pursue medicine as well as to emigrate to England, which he did in 1764. On his arrival, Pringle secured his introduction to prominent figures in the natural philosophical and medical communities**.** Kippis claims that "there was no foreigner who, at the different periods of his residence in this country, enjoyed so great an intimacy with him as Dr. Ingenhousz."[7] As we shall see, Pringle's attentions were instrumental in securing Ingenhousz a living and, in return, the younger physician turned his considerable talents as an experimenter to exploring the aerial aspect of the problem of putrefaction—particularly the possibilities raised by Priestley's experimental investigation into air.

One finds a somewhat less edifying instance of Pringle's intervention in the case of the self-experimenter William Starck (1740-1770) in whom Pringle and Franklin both took an interest. Starck's exploration of diet fed into Pringle's own views on nutrition, particularly as they concerned the prevention of scurvy and other diseases that appeared in a military context. A letter from June of 1769, from Pringle to Franklin reads:

> Sir John Pringle's Compliments to Dr. Franklin, and begs to introduce to his acquaintance the bearer Dr. Starck who has lately made the curious experiments on living on bread and water, and who wanting to make a pair of nice scales for

---

[7] Kippis (1783), p. 125.

> weighing himself in this prosecution of those experiments Sir J.P. has taken this liberty to address him to Dr. F. for his advice about the construction.[8]

Starck died on 30 Feb 1770, apparently of malnutrition. The editor of Starck's posthumous works describes “his experiments on diet, to which undertaking he was greatly encouraged by Sir John Pringle and Dr. Franklin, whose friendship he then enjoyed and from whom he received many hints, both as to the plan, and afterwards, in the execution and design.”[9]

To some extent, then, the history of inquiry in areas surrounding air and health was determined by the practical quid-pro-quo arrangements that governed advancement in society generally. This is not to imply that those who sought Pringle’s support were cynical or mercenary in choosing their areas of investigation. Rather, they, like Pringle, settled on a promising venue in which to pursue useful research, and willingly accepted assistance from well-placed supporters.

Pringle’s rise to prominence within the Royal Society took place during a period in which the Society was dominated by Whigs—a fact that may go some way towards explaining his unanimous election. His own views on putrid air, particularly its relationship to a global economy of air, shared in an emerging understanding of the progressive, and hence potentially radical, nature of natural philosophy promulgated by his Whig friends and allies, notably Priestley, Franklin, and Richard Price (1723-1791).[10] In the charged atmosphere surrounding the

---

[8] John Pringle to Benjamin Franklin, June 1769 in *The Papers of Benjamin Franklin. Volume 16: January 1, 1769 to December 31, 1769*, ed. Leonard W. Labaree, Helen C. Boatfield, and James H. Hutson. (New Haven: Yale University Press, 1972), 162.

[9] Stark (1788), pp. x-xi.

[10] Price was a dissenting clergyman, a member of the Bowood circle, a friend of Joseph Priestley, and a radical in politics. He was elected FRSL for his methods of calculating reversionary payments, and also wrote on demographics. He was not an experimenter in natural philosopher.

American Revolution these associations would cost him his position as President of the Royal Society.

5.1 Sociability and Power

Pringle's Scottish identity, and his family's relationship to the English, shaped his progress through London life and his international reputation as a scholar. He was born in the Scottish border counties, an area shaped by its location between the Highland Scots and the English. In a letter to his Swiss friend Haller dated May 9, 1765 discussing the authenticity of the controversial epic poems attributed to Ossian, an ancient Scottish Bard, Pringle described the liminal culture of his border clan:

> I am not interested in this matter for the honour of my countrymen; for tho' a Scotchman, I am no Highlander, being born near the banks of the Tweed [the border with England runs from the mouth of the Tweed in the East to the Solway Firth in the West], of a race composed of Saxons and Danes, and without the least knowledge of the Galic language. The true Highlanders call us contemptuously the bastards of the Saxons: for they have no word in their tongue than Saxon to express an Englishman by.[11]

Pringle's first Hanoverian patron was a notorious persecutor of the Highlanders. The Duke of Cumberland treated the Highland rebels cruelly following the defeat of the Jacobite rebellion in 1745—a campaign that Pringle witnessed as Physician General. Yet Pringle, like many Scots in London, was never fully assimilated. In 1754, decades before his alleged rebuke from George III and his attempted return to his home country, he claimed that he would have preferred to have remained in Edinburgh.[12] A letter also survives from Pringle to a family relation, an officer in the

---

[11] Sonntag (1991), p. 79.

[12] John Pringle to Mrs. Calderwood, 9 March 1754, Papers of the Hall Family of Dunglass, East Lothian, GD206/2/554/ National Archives of Scotland, Edinburgh.

army, written in the aftermath of the anti-Catholic Gordon Riots that had threatened his Pall Mall residence in the summer of 1780. In it he stated,

> We both congratulate you upon your successful campaign against the rebel canaille of London, & the rather as you had no occasion to fire; for had you & our other countrymen been brought to that necessity, our equitable and loving brethren of the South might have [said] of you, that you had seized the opportunity to have the pleasure of shooting Englishmen.[13]

During his ascendency in London, Pringle associated with the large community of Scottish diaspora who relocated there to be at the centre of patronage and power.[14] Among his close friends were William Hunter (also a physician to Her Majesty), John Hunter (his brother, an eminent London surgeon), David Hume, and James Boswell.[15] One encounters Pringle, for instance, at a literary party at the home of the hugely successful Edinburgh-born printer William Strahan in the company of David Hume, and Benjamin Franklin.[16] His *Observations* was published by Andrew Miller, another London Scot and "the greatest bookseller and publisher of the mid-eighteenth century."[17]

Pringle, like many of his fellow expatriate peers, seems to have been particularly well disposed to Scottish interests. Members of the Edinburgh philosophical community could expect a sympathetic hearing from a countryman in London for their submissions to the *Philosophical Transactions*. In 1768 he, along with a coterie of friends and allies, publicly endorsed the efforts of the Edinburgh teacher Thomas Braidwood (1715–1806) who was engaged in teaching the

---

[13] John Pringle to William Hall, 20 June 1780, Papers of the Hall Family of Dunglass, East Lothian, GD206/2/428/12, National Archives of Scotland, Edinburgh.

[14] Nenadic (2010), 230-236. See the recent edited volume *Scots in London*.

[15] Joseph Black to Adam Smith, Edinburgh, March-mid April 1776. In Black (2012), p. 329.

[16] Sher (2006), pp. 303-304.

[17] Sher (2006), pp. 275, 622.

deaf.[18] Seven of the twelve books addressed to Pringle over his life were written by Scots. Nearly sixty letters addressed to Pringle, many of them from Scots, appear in the *Philosophical Transactions* between 1752 and 1780. The very well-established Scottish Laird and judge Henry Home, Lord Kames would, in 1776, dedicate his work on agricultural improvement with an "Epistle to John Pringle, President of the Royal Society":

> Ambition to have the patronage of the Royal Society to this work, is my motive for addressing you in this public manner. The plan it recommends, has been my guide many years; and success has left me no doubt of its solidity. Your sanction, my friend, will ensure it a gracious reception, from a body of learned men, who have distinguished your literary merit by the greatest honour they have to bestow. It is my fervent desire to be useful to my country: the stamp of that illustrious Society, will give a currency to the work: every one will read; and every sensible farmer will profit by it.

As Home's reference to "literary merit" implies, Pringle's reputation was founded in the humanist education permitted him by his well-off family—a significant social advantage in pursuing patronage in the early modern period.[19] For instance, Pringle and Home were both mentioned by Boswell as members of the literary Rankenian club in Edinburgh, whose members supported Pringle's early efforts to establish himself in medical practice.[20] It had earlier helped him fit into the cosmopolitan centre of Scottish society and subsequently proved an advantage within the several institutions that I describe below.

Pringle's emergence in London was also facilitated by a network of personal and family connections which extended beyond the borders of Scotland. By the early eighteenth century, the

---

[18] *Gazeteer and New Daily Advertiser*, August 31,1768. Burney Collection of Newspapers. British Library/ GALE Digital Collections.

[19] Biagioli (1993), p. 117-118.

[20] Boswell (1782), p. 3; Stewart (1985), pp. 26, 44; Home (1807), vol. 1, pp. 50-51 (appendix). Home is not among the list of Rankenian members provided in his own memoires. Many of his Edinburgh friends, including MacLaurin and Pringle, are listed.

Pringles had become a presence in Scottish politics, largely for having been on the right side of British history. Pringle's paternal uncle, Robert Pringle (d. 1736), had left Scotland for the Low Countries during the reign of James II and returned with William III.[21] He was afterwards rewarded with a number of increasingly elevated positions, from Undersecretary of State for Scotland (1695) to Secretary of War (1718). The Pringle clan was represented in the Scottish Parliament as part of the *Squadrone Volante* party that had lent critical support to the Act of Union, and, in so doing, won the support of the Hanoverians.[22]

Education was valued among the cosmopolitan elite to which the Pringles of Stichill belonged by virtue of their connections rather than their modest wealth. The young John Pringle was tutored at home before studying with a close relative who taught Greek at St. Andrews. This training in classical languages would likely have provided some advantage in his medical studies—the opening of the Edinburgh medical school, where Pringle studied for a year, provided the Professor of Greek extra income teaching Hippocrates's *Aphorisms* (required knowledge for membership in the local college of physicians), as well as the *de apellationibus partium corporis humanum* of the first century Greek physician, Rufus of Ephesius.[23] Pringle's classical education helped qualify him for the post of joint Professor and then sole Professor of Ethics at Edinburgh University in 1734—a major achievement for a rising humanist who was, at the same time, seeking clients for his newly established medical practice.

---

[21] Kippis (1783), p. ii.
[22] The Acts of Union dissolved the English and Scottish Parliaments into a single Parliament of Great Britain.
[23] Stewart, M. A. (1990), pp. 393-394.

Pringle's place would have been secured for him by family and friends—Boswell mentioned the assistance of his father Lord Auchinleck (.[24] While a professorship was likely seen as a lower rung on the ladder of patronage, it was nevertheless a very prominent position at an important cultural moment for the Scottish elite, who were then creating or reinventing a number of Scottish institutions, notably the universities.[25] Pringle's suitability for the position is, again, a testament to his education. Unfortunately, he burned his lectures along with his correspondence towards the end of his life. Little survives beyond a student transcription of a series of lectures on Cicero, and a list of his texts: Cicero, Marcus Antoninus, Puffendorf, and Bacon.[26]

In Scotland, the public sphere emerged, in large part, from the philosophical circles led by individuals appointed to positions within the universities.[27] This is apparent, for instance, in the significant role played by academics among the various learned societies. The Edinburgh medical faculty's prominence among the Edinburgh Medical Society that published the *Medical Essays and Observations* was a notable example. Pringle arrived at the University during a period in which the efforts by the civic authorities to educate young men, who would otherwise have gone to Leiden and Utrecht, had been completed at Edinburgh.[28] His own appointment had a place in that effort.

Pringle's professorship had two essential purposes which are evident in a contemporary description of the course.[29] As we have noted, the first of these was to demonstrate the rational

---

[24] Boswell (1782), p. 2.
[25] Shapin (2006), p. 183-184.
[26] Henderson (1741), p. 373, Kippis (1783), p. vii.
[27] Wood (2006), p. 193.
[28] Phillipson (1981), p. 28.
[29] Boswell (1782), p. 3; Henderson (1741), p. 373.

justification of Christian belief. The professorship was a venue from which to promote the Baconian interests of Scotland's virtuoso elite through promoting natural religion. Its second purpose was more traditional: to inculcate in young gentlemen the Stoic character—values such as service, moderation, decorum, and seriousness—that had once shaped the Roman elite and continued to provide an exemplary archetype.

Pringle's lectures illustrate the early stage of an intellectual shift from neo-classical civic morality to a newer model ("the science of man")—long considered emblematic of the Scottish Enlightenment.[30] Both encouraged the elite towards public engagement, while the latter was promulgated by figures such as David Hume, Adam Smith, and Thomas Reid, who also sought to describe the bond between the individual and society.[31] Pringle's course explained "the origin and principles of Civil Government, illustrated with an account of the rise and fall of the ancient governments of Greece and Rome, and a view of that form of government which took its rise from the irruptions of Northern nations."[32]

As in antiquity, mastery of language and rhetorical polish remained a cornerstone of public credibility. Pringle's weekly discourses "upon some important head of Pneumatical or Moral Philosophy" were required for his students, attended by the Principal, and open to the public. Alexander Carlyle (1722-1805), a future Church of Scotland minister who attended his course in moral philosophy at Edinburgh, considered his weekly Latin address to have been the best part of the course—an early instance of the "literary merit" for which he was later noted.[33]

---

[30] Lawrence (1979), pp. 28-34.
[31] Phillipson (1981), pp. 19-22.
[32] Henderson (1741), p. 373.
[33] Selwyn (1966), p. 267.

Participation in the public life of Edinburgh played an important role in Pringle's advancement. Boswell, for instance, mentions Pringle's professorship as a turning point in his efforts to attract clients to his practice. Early eighteenth century Edinburgh was a hotbed of literary societies and social clubs. In 1726, the Edinburgh Musical Society, in which the well-heeled Pringles rubbed shoulders with the local gentry, was formed to perform continental music at weekly concerts (John Pringle played the cello). Pringle was also a member of the literary Rankenian club, founded in 1717 to disseminate "freedom of thought, boldness of disquisition, liberality of spirit, accuracy or reasoning, correctness of taste and attention to composition", as *The Scots Magazine* was to describe it years after the club's disbandment.[34]

As a young man in Edinburgh, Pringle was gregarious. Referring to the period during which Pringle had been anxious to establish himself at Edinburgh, Boswell noted that "He was much among the Ladies —He was reckoned a wit. He had not yet assumed that reserved gravity by which he afterwards secured a respectful awe."[35] The archetype of the Stoic aristocrat, which Pringle introduced to his Edinburgh students, seems to have defined his own character in later years. One catches glimpses of this persona in a sketch of Pringle's mature character provided by Kippis:

> His sense of integrity and dignity would not permit him to adopt that false and superficial politeness, which treats all men alike, though ever so different in point of real estimation and merit, with the same shew of cordiality and kindness. He was above assuming the professions, without the reality of respect.[36]

---

[34] Emerson (1979), p. 156.
[35] Boswell (1782), p. 3
[36] Kippis (1783), p. lxxix.

For instance, in 1767 Pringle chided James Boswell, in London for a short stay, for having shown an unseemly commercial interest in promoting Boswell's *Account of Corsica*, noting, "you have done rather ungenteelly in selling your copy (before the publication) to a Bookseller. This has too much the air of writing for gain, I mean for money, which is below a gentleman."[37] Boswell had received £100 for his manuscript from the London Publishers Edward and Charles Dilly.[38] Pringle was particularly concerned that unscrupulous booksellers would advertise the text as a natural history—an area of knowledge that Boswell had not cultivated and for which he did not deserve credit.

Pringle was, as we have noted, among a select group who planned to found a "society for promoting the Study of Natural Knowledge" in 1737.[39] This effort was headed by Colin MacLaurin, a Newtonian mathematician of international reputation, and Fellow of the Royal Society. MacLaurin was not among Pringle's sponsors to the Royal Society—he had fled Edinburgh during the Jacobite uprising in 1745 and afterwards fell mortally ill. The Edinburgh-born Sir Andrew Mitchell (1708-1771), who was among MacLaurin's group, was also a frequent correspondent with Pringle during his army period. As Under-Secretary of State for Scotland, Mitchell seems to have been among Pringle's more important sponsors.

The literary skills that Pringle cultivated in Scotland supported his emergence as a court philosopher (which, as a salaried royal physician, he essentially became). Kippis claimed that he "took uncommon pains with respect to the style of his compositions; and it cannot be denied that

---

[37] John Pringle to James Boswell, 4 Dec 1767, in Boswell (1993), p. 261.
[38] Sher (2006), p. 200.
[39] Colin MacLaurin to Sir John Clerk, 2nd Baronet of Penicuik, Edinburgh, May 5th, 1737, in MacLaurin (1982), pp. 71-72.

he excels in perspicuity, correctness, and propriety of expression."[40] His 1782 Eulogy in the *Histoire de l'Académie des Sciences* likewise noted that:

> He embraced, at once, practically all of the physical sciences, speculative philosophy, erudition, even theology. He liked to assemble about him all the most celebrated savants of England, and foreigners—in short, anyone from whom he hoped to learn something, or who could profit from his insights.[41]

These literary abilities are most recognizable in the highly-researched Copley addresses which were an outstanding feature of his presidency. These polished speeches made him the Society's public voice during his six-year tenure as President.

It was, however, a single personal connection that James Boswell would describe as "That stroke upon the Billiard Ball which was the irresistible cause of every subsequent movement and of his finally resting in the pocket of prosperity." This was his attachment to the Earl of Stair, which was to pave his way to the centre of patronage in London. So significant was this relationship that one finds differing accounts as to who deserved credit for having brokered it. Boswell claimed that Mr. Robert Keith, "the relation and intimate friend of Pringle", who was afterwards an ambassador, happened to be with Lord Stair at a time when Stair's regular physician was away.[42] On the other hand we also read that Colin MacLaurin,

> on Lord Stair's arrival in London, put his Lordship in mind of the high regard he had always bore for Doctor Pringle (now Sir John Pringle) then Professor of Moral Philosophy in the University of Edinburgh. The Doctor was at his own house in Stone laws-close, when a letter arrived from Mr. Mitchell, dated 14th of

---

[40] Kippis (1783), p. lxxiii.

[41] Vicq-d'Azyr (1782), p. 67. "Il avoit embrassé à la fois presque toutes les Sciences physiques, la Philosophie spéculative, l'Érudition, la Théologie même : il aimoit à rassembler autour de lui les Savans d'Angleterre les plus célèbres, les Étranges, tous ceux, en un mot, de qui il espéroit apprendre quelque chose, ou qui pouvoient profiter de ses lumières ;".

[42] Boswell (1782), p. 3.

> June, 1742 acquainting him that he was appointed Physician to the British Ambassador then at the Hague.[43]

Finally, Dr. John Stevenson, a friend and fellow of the Edinburgh College of Physicians, also took credit for introducing Pringle to Stair.[44]

These accounts are notable because they enhanced the reputation of the individual who brokered this auspicious patronage relationship. Pringle's attachment to Stair also demonstrates the opportunities presented by the patronage hierarchy available to Scots through the British military. In 1745, the sponsors of his fellowship to the Royal Society included John Ranby (1703-1773), a surgeon close to the Hanoverians who had been on campaign with Cumberland, and Edward Wilmot (1693-1786), Physician General to the Army and a royal physician. The army was the first of several British institutions that constituted power and philosophical credit through which Pringle would consolidate his reputation and promote his effort to prevent fever and study its causes.

---

[43] *Craftsman or Say's Weekly Journal*, February 23, 1771; Issue 657. Burney Collection of Newspapers. British Library/ GALE Digital Collections.

[44] Singer (1949), pp. 131-132.

5.2 Advancing antiseptics within the Army and Navy

Pringle's pride in his position as a commissioned officer in the military is evident in a very public statement of his commitment to the military life. The *Life of General James Wolfe* (1760), was an ode to heroism "attempted according to the rules of eloquence", that Pringle composed and had published following the death of James Wolfe on the Plains of Abraham in 1759. Wolfe enjoyed a good reputation among non-Jacobite Scots for the period from 1749 to 1753 that he spent as a senior officer in a regiment garrisoned in Scotland.[45] Pringle's neo-classical elegy extolled military virtue in a register that probed the limits of hyperbole:

> Wolfe has acquired that life of lasting memory; none envy it him; He flourishes like the balm-tree, and shall be exalted as the Cedar of Lebanon; every grateful Briton has already raised a monument to him in his Breast… We shall say, it is Wolfe that has deserved all this: We can say no more; we feel the rest; we feel the bright Effigies of his Glory making our bosoms to pant…[46]

A military commission conveyed a special status among the liberal professions and involved a personal loyalty to the crown. When James Wolfe was offered a lucrative opportunity to lead the third Duke of Richmond on the grand tour, he declined, stating "I can't take money from anyone but the King my master or one of his blood."[47] Pringle complained when German officers in the allied armies facing the French in the War of the Austrian Succession failed to recognize the gentlemanly status confirmed by his commission.[48]

---

[45] Brumwell (2006), pp. 67-104. The troops under Wolfe's command during the Seven Years War in North America also included Highlanders.

[46] Pringle (1760), pp. 25-26.

[47] Guy (1985), p. 19.

[48] Singer (1949), p. 135.

Both Pringle and Wolfe had been at the Battle of Dettingen in 1743 and had taken part in the Jacobite campaign in 1745.[49] The Duke of Cumberland played a critical role in advancing the careers of both men. By 1749, when Pringle became physician to the Duke of Cumberland, however, Wolfe had fallen out with his former master.[50] Pringle's text may be understood as a panegyric to the Army as well as to Wolfe himself, since it portrayed an exemplary type, the ideal soldier. Pringle was, after all, far from the first in his Southern family to declare his allegiance to Hanoverian rule. Army life was a common path for Southern, and, increasingly over the second half of the century, for Northern Scots.

As Pringle established himself in his role of Physician General, he corresponded with John Clerk (1689-1757), the head of the Edinburgh pharmaceutical committee as he developed a dispensary for use in the army hospital. This was later disseminated by Cumberland himself as the *Medulla Medicinae Universae*, "Compiled at the Command of his Royal Highness the Duke, For the Use of the Military Hospital Abroad."[51] Though attributed to the physician John Theobald, who translated it and produced the indexes, archival research by Charles Gordon has shown it to be based on a word-for-word reprint of a manuscript army dispensatory written by Pringle, which survives among Cumberland's papers.[52]

Pringle's growing influence within the military may be seen in terms of a subtle but fundamental shift in the way the British army approached the health of its soldiers. Benjamin Thompson (later Count Rumford, 1753-1814), a New England loyalist who served in the British army after having

---

[49] Hamilton (1963), p. 145.

[50] Reid, Stuart. "Wolfe, James (1727–1759)," in *Oxford Dictionary of National Biography*, ed. H. C. G. Matthew and Brian Harrison (Oxford: OUP, 2004); online ed., ed. Lawrence Goldman, October 2008.

[51] Gordon (1989), pp. 8-9; Gordon (1982), p. 2.

[52] Gordon (1989), pp. 8-9.

been refused a commission in the Continental Army, attributed the high rate of disease in their camps to the dirtiness and poor hygiene of the soldiers. Cleanliness formed part of the traditional culture of martial discipline that the professional soldiers of the British army, such as Thompson, believed to be essential to an effective military.[53] A contemporary British work on military medicine by Richard Brocklesby, physician to the army in Germany during the Seven Years War, considered the

> well being of the men, and the preservation of their healths to be a constant serious business, and an unceasing care of their Officers, as well as of the Doctor. It is only by their prudence and healthful regulations, the private men are to be preserved from rotting away in the most supine negligence, and dirt around their persons, and from being spendthrifts of that very slender pittance, which they are allowed.[54]

Consequently, comments on the poor hygiene of the American rebels implied the carelessness and incompetence of their leaders.

Brocklesby's published medical observations, gathered during the Seven Years War were entitled *Oeconomical and Medical Observations in two parts. From the Year 1758 to the Year 1763, inclusive. Tending to the Improvement of Military Hospitals, and to the Cure of Camp Diseases, Incident to Soldier* (1764). Richard Selwyn, who published a biographical article on Pringle in 1966, claims that Brocklesby "strove to implement Pringle's reforms throughout the Army."[55] Brocklesby's work is a further indication of Cumberland's continued support for these health reforms as he led the campaign against the French in Germany.

---

[53] McCullough (2005), p. 32.
[54] Brocklesby (1764), p. 21.
[55] Selwyn (1966), p. 269.

Kippis claimed that “It cannot be doubted but that the treatment he hath recommended, from his own observation and experience, hath been adopted by the able and judicious practitioners who have succeeded him…” He cited one instance of Pringle’s project being enacted by a reforming officer. General Melville, Governor of the Neutral Islands (Dominica, St. Vincent and Tobago, and Grenada in the Caribbean) was “a gentleman who unites with his military abilities, the spirit of philosophy, and the spirit of humanity...” Melville was deemed “the happy instrument of saving the lives of seven hundred soldiers” for having shifted their quarters from low, swampy ground into the hills based on conversations with Pringle and the advice of his book.[56]

One may also point to specific instances in which Pringle’s hygienic reforms were applied, almost certainly with Cumberland’s support. For instance, his measures to prevent outbreaks of disease on transport and hospital ships were tried on the expeditions to Rochefort in 1757, and to Cherbourg and St. Malo on the French Coast in 1758.[57] A large number of men were required for these raids in force and had to be carried considerable distances onboard ships—circumstances that might lead to catastrophic outbreaks of fever. Pringle attended one such raid to the Rade des Basques in 1757, appending his observations to the third edition of *the Observations on the Diseases of the Army* which appeared in 1765.[58]

Orders survive that were issued by the 3rd Duke of Marlborough on May 24th 1758. Marlborough’s instructions as Commander of the Raid on St. Malo, consisting of 14,000 men, were explicit and rigorous in their imposition of these new practices. They indicate the extent to which such measures suited the disciplined and regimented military life of the British Army:

---

56 Kippis (1783) pp. xxviii-xxix.
57 Gordon (1985), pp. 43-44.
58 Pringle (1765), pp. 307-308.

> As the preservation of the men's health depends chiefly on cleanliness, keeping as much as possible on Deck, and supplying the space which the soldiers occupy below the decks with fresh air. The men are as usual to change their linen twice a week, to comb their hair every day to swab between decks and carefully to sweep out their berths every morning, to do which effectually their bedding, knapsacks, hammocks and all their necessaries are to be brought upon the deck. The sergeants of every squad to be answerable for the exact performance of this. The berths cleaned and cleared before 8 a.m. in the morning and if ships have no ventilators an air sail to be used immediately after the berths are cleared and to be continued during the day, of possible, with supplying fresh air.
>
> At nine o'clock a subaltern officer to visit between decks that he may be the better judge of the order etc. that the berths are kept in. Every person to be upon deck whose health will permit of it. While he visits he is likewise to visit at 7 o'clock every evening and each time to report to the Commanding Officer of the transport.
>
> If there is no vinegar on board the transports for washing and sprinkling between decks, it is recommended to the Commanding Officer to buy some as nothing tends to the preservation of men's health and the Pitch Pots should likewise be burned between decks twice a week.[59]

If Pringle acquired a reputation as a patriotic reformer, others within the military establishment were to follow his lead. A notable example is Captain James Cook's second voyage to the south pacific aboard the *Resolution* from 1772 to 1775.

Likely at Pringle's suggestion, Cook imposed strict standards of cleanliness as well as other measures to prevent scurvy. These he described in a letter to Pringle as President of the Royal Society entitled "The Method Taken for Preserving the Health of the Crew of His Majesty's Ship the Resolution during her late Voyage Round the World." The report received the enthusiastic endorsement of the Society, earning Cook the fourth Copley Award of Pringle's presidency, the second such award that is readily associated with his own particular interests in antisepsis, and

---

[59] Gordon (1985), pp. 43-44.

the relationship between air and disease.[60] Cook's account described an exemplary voyage in which only a single man died of sickness, a philosophical triumph that excised the memories of Anson's disastrous voyage.[61] He related that:

> Proper methods were employed to keep their persons, hammocks, bedding, cloaths, &c. constantly clean and dry. Equal pains were taken to keep the ship clean and dry between decks. Once or twice a week she was aired with fires; and when this could not be done, she was smoaked with gunpowder moistened with vinegar or water. I had also frequently a fire made in an iron pot at the bottom of the well, which greatly purified the air in the lower parts of the ship.[62]

Cook's primary focus was on diet, particularly the testing of several antiseptic remedies that had emerged based on Pringle's work on antisepsis. The first of these was the antiseptic scurvy treatment devised by the Irish-born naval surgeon David Macbride, Pringle's most immediate and enthusiastic disciple.

Like Pringle and Cook, Macbride's career had developed within the Georgian military; he had served on board a hospital ship, eventually becoming a surgeon. After the war he settled in Dublin to practice surgery and eventually received his medical doctorate at Glasgow in 1764. As with Pringle's *Diseases of the Army,* Macbride directed his *Experimental Essays* towards preventing putrid fever within the crowded institutional circumstances of military life. He proposed that the provisions for an easily-prepared fermenting "wort" beverage, based on dried (and hence non-perishable) beer malt, be kept on board naval vessels as an antiseptic treatment for scurvy.[63] The notion was founded in long experience—the knowledge that green plants

---

[60] Cook (1776), pp. 402-406.
[61] Kippis (1783), p. 146.
[62] Cook (1776), p. 404.
[63] Macbride (1764), pp. 190-198.

(which he followed Pringle in associating with fermentation) prevented scurvy but could not be kept fresh on long voyages. He noted:

> I was firmly of the opinion that the cure of the sea scurvy depended chiefly, if not altogether, on the fermentative quality of the fresh vegetables; which are found, by experience, to be the only things that, with certainty, conquer this destructive disease. And in consequence of this persuasion, it occurred to me, that as there are vegetable substances, which, though not perfectly recent, are yet capable of fermentation, such in particular as common malt; that this, if taken in the way of medicine, would, in all probability, produce effects similar to those produced by green vegetables, and consequently cure the scurvy; and as malt can be preserved sound, for a considerable length of time, it might be carried to sea, and there be kept, in order to make wort occasionally as it might be wanted..[64]

Had it been successful, Macbride's search for an antiscorbutic would likely have made his reputation—one need only consider the posthumous praise lavished on James Lind (1716-1794) after the year 1796, when the effectiveness of the citrus cure was finally recognized.[65] Had such an effective cure been ascertained unambiguously during the discoverer's lifetime (Lind himself had not fully appreciated the significance of his citrus trials), that person would have been fêted for having overcome one of the most significant problems facing an early modern military. To attempt such a discovery, however, required patronage and support within the military in order to perform trials at sea and in naval hospitals upon the victims of scurvy. To this end, Macbride's book was dedicated to Sir Charles Saunders, Vice-Admiral of the White, Member of Parliament, and treasurer of Greenwich hospital.

Macbride enjoyed an early coup when a letter detailing his proposal, addressed to his friend George Cleghorn (1716-1789), who taught anatomy in Dublin (later professor at Trinity

---

[64] Macbride (1764), pp 171-172.

[65] Bullough (2008), pp. 361-363. See also Carpenter (1986) and Smith (1919).

College), was circulated among London’s medical elite.[66] These supporters paved the way for a trial of his wort cure at the naval hospitals at Portsmouth and Plymouth that took place in 1764. This did not go well, though Macbride attributed the problems to the patients' unwillingness to be deprived of the fresh vegetables which they knew would cure them.[67]

Like Pringle, Macbride had the notable advantage of family connections within the military. Shortly after the publication of the book’s first edition, his brother John Macbride, a naval lieutenant, had command of a ship called the *Jason* on a voyage to the Falklands. The second edition of David Macbride’s *Essays*, published in 1767, included an extract of the surgeon’s medical journal on that voyage which took place from 1765 to 1767.[68] This provided day-by-day medical histories of four seamen eventually cured of their scurvy by Macbride’s wort.[69]

Pringle’s role in supporting Macbride’s efforts is open to some speculation. What is clear is that Pringle’s status increased substantially during the 1740s and 1750s when Macbride had petitioned for opportunities to try his hygienic reforms. By the publication of the first edition of Macbride’s book in 1764, Pringle had become a physician to the Queen, a prominent member of the Royal Society, a full member of the Royal College of Physicians of London ex *speciali gratia* (as he had not been educated in England) and, though he had quit the army in 1758, he doubtless retained many of his military connections. The Seven Years War (1756-1763) saw “a

---

[66] Badenoch (1776), pp. 61-71. Later editions of the book were introduced by a dedication, dated 1767, to Charles Saunders who had been made a Lord of the admiralty in 1765. This would have coincided with a period of numerous naval trials of Macbride’s Wort cure.

[67] Macbride (1764), p. 174; Badenoch (1776), p. 65.

[68] Scott (1970), p. 49. Singer (1949), pp. 151-152.

[69] Macbride (1767), pp. 290-296.

massive expansion" of military activity managed by patronage networks in London.[70] Pringle was, by then, well placed to support Macbride's investigations into putrefaction and antisepsis.

There is some evidence that he did. Almost immediately following the book's publication he wrote Macbride a warm letter of support that detailed his own observations. This letter was added to subsequent editions of Macbride's book.[71] Macbride had also approached Robert Adair, Sergeant-Surgeon to George III, who was a close friend of Pringle.[72] Later the same year, Pringle provided his friend and long-time correspondent, the Swiss anatomist Albrecht von Haller with a copy of Macbride's "very ingenious" *Experimental Essays*, though Haller was not convinced that fixed air would be effective in counteracting putrefaction.[73] Pringle was also among the group who secured Macbride his trial at Portsmouth and Plymouth.[74]

Macbride's project, founded on the belief that fixed air provided an effective and stable antiscorbutic, paved the way for further work in this area much as the earlier ventilators of the seventeenth century had given way to newer, more specialised designs. For instance when Joseph Priestley, who was known within the field of natural philosophy for his Franklinist electrical experiments, sought to enter the emerging field of aerial experimentation, he found the search for an antiscorbutic a useful place to begin.

---

[70] Nenadic (2010), p. 243.
[71] Macbride (1767), pp. 206-209.
[72] McBride (1991), p. 166.
[73] Sonntag (1999), p. 83; Singer (1949), p. 152.
[74] Scott (1970), p. 49.

Priestley's first public contribution to pneumatic chemistry, a pamphlet entitled *Directions for Impregnating Water with Fixed Air* (1772), was based directly on Macbride's theory.[75] Priestley's pamphlet described a method for creating an antiscorbutic beverage saturated with antiseptic fixed air. Like Macbride's wort, the apparatus and method that Priestley described, was intentionally simple and could be performed using readily available materials.[76] Essentially, two vessels were attached by airtight tubing with a bladder between them. Acid (typically oil of vitriol) was applied to chalk in the first chamber. The resulting fixed air was then pumped into the second chamber which contained the water using the bladder which was then agitated to dissolve the fixed air. The whole process was claimed to take about fifteen minutes.[77]

Cook's voyages provided an opportunity for a systematic test of the antiseptic scurvy remedies of both Macbride and Priestley. Pringle was almost certainly instrumental in securing such trials.[78] Cook's report to Pringle, for which he later won the endorsement of the Royal Society, offered a measured endorsement of Macbride's wort cure, considering it

> One of the best antiscorbutic sea-medicines yet found out; and if given in time will, with proper attention to other things, I am persuaded, prevent scurvy from making any great progress for a considerable time: but I am not altogether of the opinion, that it will cure it in an advanced state at sea.[79]

Cook's report did not mention the effectiveness of Priestley's medicinal soda water.

---

[75] Priestley (1772b), pp. 1-3. This was, like Macbride's *Experiments and Observations*, dedicated to a powerful individual in the navy. It noted that the Admiralty had referred his process to the college of physicians who had recommended forthcoming sea trials— a fact proudly repeated in his memoir.

[76] Golinski (1992), p. 114.

[77] Priestley (1772b), p. 13.

[78] Lawrence (1987), p. 7; McBride (1991), p. 166.

[79] Cook (1776), p. 403.

By the time that Cook was granted his Copley medal in March of 1776, he had already departed on his third voyage of the HMS *Resolution* from which he did not return. Had he lived, the endorsement of the Royal Society for having contributed usefully to the improvement of the health of sailors and enlisted men would have been an ornament to his career and reputation. The support of such efforts at improvement represented for Cook, as it had for Cumberland, a means to distinguish himself as an enlightened and patriotic manager of His Majesty's subjects. Pringle's activities within the Royal Society had done a great deal to make possible such efforts.

Pringle's influence within the military was not universally admired. In November of 1775, while British troops were engaged in a costly war with the American colonists, a satirical column in the London papers attacked him obliquely as undermining English pre-eminence within the army.

> Intelligence Extraordinary, The College of Physicians at Edinburgh have addressed the _____ To send out several hogheads of pease bannocks, to be contracted for in that city; and have represented the bannocks as a proper *pabulum*, from its containing a great quantity of fixed air, not only as a *prophy laxis*, but as a remover of the *colluvies*, which is frequently accompanied by a dyspnea, inducing to a *cachexy*. –This, with the Dunse Spaw to wash the face and hands of the afflicted soldiers, it is hoped, will restore them as clean skins as the people of that cleanly metropolis are famous for.—The Address was most graciously received and we hear that Maister Muire is to contract in Edinburgh accordingly for a quantity of the aforesaid bannocks, to be shipped from Leith to Boston, that the soldiers may have them to eat with their sour crowty.—N. B. No Englishman has been allowed to take a contract for Cabbages, Potatoes, or Onions, for fear he should poison the soldiers.[80]

The piece is notable for combining anxieties over the Scots' pervasive reliance on the army for advancement in business with fears of innovation, originating in Edinburgh, taking root within

---

[80] *Morning Chronicle and London Advertiser*, November 1,1775; Issue 2011. Burney Collection of Newspapers. British Library/ GALE Digital Collections.

the British establishment.[81] Pringle, who was then actively advancing antiseptic medicine through the Royal Society, was its unnamed target. As the figurehead of a powerful Whig faction within the Society, Pringle was to become the subject of increasing scrutiny in the period surrounding the American Revolution.

[81] Nenadic (2010), p. 229-230.

5.3 Patronage and Influence within the Royal Society

On November 30, 1773, John Pringle gave his most articulate and public statement on the importance of the air in relation to health on the occasion of the awarding of the Copley medal for 1772 to Joseph Priestley. The award recognised Priestley's "Observations on Different Kinds of Air", a lengthy account of his pneumatic experiments that had appeared in the *Philosophical Transactions* earlier that year. Pringle used the occasion to emphasize the importance of the air as an area of continued investigation for the physician-observer and the experimenter.

> There is not perhaps any branch of Natural philosophy that has more engaged the attention of the learned, or been more successfully cultivated, than the nature of the common air. The knowledge of how indispensable it is to the preservation of animals must have been coeval with mankind: it was from the beginning, as now, *the breath of life*. It was found likewise to be a necessary support of fire, and they say that the vegetable creation, deprived of it, languished and died. Nor did physicians fail to distinguish, at least attempt to distinguish, between the effects of an air too hot and one too cold, an air too moist and one too dry, and between an insalutary and a wholesome air.—Thus far the experience, or the theory of all ages.—[82]

John Pringle's Copley Medal speech, celebrating Joseph Priestley's experiments on air, was a learned text, an official summation meant equally for the Royal Society and all of Europe. Pringle's summation of Priestley's work was to be the first of six such discourses over his tenure as President. After he delivered it, the Royal Society's Council voted unanimously to have one thousand copies printed at the Society's expense—a gesture that was to be repeated following

---

[82] Pringle (1773), pp. 3-4.

each of Pringle's yearly Copley discourses. This was a singular honour for the President, and an indication of the importance of literary refinement to Pringle's status as a natural philosopher.[83]

Pringle composed each discourse on the topic of the year's Copley-winning work. Subjects ranged from the electricity of the torpedo fish to the theory of gunnery. Each highly formal composition provided an occasion to demonstrate the breadth of his learning and eloquence as he situated the work in the context of an evolving field whose roots lay in antiquity. Following his death, they were reprinted with Kippis' "Life of Sir John Pringle" as a preface. These texts were to be a lasting token of his period at the helm of the Royal Society.

Pringle's speechifying was not universally admired. Aside from the parody of his acceptance speech that had appeared in the *London Morning Chronicle in* 1772, Kippis later noted that Pringle had been "more ready to comply" with the request that his first Copley address be published because "an absurd account of what he had delivered had appeared in a newspaper."[84] I have not been able to discover whether this "absurd account" was simply a bad transcription, further mockery of his literary and philosophical pretensions, or, perhaps, a more pointed criticism of his role in bringing the Royal Society to endorse Joseph Priestley, already a highly controversial figure.

To those familiar with Pringle and his London circle, it was probably no surprise that the first Copley address of Pringle's presidency went to Priestley. Pringle and Franklin had, for several years, considered him worthy of special endorsement. Franklin had been a key supporter of the electrical work with which Priestley had established himself as a natural philosopher. Their

---

[83] Kippis (1783), pp. xxxvi-xxxvii.
[84] Kippis (1783), p. xxxvii.

communication began in 1766, the year before Priestley published *The History and Present State of Electricity*. This work referred to Franklin's kite experiment as "the greatest, perhaps, that has been made in the whole compass of philosophy, since the time of Sir Isaac Newton"; it evidently pleased Franklin. [85]

In November of 1767 Franklin unsuccessfully supported Priestley as a candidate for the Copley medal at a meeting of the Royal Society's Council. Pringle's role in the matter is not clear, though he was close to Franklin and a powerful figure on the Society's Council. The bid to recognise Priestley's work on electricity was resisted on the legitimate grounds that his paper had not been submitted to the Society before its publication. A study of Sir Godfrey Copley's will confirmed that Priestley was not eligible and, though an exemption was granted and the matter resubmitted to a later meeting of the Council, Franklin observed that: "some Persons are busy in an Opposition to the Measure."[86]

The extent to which Franklin and Pringle might have influenced Priestley's decision to switch his primary focus from electricity and optics to air is a matter of conjecture. It is notable, however, that Pringle's address placed Priestley's *Observations on Different kinds of Air* within a distinctly medical framework.[87] For instance, Pringle used the occasion to acknowledge Priestley's contribution to the treatment of scurvy by means of his artificial mineral water, which he connected to the earlier discoveries of figures such as William Brownrigg, Joseph Black, and

---

[85] Priestley (1769), p. 171.

[86] McKie (1961), pp. 18-22; Benjamin Franklin to John Canton, 27 Nov 1767 in *The Papers of Benjamin Franklin, Vol. 14. January 1, 1767 to December 31 1767*, ed. Leonard W. Labaree, Helen C. Boatfield, and James H. Hutson. (New Haven: Yale University Press, 1970), 326.

[87] Golinski (1992), pp. 107-110. Golinski's reading of the Copley address suggests that "Pringle's Copley Medal address was a pièce d'occasion, designed to construct a pattern out of more than five decades of experimentation that would point teleologically toward his own concerns." This is reasonable but for the fact that, in my view, Priestley's experimental interests were very similar to, and probably inspired by, those of Pringle.

David Macbride. Here he gave voice to his longstanding views regarding the value of antiseptic medicine. Scurvy, he claimed, "… is a putrid distemper, requiring all the antiseptic quality of those mineral waters, without the chalybeate principle, which might injure, by over-heating the blood, too much disposed to inflammation."[88]

Pringle cited Priestley's artificial mineral water as an example of a practical invention that best illustrated the Society's purpose:

> [Priestley] made a simple apparatus, for generating this species of air from chalk, and mixing it with water, in such quantities, and in so speedy a manner, that, having exhibited the experiment before this Society, and the College of Physicians, it met with so much approbation, that, in order the Public might the sooner reap the benefit of it, he was induced to detach this part of his labours, and in a separated Paper to present it to the Admiralty. [89]

Priestley's artificial mineral water was the first of two inventions to come out of his early pneumatic work that Pringle singled out for praise in his address. The second, which came to be known as the "nitrous air test" was still in its infancy; Pringle was perhaps the first to publicly recognise its potential. Elaborated into the instrumental practice of "Eudiometry", which promised a means to determine the relative level of putrid miasma in a sample of air, the nitrous air test was to provide the essential technology behind one of the more active areas of experimental inquiry in the last quarter of the eighteenth century.[90]

The nitrous air test came out of Priestley's search for new chemically distinct "species" of air—an investigation for which he has long been assigned a major role in the history of chemistry.

[88] Pringle (1773), pp. 21-22. The 'chalybeate principle' refers to the chemical substances naturally dissolved in medicinal waters to which physicians and experimenters assigned their healing properties.

[89] Kippis (1783), p. 22.

[90] Boantza (2013a), pp. 377-388; Golinski (1992), pp. 117-128; Schaffer (1990), pp. 285-292; Levere in Holmes and Levere (2000), pp. 105-135.

Nitrous air (nitric oxide), obtained from mixing various metals with spirit of nitre (nitric acid), was among the species uncovered in his first set of experiments for which he won the Copley.[91] Priestley's investigation in this area proceeded from an earlier observation by Stephen Hales that a mixture of Walton pyrites and spirit of nitre formed a "turbid red mixture" that diminished a volume of common air.[92] Priestley measured this diminution and observed that it took place in proportion to the common air's fitness for respiration. From there he worked out a procedure that he claimed might provide a measure of the extent to which air in a given place had been vitiated, that is, the extent to which a toxic element had been added to the air by processes known to render air incapable of supporting respiration: its vitiation by continued respiration, or by the effluvia from a burning candle or an element such as calcified metal.

In all such cases, the vitiation of air was attributed to the addition of a putrid substance to the air, rather than the removal of a vital element from it.[93] This was to form a key point of contention between Priestley and the French chemist Lavoisier. Priestley's early understanding of the test's implications is evident in a passage from his *Observations* of 1772, in which he identified it as providing " a prodigiously large scale, by which we may distinguish very small degrees of difference in the goodness of air." Early trials, though limited, seemed to bear out his assumptions about the test's utility:

> … if I did not deceive myself, I have perceived a real difference in the air of my study, after a few persons have been with me in it, and the air on the outside of the house. Also, a phial of air having been sent me, from the neighbourhood of York,

---

[91] Golinski (1992), pp. 118-119.

[92] Hales (1727), p. 126; Priestley (1772a), p. 210. In Priestley's experiment two volumes of common air were placed in a vessel over water. One volume of nitrous air was then added producing the dramatic effervescence and red fumes. With good common air about 1.8 of the original three volumes of air would remain. The extent to which the remaining volume exceeded this amount represented the degree to which it was loaded with effluvium.

[93] Priestley (1772a), p. 182; Priestley (1776), pp. 226-227.

> it appeared not to be so good as the air near Leeds; that is, it was not diminished so much by an equal mixture of nitrous air, every other circumstance being as nearly the same as I could contrive. It may perhaps be possible, but I have not yet attempted it, to distinguish some of the different winds, or the air of different times of year, by this test.[94]

In his Copley address Pringle linked the test to the foundations of the Royal Society and British natural philosophy itself. He claimed that:

> It was upon such a prospect of obtaining a criterion for distinguishing good air from bad, that Lord Bacon almost in a rapture breaks out: 'These are noble experiments that can make this discovery; for they serve for a natural divination of seasons!' and again, 'They teach men to chuse their dwelling for their better health."[95]

By evoking the Royal Society's longstanding interest in meteorological data-gathering, Pringle was proposing eudiometry as a means to supplement, and in some applications to supplant, existing instruments.[96] Pringle likely also played a significant role in the Royal Society's decision, taken in 1773 shortly after the delivery of Priestley's Copley, to begin gathering meteorological readings using sophisticated equipment—a project headed by Henry Cavendish, his close friend.[97]

In this case, as in others, Pringle's ability to get his way within the Royal Society had much to do with his influence over which papers were read at its meetings and disseminated through its journal. Others had reasons to recognise his interests. For instance, Priestley's commitment to Pringle's earlier work is evident in his public reply to a book, published in 1771 by the

---

[94] Priestley (1772a), p. 215.

[95] Kippis (1783), pp. lxviii, 28.

[96] Golinski (2007), pp. 161-163.

[97] Golinski (2007), pp. 206-207

Edinburgh surgeon William Alexander (*bap.* 1742?, *d.* 1788?), which appeared in the *Philosophical Transactions*.

In *An Experimental Inquiry Concerning the Causes Which Have Generally Been Said to Produce Putrid Disease*—a work "respectfully dedicated" to Pringle—Alexander followed Pringle's experimental methods to systematically test the potential causes of putrid disease. While most of his conclusions were similar, in some cases identical, to Pringle's, he differed on several points. The most significant of these was his view that "mixed effluvia" posed little obvious threat. Having suspended bits of mutton over various marshes, swamps, and privies, Alexander determined that the issuing vapour was, in fact, somewhat antiseptic probably owing to fermentation.[98] Tactful though Alexander was in framing his conclusions, they nevertheless seemed to contradict Pringle's views on the dangers of swamps and marshes.

In response to Alexander's polite challenge, Pringle's supporters within the Royal Society rallied around the President. On 8 November 1773, three days before the Royal Society Council reached its unanimous decision to award him the Copley, Priestley drafted a letter to Pringle. In it he verified the toxicity of putrid vapours using instrumental techniques including the nitrous air test that he had introduced in his *Observations*.[99] Priestley added that:

> I was particularly surprised, to meet with such an opinion as this, in a book inscribed to yourself, who have clearly explained the great mischief of such a situation, in your excellent treatise on the diseases of the army. On this account, I have thought it not improper to address to you the following observations and experiments, which I think clearly demonstrate the fallacy of Dr. Alexander's

---

[98] Alexander (1771), pp. 74-81.

[99] Priestley (1774), pp. 91-93.

> reasoning, indisputably establish your doctrine, and indeed justify the apprehensions of all mankind in this case.[100]

The accompanying entry in the Royal Society's *Minute Book* stated that Priestley's "... present object is to oppose an opinion lately advanced by Dr. Alexander of Edinburgh, which might be prejudicial to the life of Men."[101] Priestley's letter was published in 1774 in the *Philosophical Transactions* along with a letter from Richard Price, who was one of Pringle's closest associates and a frequent guest at his Sunday gatherings. Price ventured further afield for the evidence behind his short letter entitled "Farther Proofs on the Insalubrity of Marshy Situations." He cited the demographical work published in 1766 in the *Memoires of the Oeconomical Society at Bern* by the Swiss demographer Jean-Louis Muret (1715-1796).

Muret's extensive study of the Swiss canton of Vaud seemed to indicate that a low-lying parish experienced substantially higher mortality than mountainous regions. While acknowledging the limitations of this data (a single parish observed over fifteen years) Price insisted that Alexander's challenge to Pringle's insight on swamps required an answer:[102] "Dr. Alexander's experiments may lead some to very wrong conclusions on this subject; I could not help thinking, that there would be no impropriety, in sending you the account, I have now given. If you think it of any importance, I shall be obliged to you for reading it to the Royal Society."[103] One might add Franklin to the list of Pringle's defenders as well; he contributed a letter to the second volume of Priestley's *Experiments and Observations*, which listed some observations on water

---

[100] Priestley (1774), p. 91.
[101] The Royal Society of London (1660-1826). vol. 28 (72-75), p. 237, 16 December 1773.
[102] Price (1774), pp. 96-98; Singer (1949), p. 145; Coley (1982), pp.94-95.
[103] Price (1774), p. 98.

gathered from the bottom of a stagnant ditch. His experiments with this putrid water reportedly brought on an intermitting fever.[104]

Pringle's interests are also conspicuous in the awarding of the fourth Copley of his presidency to James Cook for the report that Cook had provided of his exemplary circumnavigation on the *Resolution*. Cook's voyages provided an opportunity to explore a variety of philosophical questions. The Royal Society had, for instance, long made use of the evidence of exploratory naval voyages for work on natural and experimental history. Boyle's *New Experiments Touching Cold* (1665) had relied on written testimony of explorers from across Europe as virtual witnesses to phenomena unavailable to London philosophers.[105] Cook's three voyages provided the Society an unprecedented opportunity to plan and perform scientific observations and experiments in a dedicated setting.

All were attended by groups of naturalists and artists whose reports on the South Pacific were eagerly awaited throughout Europe. Cook's first voyage on board the *Endeavour*, which lasted from 1768 to 1771, observed the transit of Venus from Tahiti. His first voyage of the *Resolution*, lasting from 1772-1775, provided an opportunity for supervised trials of the new marine chronometers devised for measuring longitude. It also afforded an opportunity to demonstrate the fruits of two decades of inquiry into putrefaction.[106]

Pringle had met Cook in early 1772 shortly before Cook's second voyage (the first voyage of the *Resolution*) departed for the South Pacific.[107] Thereafter Cook appeared several times as Pringle's

---

[104] Priestley (1775), pp. 321-323.
[105] Shapin (1994), pp. 249-255.
[106] Lawrence (1996), pp. 88-91.
[107] Sonntag (1999), p. 243.

guest at the Royal Society prior to becoming FRS before his departure on his fatal voyage in 1776.[108] Cook was persuaded to use the opportunity to try antiseptic medicine in preventing putrid fever.[109] As in the case of Priestley's Copley, Cook's award provided an opportunity to frame existing work in relation to Pringle's views by means of a public display of eloquence. He declared:

> I would now enquire of the most conversant in the study of bills of mortality, whether, in the most healthful climate, and in the best condition of life, they have ever found so small a number of deaths, in such a number of men, within that space of time? How great and agreeable then must our surprise be, after perusing the histories of long navigations in former days, when so many perished by marine diseases, to find the air of the sea acquitted of all malignity, and, in fine, that a voyage round the world may be undertaken with less danger, perhaps, to health, than a common tour in Europe![110]

Pringle's discourse also recalled the disastrous epidemic of scurvy that crippled Anson's earlier circumnavigation.[111]

Cook's letter had been brief and had included only a short passage on the effectiveness of fermenting wort. Pringle's address, by contrast, contained a lengthy digression on the effectiveness of fixed air ("This salutary gas") as an antiseptic.[112] Likewise, where Pringle's discourse on Priestley's pneumatic work had remained largely descriptive (albeit with various embellishments), his speech on Cook's voyage provided a far more extensive survey of putrid fever and antiseptic medicine. It was another opportunity to publicise recent inquiry into

---

[108] The Royal Society of London (1660-1826), vol. 29 (76-79), pp. 13, 27, 41
[109] Lawrence (1987), p. 7.
[110] Pringle (1776), pp. 146-147.
[111] Pringle (1776), pp. 150-153.
[112] Pringle (1776), pp. 166.

antiseptic medicine, including its aerial component, as well as other measures to prevent putrid vapours, including the Hales ventilator which, unfortunately, had not been provided to Cook.[113]

There is a further notable aspect to Pringle's aerial project within the Royal Society, one best represented by a familiar passage in his 1772 address dedicated to Priestley's pneumatic work.

> From these discoveries we are assured, that no vegetable grows in vain, but that from the oak of the forest to the grass of the field, every individual plant is serviceable to mankind; if not always distinguished by some private virtue, yet making a part of the whole which cleanses and purifies our atmosphere. In this the fragrant rose and deadly nightshade co-operate: nor is the herbage, nor the woods that flourish in the most remote and unpeopled regions unprofitable to us, nor we to them; consider how constantly the winds convey to them our vitiated air, for our relief, and for their nourishment. And if ever these salutary gales rise to storms and hurricanes, let us still trace and revere the ways of a beneficent Being; who not fortuitously but with design, not in wrath but in mercy, thus shakes the waters and the air together, to bury in the deep those putrid and pestilential effluvia, which the vegetables upon the face of the earth have been insufficient to consume.[114]

Pringle is here referring to an aspect of Priestley's experimental investigation that seems to have particularly interested him—the means through which nature removes the putrid substance, generated by processes such as respiration, combustion, and putrefaction, from the atmosphere. This "aerial economy" was one of many systems accessible to human reason that had been designed by a benevolent creator. In view of the potential dangers of putrid air, such a system took on a profound significance. "Without such", Pringle claimed, "the whole atmosphere would in time become unfit for animal life, and the race of men, as well as beasts, would die of a pestilential distemper."[115]

---

[113] Pringle (1776), pp. 190-192.
[114] Pringle (1773), pp. 34-35.
[115] Pringle (1773), p. 32.

As noted, Joseph Priestley studied putrid effluvia among the various “species” of air. His extensive chemical investigation of air led him to the conclusion that putrefaction was one of a number of “phlogistic” processes that saturated the air with phlogiston, rendering it unbreathable. He used his nitrous air test as a measure of the relative level of phlogiston in a sample of air. Priestley’s main experimental interest, however, involved a means to repair this air—both for the medical possibilities of such a discovery, but also to uncover how nature itself removed vitiated air from the atmosphere in order to sustain life. The result, presented by Pringle in his 1773 address: “two grand resources of Nature” for removing putrid vapour from the air, “the vegetable creation again is one, and the sea, and other great bodies of water, are the other.”[116]

Priestley had discovered that putrid air could be recovered by agitating it with water. He had consequently concluded that: “…the agitation of the sea and large lakes may be of some use for the purification of the atmosphere, and the putrid matter contained in water may be imbibed by aquatic plants, or be deposited in some other manner.”[117] In another such experiment, Priestley made the air in a sealed glass vessel noxious by allowing mice to suffocate in it; he then put in a growing mint plant. A passage from Priestley's "Observations on Different Kinds of Air”, mentions his first encounter with Pringle, a visit made to his Leeds laboratory in June of 1772. This visit reveals Pringle’s interest in Priestley’s finding, as well as his role as a trusted witness on behalf of the Royal Society: “Dr. Franklin and Sir John Pringle happened to be with me, when the plant had been three or four days in this state, and took notice of its vigorous vegetation and remarkably healthy appearance in confinement.”[118]

---

[116] Pringle (1773), p. 33.
[117] Priestley (1772a), p. 202.
[118] Priestley (1772a), p. 196.

Pringle and Priestley, then, shared an interest in discovering the means by which nature repaired vitiated air. Priestley rewarded his benefactors with privileged accounts of his research before it was published—particularly those aspects that would most interest them.[119] Reporting the mint experiment to Haller in 1772, Pringle noted: "I do not know whether the ingenious author has made any trials upon inodorous plants, but whether they prove antiseptic or not, we have certainly gained one pleasing article to add to our account of the Wisdom of God in creation."[120] It is impossible to know whether Pringle (or more likely Franklin speaking on Pringle's behalf) had inspired Priestley to make these experiments. It is notable that Jan Ingenhousz's later experiments into the aerial effects of plant respiration were carried out, in large part, to repay Pringle for his earlier patronage.

In Franklin's opinion, the mint experiment confirmed Priestley's hypotheses about putrid air. He noted in a letter to Priestley that "The strong thriving state of your mint in putrid air seems to shew that the air is mended by taking something from it, and not by adding to it."[121] . Franklin endorsed these findings in a letter that Priestley republished in *his Experiments and Observations* of 1775 : "That the vegetable creation should restore the air which is spoiled by the animal part of it, looks like a rational system, and seems to be of a piece with the rest." Such "natural systems" included the purification of water through distillation by fire and filtration through the earth.[122] He contributed an observation that drew a connection between such natural powers and the fecundity of the Americans:

---

[119] Golinski (1992), p. 68.
[120] Sonntag (1999), p. 253.
[121] Priestley (1772a), p. 199.
[122] Priestley (1772a), pp. 199-200.

> I hope this will give some check to the rage of destroying trees that grow near houses, which has accompanied our late improvements in gardening, from an opinion of their being unwholesome. I am certain, from long observation, that there is nothing unhealthy in the air of the woods; for we Americans have every where our country habitations in the midst of woods, and no people on earth enjoy better health or are more prolific.

Franklin's comments reflect a new understanding of natural philosophy promulgated, in London, by Priestley, along with a coterie of sympathetic lecturers.[123] Earlier in the century, natural philosophers engaged in the emerging entrepreneurial culture of public lecturing impressed audiences by displaying the "active powers" within matter. This fit "a doctrine of political and moral authority" arising from a sense of awe appropriate to an experience of the deity's power.[124]

In its place, Priestley presented his readers with a new vision of natural philosophy that drew on Scottish rationalist approaches to political economy emphasising systems accessible to human nature. This understanding is evident in the aerial economy endorsed by Pringle and Franklin.[125] Moral meaning was to be derived from the extended encounter with nature, afforded by engaging in experiment, rather than a mediated spectacle. According to this vision, the moral improvement of society and the understanding of nature were both progressive, and hence corrosive to established authority.

Without delving into Priestley's heterodox natural philosophy (which few of his sympathisers, including Pringle, would have swallowed in its entirety), one can point to certain characteristics that were shared by several philosophers who regularly attended Pringle's supper table. Priestley

---

[123] Schaffer (1989), pp. 39-53.
[124] Schaffer (1983), pp. 5-6.
[125] Schaffer (1987), pp. 42-43; Schaffer (1983), pp. 25.

viewed Creation as the product of a rational intelligence.[126] He saw the authority of the Anglican Church, fundamentally linked to state power, as founded on irrational “exploded doctrines” (typically accretions of Greco-Roman origin not found in the Gospels) such as the doctrine of the Trinity —Priestley was, by the 1770s, a committed Unitarian.[127]

Priestley’s philosophy was essentially a radical instantiation of natural religion, the belief in a Creator whose nature is compatible with Christian doctrine and whose existence is evident in nature.[128] Pringle’s own sympathies tended to rational religion and against the opposing view that religious meaning is available exclusively through divinely inspired texts. Andrew Kippis, himself a dissenting cleric, wrote that: “He was another instance of those illustrious philosophers, who have not been ashamed of religion; and added another to the catalogue of the excellent and judicious persons, who have gloried in being RATIONAL CHRISTIANS.”[129] Boswell likewise noted that “He used to tell me that he despaired of making me a rational Christian.”[130]

In England, many readings of natural religion were socially acceptable, especially when one could reconcile one’s view of nature with the doctrines of the Anglican Church (which Priestley notoriously could not). This had been a central argument of the Royal Society’s founding apologists, notably Boyle, who believed that public science could be an antidote to religious

---

[126] Brooke (1991), p. 177.

[127] Brooke (1991), pp. 179-180.

[128] Although Priestley was a Christian, it is not easy to see how Trinitarian Christianity was compatible with his Unitarianism.

[129] Kippis (1783), pp. lxxxiv-lxxxvii. This last phrase provided its author with the occasion for a long essay-like digression on “natural religion” presented as a footnote which, over several pages, threatens to overwhelm the main text. This was essentially a rebuttal to Soame Jenyns *Disquisitions on Several Subjects*, an attack on natural religion in favour of religious revelation.

[130] Boswell (1782), p. 4.

controversy in the wake of the English Civil War.[131] As noted, Pringle had been given a mandate to preach this gospel when he was granted the chair of moral philosophy at Edinburgh.

Priestley's vision of a new natural philosophy gave natural religion a more controversial reading. An passage in the preface to the first volume of his *Experiments and Observations on Different Kinds of Air* (1774) read:

> This rapid progress of knowledge, which, like the progress of a wave of the sea, of sound, or of light from the sun, extends itself not this way or that way only but in all directions, will, I doubt not, be the means under God, of extirpating all error and prejudice, and of putting an end to all usurped authority in the business of religion as well as of science.[132]

Historians examining emerging tensions surrounding natural philosophy and political authority have naturally tended to focus on the example of Priestley and the period surrounding the French Revolution, that is, the late 1780s and 1790s.[133] As discussed below, this is most evident in the discourse linking revolution with chemistry—an association that is particularly evident in Priestley's own rhetoric. The changing understanding of the natural philosopher noted by Schaffer was, however, beginning to make an impression on public discourse somewhat earlier in a manner that reveals an awareness of the potential political meaning underlying the economy of antiseptic virtue promoted by the Royal Society.

In 1774, a humorous pamphlet appeared that was addressed to William Warburton (1698–1779), Bishop of Gloucester, a public defender of the literal truth of biblical prophecy. Its

---

[131] Stewart (1992), pp. 7-10.

[132] Priestley (1772a), p. xiv.

[133] See especially: Crosland, Maurice. (1987) "The Image of Science as a Threat: Burke versus Priestley and the 'Philosophic Revolution.'" *BHJS*, 20, 277-307.

anonymous author borrowed the terminology of antisepsis in a religious metaphor evoking natural religion.

> Mere natural religion your Lordship knows is a cold uninteresting object. It only becomes a striking phaenomenon in the moral world, when it is animated by the prodigies, miracles, and predictions of Revelation; as common water, tho' tasteless and insipid in itself, acquires the spirit and flavour of Pyrmont, by a proper infusion of fixed air. I am too well apprised, my Lord, of the very arduous and invidious task which I have undertaken. Your Lordship knows that the best and purest salt cannot long preserve the slimy texture of French beef from corruption; nor can (I beg the pardon for the comparison) the divine spirit and acumen of prophecy penetrate the fashionable infidel, nor make him "wise unto salvation."[134]

The statement shows the cultural currency of the new natural philosophy as well as its connections to the President of the Royal Society—a figure known for his foreign associations. Like the similar complaint about Scots and the provisioning of the army in America, it was likely, in part, a reflection of Pringle's status. If this is the case, then such views could only gain currency as tensions rose between the Crown and the American colonists, supported by the French abroad and Dissenters at home.

The investigation of electricity and air, both subjects of intense interest among natural philosophers, were fields led by Franklin and Priestley respectively. Both were vocal opponents of the British establishment over the 1770s, and both were close to Pringle. As the political climate polarized during the American War of Independence, Pringle would find it impossible to reconcile his responsibilities as a Hanoverian courtier with his loyalties to his philosophical

[134] Anonymous (1774), p. 8.

friends. His resignation in 1778 and the subsequent election of Joseph Banks put an end to the extended period of Whig dominance within the Royal Society.[135]

[135] Miller (1998), pp. 78-80.

Court and Coffeehouse:

On the 10th of January, 1773, about a month after Pringle had been sworn in as President, a short address on behalf of the Society was delivered to the King during a ceremony at which the twenty members of the Society's Council were permitted to kiss the King's hand.

> We Your Majesty's dutiful and Loyal Subjects the President and Council of the Royal Society of London, beg leave to approach your Royal Person, and in the Name of that Body humbly to express [our] most grateful acknowledgement to your Majesty for the repeated Marks of your Royal Favour , in particular for your Majesty's ample Benefaction and for the Assistance of your Majesty's Ships, Whereby we have been enabled to make Observations of Various kinds, in the remotest parts of the Globe, which could not have been effected by the Funds of the Society.

The passage recognized the King's place as the Society's patron, a position cited in the annual listing of British public offices called the *Court and City Kalendar*, which placed him above the Society's President and Council. It is also indicative both of the close collaboration between the military, the government, and the Royal Society in promoting the various voyages of exploration, as well as in the particular advantages of Pringle's role as President. In Pringle's ascent to the presidency of the Royal Society, we see a trusted, long-time member of the court placed at the head of the nation's natural philosophers.

Pringle's mention of "your Majesty's ships", referred to Cook's voyage aboard the HMS *Endeavour* (1768-1771) to observe the transit of Venus in Tahiti, one of several voyages meant to establish solar distance by measuring parallax, which the King had sponsored to the tune of £4,000. This was one instance of the King's interest in technology, navigation, and to a lesser extent, natural philosophy. It also represented a desire, on the part of the crown, to play a role in the prestigious international effort to study the transit.[136] The King sponsored the Kew Observatory at Richmond, Surrey to observe the 1769 transit and would later patronize the Hannover-born astronomer and instrument maker William Herschel (1738-1822). He also supported the horologist John Harrison (c. 1693-1776) whose naval timepieces had satisfied the conditions of the Longitude Act, in his ongoing dispute with the Board of Longitude.[137]

These commitments are further evidence that the common understanding of a fundamental separation between the court and Royal Society requires amendment. The received view results from the comparison to the better-endowed societies of Europe, notably the Académie des Sciences, that flourished under generous royal patronage, as well as the financial insecurity and contested legitimacy of the restored monarchy, during which the Society was founded.[138] Simon Werrett, whose analysis is focused on Charles II, argues for a more nuanced perspective on the ways in which British monarchs sought legitimacy through experimental knowledge as their fortunes rose and fell.

In post-restoration England, the tradition of touching for scrofula—a royal ritual demonstrating the special qualities of the divinely-anointed royal body—had lost some of its former legitimacy for its association with the Catholic doctrine of transubstantiation.[139] Charles II undertook a series of experiments into a liquor that could stop bleeding more quickly, and with less discomfort, than cautery. He performed these trials under the auspices of the Royal Society and the results of his trials were published in the *Philosophical Transactions*. The connections between the

---

[136] Gascoigne (1999), p. 176.
[137] Wess (2004), pp. 324-326.
[138] Werrett (2000), pp. 377-379.
[139] Werrett (2000), pp. 391-393.

contested scrofula ritual and the extraordinary styptic liquor, both associated with the King's person, are evident in Charles' experiments, which he undertook at a time when both the he and the Royal Society were seeking legitimacy.[140]

While Charles' grip on power may have been tenuous, the court nevertheless retained a prominent place in the English social order. By contrast, the Hanoverians were a regime that had renounced the courtly ceremony of the Stuarts. Their reign saw the court supplanted by London itself as the arbiter of culture.[141] Yet the Society remained valuable to the crown, while the crown remained a source of legitimacy for the Society's activities and a key source of patronage for its members. John Pringle's career through the Royal Society is emblematic of a period in which the British fortunes were expanding along with its empire following the peace terms of 1749 and the victories of the Seven Years War.[142] Just as Charles II's styptic liquor represented a benevolent gesture towards the soldiers and sailors who served his state, Pringle, the reformer of army medicine, represented his royal patrons' benevolent interests through his prominence among the nation's philosophers.

Pringle's interest in natural history and exploration, evident in his correspondence to Haller, made him an ideal go-between at a time when the Society was engaged in the court-sponsored enterprise of surveying Britain's new domains. The King maintained vast collections of

---

[140] Werrett (2000), pp. 388- 393

[141] Brewer (1997), pp. 1-55.

[142] Schama (2001), p. 493. The Treaty of Aix-la-Chapelle greatly improved Britain's position in India by awarding it the city of Madras.

geographical material and scientific instruments which survive.[143] In 1774 Pringle gave the Queen a bird specimen that Joseph Banks had gathered on Cook's second voyage.[144]

Cook's voyages had been largely conceived and planned within the Society's twenty-member Council beginning in 1766.[145] Pringle was not then serving on the Society's Council, though he was close to Henry Cavendish, among others, who were privy to the planning of the *Endeavour* voyage, if not directly involved. It is also very likely that Pringle's proximity to the royal family played some role in the Admiralty's decision to permit the testing of antiseptic medicines devised by Macbride and Priestley, as well as his own measures against miasmatic illness, on Cook's second voyage to the South Pacific.

Just as the Hanoverians encouraged loyalty and bravery through managing military advancement, Pringle moved up the ranks of royal patronage until he was made Physician Extraordinary to King George III midway through his term as President of the Royal Society—a recognition, no doubt, of his contribution to the medical improvement of the army and navy. It was relatively common for royal physicians to obtain their positions through military channels.[146]

Pringle's career as a courtier formally began in 1749, when he was made physician to the Duke of Cumberland. At that point he joined the salaried company of royal servants, ranging from Lord Chamberlain to Laundress of the Body Linen. The next step up the ladder was his appointment as Physician to the Queen's household on the arrival in London of Princess

---

[143] Barber (2004), pp. 263-264; Wess (2004), pp. 313-314.
[144] John Pringle to Joseph Banks, Fri [Jan] 1774.
[145] Williams (1998), pp. 4-5.
[146] Bynum (1990), p. 284.

Charlotte of Mecklenburgh-Strelitz in 1761 to be married to King George III.[147] He remained in her service on a salary of £200 while serving others in the royal family including the Princess Dowager of Wales, from whom he received a further £100 beginning in 1768.[148]

Though circumstances varied, the royal physicians were seen as enjoying a privileged position among their peers, one that might allow a special proximity to royal patronage. David Hamilton, Physician to Queen Anne, became a close confidant and was knighted in 1703. Pringle was made a baronet in 1766 and seems to have been relatively close to Queen Charlotte and able to approach the King.[149] In January of 1777, he wrote to his friend Lord Kames, from whom he had recently received a copy of *The Gentleman Farmer* to give to the Royal Society.

> If you choose it, I shall call for a second [copy], to lay, in your name, at His Majesty's feet;—a step your Lordship may with propriety take, considering the subject, your rank, and character as a writer. If agreeable to you, your Lordship may send orders to Mr. Cadell to have a copy bound in the King's taste, for that purpose. This is an office (I mean presenting the book) I could do, without the formality of applying to the Lord Chamberlain, or the Lord of the Bedchamber in waiting.[150]

Several months later, a further letter returned the King's thanks and approbation.

Social connections to the royal family would have boosted his status as a physician of note within the London medical trade, where he earned the bulk of his considerable fortune.[151] His *Observations on the Nature and Cure of Jayle-Fevers* (1750), published as a letter to Dr. Richard Mead, was a public conversation between two members of the Royal household—their

---

[147] Kippis (1783), p. xxx; Gordon (1989), p. 6.

[148] Kippis (1783), p. xxxii; St. James' Chronicle. July 16, 1768, Issue 1152, Burney Collection of Newspapers.British Library/ GALE Digital Collections.

[149] Kippis (1783), p. xxxi.

[150] Home (1807), vol. 2, pp. 192-193.

[151] Kippis (1783), pp. lxvi-lxvii.

respective ranks, “Physician to His Majesty” and “Physician to his Royal Highness the Duke”, were noted on the pamphlet’s cover.

Though difficult to discern in the historical record, royal patronage was also likely to have been an important factor in securing Pringle’s place within London’s physician trade, controlled, since 1518, by the Royal College of Physicians of London. The College’s strict licencing requirements demanded a thorough knowledge of Galenic medical doctrine and an ability to discourse in Latin.[152] Over the course of the 17th century, however, a number of practitioners who did not conform to the College’s standards (usually iatrochemists) were able to dodge prosecution, and even obtain membership in the College, through the support of aristocratic patrons connected to the Stuart court.[153]

The College’s exam would likely not have been an insurmountable task for Pringle—he had faced similar challenges in completing his Leiden doctorate and obtaining his licence from the Edinburgh College. It is notable, however, that he practiced in London for nearly a decade before receiving his licence from the College in 1758 (he became a full fellow *ex speciali gratia* in 1763). No doubt his connection to Cumberland assisted his bid for full membership within the Oxbridge dominated community. Surely the patronage of the Royal Family, which had shielded Paracelsians from the venom of the College’s Galenists a century earlier, would have done much to lift Pringle above the London fray.

At very least, given Pringle’s royal connections, it would have been wise for philosophers to cultivate his friendship. Several instances in which Pringle used his proximity to the Royal

---

[152] Dawbarn (1993), pp. 7-9.
[153] Dawbarn (1993), pp. 1-3.

Family to assist friends and acquaintances survive in the historical record. In 1772, for instance, he passed on a gift of silk to the Queen on behalf of Franklin and the raisers of silk in Pennsylvania. This, like his conveying a bird from Joseph Banks, a book from Lord Kames, or a flattering poem from the Swiss philosopher Albrecht von Haller, are a few surviving instances of gift exchange—an aspect of early modern patronage.[154]

His correspondence with Albrecht von Haller, which took place in English between 1760 and 1777, details a lengthy attempt to convince Haller to return to a professorship at the University of Göttingen, which Haller had held from its opening in 1736 until 1753, when he returned to Bern, his birthplace.[155] The University of Göttingen had been founded by George II as a prized institution within the Hanoverian homeland. Efforts to woo Haller lasted until 1770. Over this period, Pringle's letters reveal his role as intermediary between his friend and the Royal Family. On Dec. 14th, 1764 he wrote to Haller:

> Of your letter, dated October the 22d, I read as much to their Majesties as belonged to them , and at the same time I presented to the Queen your book of German Poetry; which She graciously accepted, & she ordered me to tell you, that She was much obliged to you , that She returned you thanks for a present, than which you could send Her none more agreeable, as being the work of a person of genius, learning & moral character She had heard so much praised. As to the King, after hearing what you had written to me about the request concerning a delay, in order to have time to deliberate about the expediency of returning to Gottingen , His Majesty, in the best natured manner, desired You to take what time you thought proper, to consider of his proposals, & to bring your family & friends over to them, & therefore that You would not hurry your self in sending the final answer.[156]

---

[154] Biagioli (1991), pp. 46-50.
[155] Sonntag (1990), pp. 17-18.
[156] Sonntag (1990), p. 75.

Pringle’s negotiations with Haller point to his role on the Hanoverian Court as a philosopher with a significant scholarly reputation and wide reach within the republic of letters. These connections permitted the court to project its diplomatic influence. The correspondence recorded in Pringle’s *Medical Annotations* indicates that it was an important venue for gathering and exchanging philosophical information. While Pringle destroyed his correspondence, and the material on the *Medical Annotations* consists mainly of medically-relevant excerpts, the published material received by Haller reveals a wide-ranging conversation. Indeed, it seems likely that students of Boerhaave such as Pringle, van Swieten, and Haller worked together to colonise a substantial part of the pan-European medical elite.

Pringle’s military improvements spoke to Hanoverian martial interests, as well as their desire to elevate the scholarly prestige of their university in Hannover. This is evident in Pringle’s dealings with another Hanoverian court philosopher, Johann David Michaelis (1717-1791), a bible scholar and professor at Göttingen. Pringle published their theological correspondence at his own expense in 1773. This Latin dialogue between two salaried courtiers was meant as a demonstration of the philosophical sophistication of the Hanoverian court.[157]

Another notable instance in which Pringle placed his philosophical network in service of the court involved the younger philosopher Jan Ingenhousz. During his stay in England, Ingenhousz became familiar with the process of smallpox inoculation. In 1768, the Hapsburg Ambassador requested of the British court that a physician be nominated to inoculate the Imperial family. The task of selecting the candidate fell to Pringle, then personal physician to the Queen, who chose Ingenhousz for the task. The following year, Pringle was awarded three gold and eighteen silver

[157] Kippis (1783), pp. Lxxiv-lxxv. See Michaelis and Pringle (1773).

medals by the Austrian ambassador. Ingenhousz was granted a place at the Hapsburg court and a lifetime salary for the successful inoculation.[158] The episode testified to the pre-eminence of the Hanoverian court in practical and scientific affairs.

Pringle's negotiations with Haller, and his role in inoculating the Hapsburg Royal Family, show him acting as a broker on behalf of the Hanoverian court—part of, what Mario Biagioli describes as the "microphysics of patronage". The role of the broker was to negotiate between the court and potential clients such as Ingenhousz and Haller. A refusal on Haller's part might, for instance, have diminished the prospective patrons, the King and Queen. Likewise, had Ingenhousz botched the inoculation, the blame would have fallen on Pringle.[159] Thus Pringle was rewarded for having performed his role as an intermediary between the Royal Court and the broader philosophical community.

Pringle and Ingenhousz shared an interest in exploring the most promising medical element of Priestley's pneumatic work. Priestley's nitrous air test, with its promise to detect dangerous effluvia, rapidly became one of the most exciting technological improvement to be developed by the natural philosophers in the late eighteenth century. Priestley's chemical test was elaborated into an instrumental practice known as "eudiometry" over the period between 1772 and 1790.

Eudiometry was a "reformist" practice that was taken up in Europe by Felice Fontana (1730-1805), court physician to Peter Leopold II's court, Marsilio Landriani (c. 1746-c. 1816), a client of the Grand Duke of Tuscany, and Ingenhousz, physician to Maria Theresa's Austrian court.[160]

---

[158] Gordon (1985), p. 116.
[159] Biagioli (1993), p. 19-21.
[160] Schaffer (1990), p. 282; Golinski (2007) pp. 162-163.

All such experimenters developed specialized apparatus and standards in an effort to turn the test into a portable, calibrated instrument like the thermometer or barometer. They took these instruments on tours of town and city in order to discover differences in the quality of the air; Fontana did so in England, reporting his findings to the Royal Society where they were published in the *Philosophical Transactions*.[161]

On the Continent, these instruments were placed in the service of "enlightened despotism".[162] For instance, beginning in the 1760s, Fontana applied his efforts as a natural philosopher to the reform of his royal patron's kingdom, particularly to the prevention of crop diseases through investigations using the microscope, and later, to developing Priestley's original process into a workable means of testing the air in order to prevent fever.[163] Writing in 1775, he placed eudiometry within the prerogative of the benevolent ruler as "an object of equal interest to all, Sovereigns included, who, like others, share the public interest, and could greatly facilitate the means of a discovery more useful than that of the longitudes, which a century earlier was considered a superior triumph of the human spirit."[164] Again, the ultimate yardstick of useful knowledge was the problem of longitude.

Pringle did not live to see much of the development of nitrous eudiometry. He was, however, closely involved in its founding through his endorsement of Priestley's test in the 1772 Copley address. Kippis's biography notes that "The celebrated Abbé Fontana, during his time of being in

---

[161] Schaffer (1990), p. 308.
[162] Schaffer (1990), pp. 292- 300.
[163] Boantza (2013a), pp. 388-391; Schaffer (1990), pp. 292-293, 300-301.
[164] Boantza (2013a), p. 386.

England [c. 1775-1780], was much in the company of Sir John Pringle."[165] Fontana was also a disciple of Pringle's long-time correspondent Haller, and had helped him produce his publications on physiology.[166] Pringle encouraged Ingenhousz's efforts to demonstrate and apply the technology developed by Fontana. Ingenhousz and Fontana first met in 1777 and appear, along with Pringle, in each other's company at a meeting of the Royal Society in 1778. In 1779, the year after Pringle relinquished the presidency, Ingenhousz dedicated his *Experiments on Vegetables* to him. His book, which explored the effects of vegetable respiration in restoring the atmosphere to purity, included a laudatory preface thanking Pringle for his earlier kindnesses.[167] Ingenhousz's work studied the implication of Priestley's mint experiment for the aerial economy. It endorsed Fontana's instrument and described its use.[168]

The following year, Ingenhousz sent Pringle a letter reporting a series of eudiometric observations which later appeared in the *Philosophical Transactions*. These tests were conducted at Pringle's request to discover whether sea voyages might be beneficial to consumptive patients—a question that emerged from common practice and Joseph Priestley's earlier observation that, just as noxious air agitated with water rendered it breathable, the motion of ocean waves washed the air of putrid vapour. Years after the fact, he remained Pringle's dedicated client, while Pringle remained committed to using his influence to advance the investigation of the air.[169]

---

[165] Kippis (1783), p. xciv.
[166] Schaffer (1990), p. 300.
[167] Kippis (1783), p. xcv.
[168] Boantza (2013a), pp. 388-391.
[169] Ingenhousz (1780), pp. 354-356.

Eudiometry flourished in the courts of Continental Europe where enlightened physicians sought to assert their reforming agenda against the traditional authority of the Church. In Britain, the radical Whig cosmology embodied in Priestley's aerial system, was subject to scrutiny in the years surrounding the American Revolution. Such tensions were to presage the political turmoil that emerged in Britain in response to the French Revolution, which would send Priestley into voluntary exile in America after his home and laboratory were destroyed by a Birmingham mob. Equally relevant to the history of science is Pringle's fall from grace, a victim of the political turmoil surrounding an earlier revolution.

Pringle's personal connections and influence within the Royal Society, through which he encouraged eudiometry and other attempts to prevent epidemic disease, highlight his associations with prominent Whig natural philosophers. David Philip Miller's suggestion that a Whig ascendency existed within the Royal Society for much of the mid-to-late eighteenth century may explain the circumstances in which Pringle flourished. Miller attributes this Whig ascendency to the "Hardwicke Circle", a faction led by Philip York, the Second Earl of Hardwicke and his very capable client Thomas Birch.[170] The installation of Birch as secretary of the Society, and Lord Macclesfield as President in 1752, gave this group a near monopoly within the institution. This Whig dominance reflected the political climate prevailing in England until around 1780. Miller considers the circle to have been "instrumental" in the 1772 election that brought Pringle to the presidency in a unanimous vote.[171]

---

[170] Miller (1998), pp. 74-76.
[171] Miller (1998), p. 78.

Pringle was also a member of the Royal Society Club which met at the Mitre Tavern on Fleet Street. The most prestigious philosophical club in England, its membership was limited to forty people— only twice the size of the Royal Society's Council.[172] Among his close circle were several natural philosophers. He was close to William Brownrigg (1711-1800), Benjamin Franklin (1706-1790), and Lord Charles Cavendish (1704-1783), to name only those of his generation.[173] Other frequent guests at his Sunday gatherings were the Dissenting ministers Richard Price and Andrew Kippis, and Israel Mauduit, a colonial official.

He was also close to, though probably not a member of, the Club of Honest Whigs—so called by Franklin in 1775—that, unlike the Philosopher's Club, permitted political discussion. The Honest Whigs met on Thursdays at St. Paul's Coffeehouse, and, after 1772, at the London Coffeehouse. Its membership, which overlapped closely with Pringle's circle, included Franklin, Price, Priestley, and Kippis.[174] These men were vocal in support of Whig causes including the repeal of the Test and Corporations Acts, the rights of the American colonists, and the reform of Parliament. Pringle's London career thus poses something of a paradox: he was both a political insider, a figure patronized by the court, as well as something of an outsider, a Scot who rubbed shoulders with radical Whigs.

Pringle probably did not share the specifics of the materialist theology that Priestley was beginning to articulate in the mid-1770s. He seems nevertheless to have been sympathetic to Priestley's linking of natural philosophy with the renewal of society. This is evident in his celebration of Priestley's discovery of a benevolent "oeconomy" of nature in which plants

---

[172] Sonntag (1999), p. 14.
[173] Sonntag (1999), pp. 14-15.
[174] Crane (1966), pp. 210, 220.

flourished on the dangerous aerial products of animal breath and decay and the ocean filtered pestilential vapour from the air. Perfect order existed in nature. Perfect order should be possible within human society—a utopian and radical notion. Over the subsequent years of his presidency at the Royal Society, deteriorating relations between the crown and colonies tended to polarize the political discourse in Britain. Pringle's public association with the new vision of natural philosophy promulgated by Priestley and Franklin would then have become difficult to reconcile with his responsibilities as a servant of the crown.

Accounts differ as to precisely why Pringle resigned his position as President. The Kippis biography cites health problems—Pringle, who was seventy-two when he formally resigned, had been ill for some time. Other sources cite the fallout from a long and acrimonious debate within and beyond the Royal Society over the safety of Franklin's pointed lightning rods that fills the journal book of the Royal Society's Council in the years surrounding the American Revolution.[175] The matter began in 1772, when the Admiralty asked the Society for advice on protecting gunpowder stockpiles from lightning following the explosion of a powder magazine in Jamaica, which destroyed a British fort in 1763, and a similar explosion in Brescia, a city in Lombardy, which destroyed a large section of the city killing many of its inhabitants.[176] Franklin, member of several Royal Society committees, had led efforts to draft recommendations to protect public buildings from lightning using pointed lightning rods of his own design.

Benjamin Wilson (c. 1721-1788), a Copley Prize-winning electrical experimenter who was also a portraitist and print-maker, doggedly resisted the consensus about pointed rods. He believed that

---

[175] Vicq-d'Azyr (1782), p. 65.
[176] Mitchell (1998), p. 314.

pointed lightning rods attracted lightning unnecessarily. Instead he promoted a blunt model. Opposing him were several in Pringle's London circle including Henry Cavendish, Dr. William Watson (an Honest Whig), and initially Franklin. When the Purfleet armoury, protected by a pointed rod, was struck by lightning the 1777, it reignited the controversy. Through a remarkably astute campaign, Wilson succeeded in attaining a hearing from the King who, allegedly, called upon Pringle to reverse the judgment of the Society. According to a nineteenth-century historian of the Royal Society, Pringle is said to have replied "the prerogatives of the President of the Royal Society do not extend to altering the laws of nature," after which his resignation was assured.[177]

One sees in the lightning rod controversy the increasing tension surrounding the natural economies of nature. Prominent Whig philosophers such as Priestley, Franklin, and Bentham, associated political liberty with humanity's mastery of natural laws. Within the realm of aerial chemistry, the relative quality of air was labeled "virtue", and miasmatic pollution "corruption"—pneumatic terminology reflected social values. First Priestley, and later Ingenhousz, both partisan supporters of the Franklinists during the lightning rod controversy, were patronized by the powerful Whig parliamentarian Lord Shelburne, who also supported Richard Price. As with various figures in Pringle's close circle, Shelburne defended a variety of political causes that set him at odds with the King, though he was briefly Prime Minister between 1782 and 1783 and ended the War of American Independence, or the American Revolution as it was viewed in Britain. Pringle's successor as President of the Royal Society, Joseph Banks, was

---

[177] Mitchell (1998), pp. 307-311, 324; Weld (1975) p. 102; Dr. Daniel Solander to Joseph Banks,London, 11 Aug 1778, in Banks (2008), vol. 1, p. 152. In this letter, Solander informed Banks of Pringle's decision to resign about a month before Pringle made the announcement to the Royal Society. This suggests, perhaps, that if a meeting took place between Pringle and the King, it would have been no later than early August 1778.

a client of George III unencumbered by radical associations. Banks governed the Royal Society with a firm hand until his death in 1820.

During Banks' tenure as President, the Royal Society distanced itself from radical Whig ideas. In the period surrounding the French Revolution, when topics such as electricity and chemistry became enmeshed in political polemic, Joseph Priestley found himself sidelined within the institution in which he had thriven. He complained bitterly of "party spirit" which he found "injurious to the interests of philosophy."[178] Thus the culmination of the study of air's relationship to disease, still a radical enterprise, took place away from the London centre of philosophical credit, in the expanding northern industrial towns.

[178] Golinski (1992), pp. 55, 69.

Conclusion: Thinking about science and medicine in the eighteenth century

Among the most notable features of Pringle's career was the fact that he distinguished himself among physicians as well as among the broader community of practitioners of experimental natural philosophy; his experiments were accessible to a broad public and were explored by numerous experimenters who did not practice medicine. Underlying this discussion of Pringle's rise to eminence in eighteenth century Britain is the relationship (and the distinction) between the practical and intellectual territory of medicine and natural philosophy. We could say that Pringle flourished during a period in which the physician's trade was increasingly adopting the methodologies devised by natural philosophers.[1] The prominence of Edinburgh and Leiden, where new forms of observational and experimental practice were developed and added to the medical curriculum, seems evidence of this.

The Edinburgh physicians, many of whom were educated at Leiden under Herman Boerhaave, cited the Royal Society and its *Philosophical Transactions* as the model upon which their first major collective project, the *Medical Essays and Observations*, was conceived. Boerhaave, the most prominent voice in European medicine over the early eighteenth century, publicly aligned himself with British experimental philosophy in opposition to the older iatrochemical tradition. While his widely disseminated neo-classical orations are less representative of medical theory and practice than his unpublished lectures and notes, they nevertheless reveal the value that British public science held for university-educated medical men.

---

[1] Cook (1990), pp. 397-398.

A study of the early Royal Society between 1660 and 1700 shows that medical practitioners formed its largest and most active group.[2] A number of emerging practices—such as meteorology, electricity, along with various chemical projects such as the study of mineral waters, air, or the analysis of the flesh and fluids of the body — clearly fell within the space shared between the university-educated medical men and a vast community of experimenters. Pringle and Franklin frequently mentioned medical electricity in their correspondence and Pringle promoted Franklin's work in this area before the Royal Society.[3] In March of 1767, Pringle requested that Franklin electrify the daughter of the Duke and Duchess of Ancaster who was suffering from convulsions.[4]

This process of accommodating the open, inclusive discourse and experimental methodology of the new philosophy could, therefore, be corrosive to the high status claimed by the university-educated members of the highly-regulated physician's trade.[5] That training was founded in natural philosophy. The physician traditionally employed knowledge of physiology and the natural world to regulate the body and prevent diseases in patients, a practice known as physic. Physic emphasized observational skill and deep knowledge of the subject involved—Pringle's *Medical Annotations* represent this traditional esoteric aspect of the physician's trade. It contained knowledge accumulated by physicians, selected and edited by an eminent member of the trade so that others, entering the trade, might develop a firm grounding upon which to develop their own diagnoses. Pringle's text was neither to be lent out nor quoted.

---

[2] Hunter (1985), pp 23, 24,28, 115. Hunter's study excludes apothecaries from this category, as well as "doctors of medicine whose doctorate was clearly incidental to the main features of their career."

[3] Franklin (1905), vol. 3, p. 425.

[4] John Pringle, Letter to Franklin, March 1767. in *The Papers of Benjamin Franklin*. Volume 14: January 1, 1767 through December 31, 1767, ed. Leonard W. Labaree, Helen C. Boatfield, and James H. Hutson . New Haven: *Yale* University Press (1970): 95.

[5] Cook (1990). pp. 398-400. The following interpretation of "physic" and "medicine" is Cook's

Experimental natural philosophy emphasized method rather than disciplinary knowledge. Its growing status in the seventeenth and eighteenth centuries seemed to sanction empirical medicine over traditional physic, cures over the skilled regulation of the body. Physicians, such as John Rutherford at Edinburgh, attacked the empirics for their infallible cures for every disease, but Baconianism sanctioned experimentation and promised that those who followed the new method might attain useful results. Pringle, who sought to refine the materia medica through experimentation, walked a careful line between preserving the physician's domain and engaging with the burgeoning public culture of British natural philosophy. His rise to prominence among his medical peers and within the community of natural philosophers suggests that he was very successful in doing so.

Pringle's Copley-winning "Experiments Upon Septic and Antiseptic Substances" are especially notable for having been greeted as a fulfilment of a Baconian promise to set medicine on the solid foundation of experimental knowledge. Pringle's experiments may be viewed as a contribution to longstanding efforts, centred, in Britain, on the Royal Society, to clarify the presumed link between body and environment that formed a key component of the Hippocratic tradition. Pringle invoked Bacon's call to investigate conditions producing and retarding the process of putrefaction in developing his notion of "antiseptics." This was to prove a key conceptual element in the chemical experimentation from which the Chemical Revolution would emerge.

Chemistry was a "public science", and Pringle's experiments were, to a significant extent, intended as a contribution to the public discourse on experimentation. This had been the case with much of the work that preceded it, such as early modern investigations of the air and weather, Bacon's proposed experimental history of putrefaction, or Boyle's experimental work on human blood. Pringle intended this evidence to be accessible to any interested philosopher. It was taken up, or cited, by a range of figures with a variety of backgrounds and interests, from the French noblewoman and experimentalist Madame Marie-Geneviève-Charlotte Thiroux d'Arconville, to the Edinburgh chemical professor William Cullen.

Yet Pringle's experiments were implicitly grounded in a physician's familiarity with the pharmacopoeia—an expertise that he cultivated throughout his career as a physician. His objective was not to discover a panacea, but rather to attain a better understanding of the attributes of existing medicines. His comments on malignant fever reflect the range of causes and contingent factors underlying disease, which required a physician's experience and education to understand:

> Now, was putrefaction the only change made in the body by contagion, it were easy to cure such fevers, at any period, by the use of acids, or other antiseptics. But, whereas we have observed, that the disease once formed is not to be removed by any such means till the stated time of its decline, it seems, therefore, probable that whilst the septic process goes on, the fever is chiefly supported by an inflammation of the brain…[6]

The physician's claim to expertise in areas such as pharmacopoeia, anatomy, physiology, and physic, seems to have been generally accepted by other natural philosophers who tended to look to their physician colleagues for affirmation when their own efforts impinged on the medical domain. Pringle's earliest appearance in the London limelight following the outbreak of gaol fever at Old Bailey was, in part, to lend credence to a more senior philosopher's ventilation scheme. In his analysis of Ms. Stephens's medicine, Stephen Hales deferred to physicians

---

[6] Pringle (1752), p. 355.

“whose proper Province it is” as they were “best qualified to find out the means, how to use these Medicines with Safety…”[7]

Likewise, Joseph Priestley (not otherwise noted for his deference to established authority) depended on a circle of physicians and surgeons to endorse the medical attributes of his newly-discovered airs. University-educated medical men were therefore essential to the “birth of pneumatic medicine.” The Royal College of Physicians of London, at the request of the Admiralty, had produced a report on Priestley’s antiseptic mineral water that recommended further trials.[8] Physicians and surgeons in Manchester, Leeds, and Birmingham, tested the water on all manner of illnesses, and applied Priestley’s airs in “clysters” (aerial enemas), and topically. As with the chemical lecturers who introduced Priestley’s discoveries to paying audiences, Priestley’s work provided these medical men with a means to participate in the community of natural philosophers. All (save for one who had studied with Cullen) had received medical degrees in Scotland or on the Continent. Their observation on the effects of Priestley’s pneumatic therapies provided him with a means to promote the utility of his aerial work.[9]

Pringle’s contribution would not have received the attention that it did had it not fulfilled the Baconian imperative to be useful. The stated purpose of the *Observations* was to preserve the lives of military men through a series of measures intended to prevent and treat contagious fevers—a program, I argue, to be supported by those whose personal prerogative still guided much of the British military. The text was, therefore, a hybrid, combining chapters accessible to a broad philosophically-inclined readership, with a large segment that could “neither be rightly

---

[7] Hales (1740), p. 33.
[8] Priestley (1772b), p. 1.
[9] Golinski (1992), pp. 110-112.

explained nor prove instructive to others" beyond Pringle's "own profession."[10] Kippis likewise affirmed that "the latter parts lie more within the province of physicians. They alone are the best judges of the merit of the performance; and to its merit the most decisive and ample testimony has been given."[11]

Locating Pringle's medical contribution within the eighteenth century culture of improvement, we see an effort to marshal political authority in support of the physician's management of medical care and (what a later age would call) public health. Nevertheless, eighteenth-century British culture tended toward the conviction that significant reform could be, and ought to be, accomplished through laissez faire and voluntary effort.[12] As such, the potential effects of Pringle's efforts were necessarily bounded by the limits of personal prerogative. The worst conditions in the eighteenth century, whether in prisons, work houses, ships, or army encampments, lent themselves to paternal management of traditional authority. The burgeoning industrial towns of the nineteenth century, in which infrastructure became overburdened by rapidly increasing immigration leading to squalid conditions, would require new systems of management.

Pringle's work promised several advantages, notably the more efficient running of the empire during a period in which commerce and the military were closely bound—British natural philosophers of the eighteenth century focused similar attention on the treatment of the fevers afflicting soldiers and sailors as they did the problem of longitude. A clearer understanding of the seasonal and environmental mechanisms underlying epidemic outbreaks promised a certain level

---

[10] Pringle (1752), p. x.
[11] Kippis (1783), p. xxiv.
[12] Porter (1999), p.112; Gascoigne (1999), p. 174.

of predictive knowledge making the management of large bodies of men easier. Finally, even as a more bureaucratised fiscal-military state was beginning to emerge, the traditional aristocracy still exercised a great deal of control over the military. Pringle's improvements to the health of the Army embodied both the ideal of martial discipline and the enlightened benevolence of the Army's aristocratic managers.

Pringle's connections to London-based patronage via the military and the court were essential to his advancement as a natural philosopher. The Society's value to the crown had been, to a significant extent, as a tool of empire. Pringle's experiments were, therefore, an exemplary contribution, supporting a philosophically-guided program of improvement that had already received the blessing of Pringle's patron, the Duke of Cumberland—the de facto head of the British military from 1745 until 1757. The voyages of exploration would play a prominent role in the Society's activities over the second half of the eighteenth century and provide a venue for testing schemes to prevent the fevers that crippled long voyages. Pringle, an increasingly prominent natural philosopher, did much to encourage this effort.

Meanwhile, Pringle's increasing prominence as a courtier supported his reputation as a philosopher. Pringle was, for instance, engaged in a significant network of philosophical correspondence whose extent is partly revealed by his *Medical Annotations*. In his letters to Albrecht von Haller we see him engaged in the role of patronage broker on behalf of the Hanoverian court as they attempted to attract the noted Swiss philosopher to their university in Hannover. Pringle also provided an invaluable link between the court and the Royal Society, a responsibility that would prove damaging to his ambitions in the period surrounding the American Revolution.

An examination of Pringle's role as a courtier highlights the place of his humanist education and literary cultivation. His upbringing within an ambitious family of well-connected Lowland Scottish gentry led him to patronage, but it was his commitment to self-fashioning as a man of letters that made his advancement possible. Before becoming a physician to the Earl of Stair, he was a professor of moral philosophy lecturing on ethics and natural religion at the University of Edinburgh—a propagandist for Scotland's managers whose public lectures proclaimed the compatibility of Christianity with a study of the natural world. His tenure as President of the Royal Society was defined by his six Copley addresses through which he became the voice of British public science. Republished after his death along with his official biography, these formed an important aspect of his claim to a posthumous reputation.

Pringle was greatly concerned with his legacy. He was careful to destroy his correspondence before his death. The prominent theme of biography that one discovers when studying his career—his mentoring of Boswell, and his own *Life of General James Wolfe* (1760), for instance—would provide a good basis for a study of contemporary ambition and self-fashioning. His appointed eulogist, Kippis, was predictably sanguine regarding his friend's place in history. He claimed in his "Life of Sir John Pringle" that accompanied the republished Copley discourses, that "The reputation that Dr. Pringle gained by his *Observations on the Diseases of the Army*, was not of a kind which is ever likely to be diminished:"

> He was happy in the choice of his subject, which, though it ought to have been completely handled, had scarcely hitherto been touched upon; and, though improvements will, no doubt, be made, and perhaps have been made, in the course of practice, as medical knowledge becomes more and more cultivated, the

> Work will always be held in esteem, as having been founded on the solid basis of experience, and not theory.[13]

Kippis was partly correct. The *Observations* lived on as a practical guide to military medicine, and afterwards as a founding landmark in the genre. On the other hand, the details of his account of putrid disease had already been the subject of much critique. Earlier critical comments concerning minor aspects of his experimental work from the Italian physician Giambattista (Jean Baptiste) Gaber (1730-1785), and Dr. Anton de Haen (1704-1776), professor of Medicine at the University of Vienna in the late 1750s and early 1760s were followed by more substantial critiques from the Edinburgh physician William Alexander in 1770, and the Irish-born London physician James Sims in 1773.[14] On Pringle's death, Félix Vicq-d'Azyr, his eulogist at the Académie des Sciences, to which he had been admitted as a foreign member, expressed a guarded skepticism regarding the analogy between chemical experiment and processes taking place within the body—a fundamental assumption underlying his work.[15]

Much of Pringle's historical interest lies in his role as a power broker among British natural philosophers. This was noticed, for instance, by Vicq-d'Azyr who considered him, together with his collaborator Hales, "…two modest, virtuous savants, enlightened benefactors of their peers."[16] Some recent medical historians have been more critical of Pringle's pervasive influence. He has been implicated, for instance, in the perceived negative effects of MacBride's antiseptic scurvy medicine within the British Navy. According to this reading, antisepsis was a pet theory

---

[13] Kippis (1783), p. xxvi.

[14] Gaber (1772), p. 111. This article is a reprint of the following: Johannes Baptista Gaber, "Specimen experimentorum circa putrefactionem humorum animalium," in *Miscellanea, philosophico-mathematica Societatis privatae Taurinensis (Dissertationes et opuscola varia.)* vol. 1, (Turin : Augustae Taurinorum, ex typographia Regia, 1759), 75-87; Pringle (1761), p. 435; Sims (1773), p. 238.

[15] Vicq-d'Azyr (1782), p. 64.

[16] Vicq-d'Azyr (1782), p. 67. "…deux Savans modestes, vertueux, bienfaiteurs éclairés de leurs semblables."

held in place through political power in the face of contrary evidence. Christopher Lawrence notes that it was "almost certainly through Pringle's influence" that Macbride's scurvy medicine was adopted by the British Navy during the 1760s and 1770s.[17] Belief in the putrid cause and antiseptic cure, the argument runs, delayed the adoption of the citrus cure for scurvy.[18] The classical survey of naval medicine by Coulter and Loyd offers a detailed history of the wort cure focussing on Pringle's role in promoting it, citing Macbride's antiseptic remedies as "mischievous in their effects"[19]

Such views are based on a misapprehension regarding eighteenth-century beliefs about scurvy and the evidence on which they rested. A more reasonable view is that Pringle operated within the prevailing understanding of putrid disease, as did Lind, who has been conventionally (and simplistically) cast as the discoverer of the citrus cure for scurvy.[20] Pringle's role in focussing the conversation about epidemic disease on the concept of antisepsis and the study of air over several decades is, however, an illustration of his extensive influence within British natural philosophy. If one wished to appraise Pringle's impact, one could well look, as his contemporaries did, to Cook's exemplary second voyage which reportedly lost a single sailor to disease where Anson's, some thirty years earlier, had lost over a thousand.

By the end of Pringle's life, pneumatic chemistry, which he had done much to encourage, was still a burgeoning field whose potential was only beginning to be explored. He did not live to see

---

[17] Lawrence (1987), p. 7.
[18] McBride (1991), pp. 159-160; Watt (1979), pp. 144-146.
[19] Coulter and Lloyd (1961), p. 308.
[20] McBride (1991), p. 167.

the abandonment of the aerial therapies which he had done much to encourage.[21] Though he felt the early tremors of the brewing conflict between natural philosophy and established authority in the form of the lightning rod dispute, he largely escaped the controversy that would cast a shadow over chemistry in the years that surrounded the French Revolution. As such, his medical approach to chemistry invites comparison to that of the Edinburgh-educated physician and chemist Thomas Beddoes, who took the medical exploration of air to its furthest extent and presided over the failure of pneumatic therapy.

Beddoes' project involved the establishment of a charitable Pneumatic Institution dedicated to exploring newly-discovered airs in order to treat the lung diseases that were becoming increasingly common in the towns of the industrializing north of England. He found the necessary support among the industrialists of the Birmingham Lunar Society, all of whom had a commercial interest in the practical uses of chemical experimentation.[22] James Watt, an inventor made wealthy by his steam engine patents, had a particular interest in the healing properties of airs. His daughter Jessy died of consumption in 1794—a son would die of the same disease a decade later. Beddoes' Pneumatic Institution opened in 1799; its most notable achievement was to give the young chemist Humphry Davy a place to make his start.

Beddoes' efforts to establish a venue where he could explore the possibilities of pneumatic medicine played themselves out against the backdrop of an increasingly heated debate about the nature of chemistry.[23] He explored pneumatic medicine during a period in which Priestley had already been sidelined from the Royal Society and was being publicly vilified by the politician

---

[21] Boantza (2013a), pp. 400-404.
[22] Levere (2009), pp. 221-224.
[23] Golinski (2007), pp. 164-167.

and writer Edmund Burke.[24] Priestley's earlier metaphorical association between chemistry and social revolution proved useful to his political opponents as the French revolutionaries harnessed technical knowledge to defend the new republic—most notably to procure new supplies of gunpowder.[25] Priestley's home and laboratory were burned by a mob in 1791, prompting him to emigrate to America. Beddoes, a democrat and supporter of the French Revolution, was mocked in the Tory press and subject to similar popular suspicion, most notably when a shipment of frogs destined for experimental work at his institute raised fears that conspirators were secretly feeding French troops hidden in the city.[26]

The parallel revolutions in science and society, which took place mainly in the industrialising north of England among democrats and manufacturers, have provided a compelling backdrop to the progress of eighteenth century medical chemistry. This has tended, perhaps, to obscure the origins of pneumatic chemistry within, and with the assistance of, the organs of the state. Unlike his radical counterparts who succeeded him and continued his work, John Pringle's efforts were embraced as part of a Hanoverian effort to reform the institutions of the Army. Only at the very end of his career did his Whig sympathies draw him into conflict with his patrons. It was a sad end to a career spent at the pinnacle of the philosophical community, and a glimpse of things to come.

[24] Crosland (1987), pp. 261-263; Levere (2009), p. 218.

[25] Golinski (1992), pp. 177-184.

[26] Levere (1984), p. 197; Golinski (2007), p. 166. The frog anecdote may be apocryphal, but reflects public suspicions surrounding Beddoes' work.

BIBLIOGRAPHY

Manuscripts

Boswell, James. (1782). "Pringle, Sir John, Memoirs." GEN MSS 89, M217, Boswell Collection. General Collection, Beinecke Rare Book and Manuscript Library, New Haven.

Pringle, John. (c. 1765- c.1779). *Medical Annotations.* Vols 1- 9. PRJ/1/1-9, Collection of Sir John Pringle. The Sibbald Library. Royal College of Physicians of Edinburgh.

Rutherford, John. (1749). "Clinical Lectures. Delivered in the Edin. Royal Infirmary by John Rutherford, Professor of the Practice of Physic in the College of Edinburgh, M. D. & F. R. S. Begin Anno Dom 1749." In John Rutherford Collection (Manuscript 6 labelled *Sylva Medica.*). The Sibbald Library. Royal College of Physicians of Edinburgh.

Casteel, Eric. (2007). "Entrepôt and Backwater: A Cultural History of the Transfer of Medical Knowledge from Leiden to Edinburgh." PhD diss, University of California.

Gordon, Charles H. (1985). "An Introduction to the 10 Manuscript Volumes of Sir John Pringle's Medical Annotations." The Sibbald Library. Royal College of Physicians of Edinburgh.

Letters to William Hall of Whitehall, 3rd son of Sir James Hall, 2nd Bart. Papers of the Hall Family of Dunglass, East Lothian, National Archives of Scotland.

The Royal Society of London. (1660-1826). *Journal Book Copy* (JBC). Archive of The Royal Society, London.

Tammone, William. (1996). "Science in Ferment: The Doctrine of Fermentation in Seventeenth-Century British Science and Medicine." PhD diss,. Bloomington: Indiana University, Department of History and Philosophy of Science.

Unknown (thought to be James Brown). (1741). "Student dictates of Dr. John Pringle's lectures on Cicero, 1741" MS 74 D, Centre for Research Collections, The University of Edinburgh.

Primary

Burney Collection of Newspapers. British Library/ GALE Digital Collections.

A Society in Edinburgh. (1733-1744). *Medical Essays and Observations, Revised and Published by a Society in Edinburgh*. Vols. 1-5. Edinburgh, London, Dublin: Printed for T and W. Ruddimans.

Addison, Joseph and Richard Steele. (1810). *The Spectator; A New Edition Corrected from the Original*. New York: Published by R. Sargent et al.

Alexander, William. (1771), *An Experimental Enquiry concerning the Causes which Have Generally Been Said to Produce Putrid Diseases*. London: Printed for T. Becket and P.A. de Hondt, and T. Cadell.

Anonymous. (1774). *The Divine Predictions of Daniel and St. John Demonstrated*… London: Printed for J. Wheble in Ave Maria-Lane.

Alston, Charles and John Hope, ed. (1770). *Lectures on the Materia Medica... Published from the manuscript of the late Dr. Charles Alston... by John Hope, M.D.* Vol. 1. London.

Bacon, Francis. (1726). *Sylva Sylvarum or A Naturall History in ten Centuries*… London: Printed for W. Lee.

Badenoch, James. (1776). "Observations on the Use of Wort, in the Cure of the Scurvy at Sea." (London, Jan. 30, 1772) In *Medical Observations and Inquiries by a Society of Physicians in London*. Vol. 5, 61-72. London: Printed for T. Cadell,in the Strand.

Banks, Joseph. (2008). *The Indian and Pacific Correspondence of Sir Joseph Banks, 1768-1820,* edited by Neil Chambers. London: Pickering & Chatto.

———. (2007). *Scientific Correspondence of Sir Joseph Banks, 1765-1820,* edited by Neil Chambers. London: Pickering & Chatto.

Black, Joseph. (2012). *The Correspondence of Joseph Black. Volume 1*, edited by Robert G. W. Anderson and Jean Jones. Farnham, Surry, and Burlington, VT: Ashgate Publishing Company.

———. (1756). "Experiments upon Magnesia Alba, Quick-lime, and some other Alcaline Substances.," in *Essays and Observations, Physical and Literary. Read before a Society in Edinburgh and Published by them*. Vol. 2, 157-226. Edinburgh: printed by G. Hamilton and J. Balfour, Printers to the University.

Boerhaave, Herman (1735). *Elements of Chemistry: Being the Annual Lectures of Herman Boerhaave*, M. D… Vols 1 & 2. Translated by Timothy Dallowe. London: Printed for J. and J. Pemberton et al.

———. (1742). *Boerhaave's aphorisms: concerning the knowledge and cure of diseases. Translated from the last edition printed in Latin at Leyden, 1728*… translated and edited by J. Delacaste. London : printed for W. Innys and C. Hitch.

———. (1983). *Boerhaave's Orations*, edited and translated by E. Kegel-Brinkgreve and A. M. Luyendijk-Elshout. Leiden: E. J. Brill.

Boswell, James. (1950). Boswell's London Journal, 1762-1763, edited by Frederick A. Pottle. Toronto: McGraw-Hill Book Company.

———. (1993). *The General Correspondence of James Boswell, 1766-1769: Volume 1, 1966-1967,* edited by Richard C. Cole, with Peter S. Baker and Rachel McClellan; and with the assistance of James J. Caudle. New Haven : Yale University Press.

Boyle, Robert. (1665-1666). "General Heads for a Natural History of a Countrey, Great or Small, Imparted Likewise by Mr. Boyle." *Philosophical Transactions* 1: 186-189.

———. (1684). Memoirs for the Natural History of Humane Blood, Especially The Spirit of that Liquor. London: Printed for Samuel Smith at the Princes Arms in St. Paul's Church-yard.

Brocklesby, Richard. (1764). Oeconomical and Medical Observations … from 1758 to 1763 Inclusive Tending to the Improvement of Military Hospitals and to the Care of Camp Diseases Incident *to Soldiers*. London: Printed for T. Becket, and P.A. de Hondt.

Cook, James. (1776). "The Method Taken for Preserving the Health of the Crew of His Majesty's Ship the Resolution during Her Late Voyage Round the World. By Captain James Cook, F. R. S. Addressed to Sir John Pringle, Bart. P. R. S." *Philosophical Transactions* 66: 402-406.

D'Arconville, Marie Geneviève Charlotte Thiroux. (1766). *Essai pour servir à l'histoire de la putréfaction*. Paris: Didot le Jeune.

Defoe, Daniel. (1697). *An Essay Upon Projects.* London: Printed for R. R. for The Cockerill.

Evelyn, John. (1661). *Fumifugium: or The Inconveniencie of the Aer and Smoak of London Dissipated.* London: Printed by W. Godbid for Gabriel Bedel, and Thomas Collins.

Fothergill, John, John Pringle, et al. (1784). "A Sketch of the Epidemic Disease which appeared in London towards the End of the Year 1775." In *Medical Observations and Inquiries by a Society of Physicians in London. Volume VI.*: 340-408.

Franklin, Benjamin. (1905-1907). *The Writings of Benjamin Franklin*. 10 vols, edited by Albert Henry Smyth. New York: The Macmillan Company.

Gaber, Jean Baptiste. (1772). "New Experiments concerning the Putrefaction of the Juices and Humours of Animal Bodies." In *The Annual Register, or a View of History, Politics, and Literature, for the Year 1767* 2nd Edition. (pp. 109-115). London: printed for J. Dodsley, in Pall-Mall.

Graunt, John. (1662). *Natural and Political Observations, Mentioned in a following Index and made upon the Bills of Mortality. By John Graunt, Citizen of London... 2nd Ed*. London: Printed by Thomas Raycroft, for John Martin, James Allestry, and Thomas Dicas, at the Sign of the Bell in St. Paul's Church-yard.

Hales, Stephen. (1727). *Vegetable Staticks: Or, An Account of Some Statical Experiments on the Sap in Vegetables…* London: Printed for W and J. Innys et al.

———. (1739). *Philosophical Experiments:…* London: Printed for W. Innys, R. Manby, and T. Woodward.

———. (c. 1740). *An Account of Some Experiments and Observations on Mrs. Stephens's Medicines for Dissolving the Stone*. London: Printed for T. Woodward.

———. (1743). *A Description of Ventilators*. London: Printed for W. Innys, R. Manby and T. Woodward.

———. (1755-1756). "An Account of the Great Benefit of Ventilators in Many Instances, in Preserving the Health and Lives of People, in Slave and Other Transport Ships. By Stephen Hales, D. D. F. R. S." *Philosophical Transactions* 49: 332-339.

Henderson, Robert. (1741). "Short Account of the University of Edinburgh, the Present Professors in it, and the Several Parts of Learning Taught by Them." *The Scots Magazine* (Vol III, printed in Edinburgh for Sands, Brymer, Murray and Cochran): 371-374.

Home, Henry. (1807). *Memoires of the Life and Writings of the Honourable Henry Home of Kames*. Volumes 1 & 2. Edinburgh: Printed for William Creech and T. Cadell and W. Davies, London.

Huxham, John. (1759). *Observations on the Air and Epidemic Disease*… London: Printed for J. Hinton, at the King's Arms in Newgate Street, and Henry Whitfield, in Plymouth.

Ingenhousz, Jan. (1780), "On the Degree of Salubrity of the Common Air at Sea, Compared with That of the Sea-Shore, and That of Places Far Removed from the Sea." *Philosophical Transactions*, 70, 354-377.

Johnson, Samuel. (1755-1756). *A Dictionary of the English Language… The Second Edition.* Vol. 1 & 2. London: Printed by W. Strahan.

Kippis, Andrew, ed. (1747). *Biographia Britannica: or, The Lives of the Most eminent Persons who have flourished in Great Britain and Ireland*… Vol. 1. Printed for W. Innys et al.

Kippis, Andrew. (1783). *Six Discourses Delivered by Sir. John Pringle, Bart. When President of the Royal Society*. London: Printed for W. Strahan and T. Cadell, in the Strand.

Lewis, W., ann. and trans. (1748). *The Pharmacopoeia of the Royal College of Physicians at Edinburgh. Faithfully Translated from the Fourth Edition.* London: Printed for John Nourse.

MacLaurin, Colin. (1982). *The Collected Letters of Colin MacLaurin*, edited by Stella Mills. Nantwich: Shiva Publishing Limited.

Macbride, David. (1764). *"Experimental Essays on the Following Subjects: I. On the Fermentation of Alimentary Mixtures. II. On the Nature and Properties of Fixed Air. III. On the respective Powers, and Manner of Acting, of the different Kinds of Antiseptics. IV On the Scurvy; with a Proposal for trying new Methods to prevent of cure the same, at Sea. V. On the Dissolvent Power of Quick-Lime…* Printed for A. Millar, in the Strand

———. (1767). *Experimental Essays on Medical and Philosophical Subjects:… The Second Edition, Enlarged and Corrected.* London: Printed for A. Millar and T. Cadell, in the Strand

Michaelis, David and John Pringle. (1773). *Ioannis Davidis Michaelis, Prof. Ordin. Philos. et Soc. Reg. Scient. Goetingensis Collegae, Epistolae de LXX Hebdomadibus Danielis: ad D. Ioannem Pringle, Baronetum : primo privatim missae, nunc vero utriusque consensu publice editae* : Veneunt apud T. Cadell, in The Strand, 1773

Newton, Isaac. (1730). *Opticks: or, a Treatise of the Reflections, Refractions, Inflections and Colours of Light. The Fourth Edition, Corrected.* London: printed for William Innys at the West-End of St. Paul's.

Poissonnier-Desperriéres, Antoine (1780). *Traité des fièvres de l'isle de St-Domingue, avec un Mémoire sur les avantages qu'il y auroit à changer la nourriture des gens de mer, nouvelle édition....* Paris : L'Imprimerie Royale.

Price, Richard. (1774). "Farther Proofs of the Insalubrity of Marshy Situations. In a Letter from the Rev. Dr. Price to the Rev. Dr. Horsley." *Philosophical Transactions* 64: 96-98.

Priestley, Joseph. (1769). *The History and Present State of Electricity with Original Experiments by Joseph Priestley, L.L.D, F.R.S. Second and Enlarged Edition.* London: Printed for J. Dodsley in Pall-Mall.

———. (1772a). "Observations on Different Kinds of Air." *Philosophical Transactions* 62, 147-256.

———. (1772b). *Directions for Impregnating Water with Fixed Air (in order to communicate to it the peculiar Spirit and Virtues of Pyrmont Water And other Mineral Waters of a Similar Nature).* London: Printed for J. Johnson.

———. (1774). "On the Noxious Quality of the Effluvia of Putrid Marshes. A Letter from the Rev. Dr. Priestley to Sir John Pringle." *Philosophical Transactions* 64: 91-93.

———. (1775). *Experiments and Observations on Different Kinds of Air. The Second Edition Corrected.* London : Printed for J. Johnson.

———. (1776). "Observations on Respiration, and the Use of the Blood. By Joseph Priestley, LL.D. F.R.S. Read at the Royal Society, Jan. 25, 1776." *Philosophical Transactions* 66: 226-248.

Pringle, John and Young, George. (1747) "Vitrum Antimonii Ceratum a Specific Medicine in the Dysentery." *Edinburgh Medical Essays and Observations.* 3rd Ed. Vol. 5, pt. 1. 162-181.

Pringle, John. (1750). *Observations on the nature and cure of hospital and jayl-fevers : in a letter to Doctor Mead* ... London: Printed for A. Millar, and D. Wilson.

———. (1753a). "An Account of Several Persons Seized with the Gaol-Fever, Working in Newgate; And of the Manner, in Which the Infection Was Communicated to One Intire Family." *Philosophical Transactions* 8: 42-55.

———. (1752). *Observations on The Diseases of the Army in Camp and Garrison...* London: Printed for A Millar, D. Wilson, and T. Payne.

———. (1760). *Life of General James Wolfe, The Conqueror of Canada*. London: Re-printed and solde by Fowle and Draper in Marlborough Street, and by Green and Russell in Queen-Street.

———. (1761). "Postscript, Concerning some Remarks made on the preceding Work." In *Observations On The Diseases of the Army in Camp and Garrison. 3rd Edition*. (pp. 413-435.) London: Printed for A Millar, D. Wilson, and T. Durham in the Strand.

———. (1772). *Beobachtungen über die Krankheiten der Armee*. Altenburg: Richtersche Buchhandlung.

———. (1773). "A Discourse on the Different Kinds of Air, Delivered at the Anniversary Meeting of the Royal Society, November 30, 1773…"In *Six Discourses Delivered by Sir John Pringle*… edited by Andrew Kippis, 3-41. London: Printed for W. Strahan and T. Caddell, 1783.

———. (1776). "A Discourse Upon Some Late Improvements of the Means for Preserving the Health of Mariners, Delivered at the Anniversary Meeting of the Royal Society, November 30, 1776…"In *Six Discourses Delivered by Sir John Pringle*… edited by Andrew Kippis, 143-200. London: Printed for W. Strahan and T. Caddell, 1783.

Short, Thomas. (1749). *A general chronological history of the air, weather, seasons, meteors, &c. in sundry places and different times*; .... Vol. 1. London : printed for T. Longman; and A. Millar,

Sims, James. (1773). *Observations on epidemic disorders, with remarks on nervous and malignant fevers. By James Sims, M.D.* London: Printed for J. Johnson in St. Paul's Church Yard and G. Robinson in Pater-noster-row.

Sinclair, John. (1791-1799). *The Statistical Account of Scotland. Drawn up from the communications of the Ministers of the Different Parishes*. Vols. 1-21. Edinburgh and London: Printed and Sold by William Creech, et al.

Sloane, Hans. (1707). *A Voyage to the Islands of Madera, Barbados, Nieves, S. Christophers and Jamaica…* Vol. 1. London: Printed by B. M. for the Author.

Sprat, Thomas. (1667). *The History of the Royal Society of London for the Improving of Natural Knowledge.* London: Printed by T. R. for F. Martyn and F. Allestry, Printers for the Royal Society.

Stark, William and James Carmichael Smyth, ed. (1788). *The works of the late William Stark, M.D. consisting of clinical and anatomical observations, with experiments, dietetical and statical, revised and published from his original MSS. By* James Carmichael Smyth. London: printed for J. Johnson.

Sutton, Samuel. (1749). *An Historical Account of A New Method for Extracting the Foul Air out of Ships, &c, with the Description and Draught of the Machines, By Which it is performed…* London: Printed for J. Brindley.

Swift, Jonathan. (1726). *Travels into Several Remote Nations of the World*. London: Printed for Benjamine Motte.

Sydenham, Thomas and John Swan, ed. (1749). *The Entire Works of Dr. Thomas Sydenham, Newly made English from the Originals.... 2nd Ed*. London: Printed for Edward Cave, at St. John's Gate.

Vicq-d'Azyr, Félix. (1782). "Eloge de M. Pringle." *Histoire de l'Académie royale des sciences avec les mémoires de mathématiques et de physique pour la même année tirés des registres de cette académie, Année MDCCLXXXII.*.

Secondary

Ahnert, Thomas and Susan Manning. (2011). “Introduction.” In *Character, Self, and Sociability in the Scottish Enlightenment*, edited by Thomas Ahnert and Susan Manning. 1-30. New York: Palgrave Macmillan.

Barber, Peter. (2005). “George III and his Geographical Collection.” *The Wisdom of George the Third: Papers from a Symposium at The Queen’s Gallery, Buckingham Palace, June 2004*, edited by J. Marsden. 263-289. London: Royal Collection publications Ltd.

Bates, Don G. (1981). “Thomas Willis and the Fevers literature of the seventeenth century.” In *Theories of Fever from Antiquity to the Enlightenment*, edited by W. F. Bynum and V. Nutton, 45-70. *Medical Histor*y, Supplement No. 1, 1981.

Biagioli, Mario. (1993). *Galileo, Courtier*. Chicago: The University of Chicago Press.

Biswas, Asit K. (1967), "The Automatic Rain-Guage of Sir Christopher Wren, F R.S." *Notes and Records of the Royal Society of London* 22: 95-98.

Boantza, Victor. (2013a). “The Rise and Fall of Nitrous Air Eudiometry: Enlightenment Ideals, Embodied Skills, and the Conflicts of Experimental Philosophy.” *History of Science* 51: 377-412.

———. (2013b). *Matter and Method in the Long Chemical Revolution: Laws of Another Order*. Burlington, VT: Ashgate Publishing Company.

Brewer, John. (1989). *The Sinews of Power: War, Money, and the English State, 1688-1783*. New York: Alfred A. Knopf.

———. (1997). *The Pleasures of the Imagination: English Culture in the Eighteenth Century*. New York: Farrar Straus Giroux.

Broman, Thomas H. (2003). “Chapter 20: The Medical Sciences.” In *The Cambridge History of Science: Volume 4, Eighteenth-Century Science*, edited by Roy Porter, 463-484. Cambridge: Cambridge University Press.

Brooke, John Hedley. (1991). *Science and Religion: Some Historical Perspectives*. Cambridge: Cambridge University Press.

Brumwell, Stephen. (2006). *Paths of Glory: The Life and Death of General James Wolfe*. New York: Hambledon Continuum.

Bullough, Vern L. (2008). “Lind, James." In *Complete Dictionary of Scientific Biography*. Vol. 8. Detroit: Charles Scribner's Sons, 361-363. *Gale Virtual Reference Library*. Web. 23 Feb. 2014.

Bynum, William F. (1990). “Medicine at the English Court, 1688-1837.” In *Medicine and the Courts of Europe 1500-1837*, edited by Vivian Nutton, 262-284. New York: Routledge.

Canteel, Sir Neil. (1974). *A History of the Army Medical Department.* Volume 1. Edinburgh and London: Churchill Livingston.

Carlyle, Margaret. (2011). “Femmes de sciences, femme d’esprit : « le Traducteur des *Leçons de Chymie* »” In *Madame d’Arconville : Femme de lettres et de sciences au siècle des Lumières*, edited by Patrice Bret and Brigitte Van Tiggelen, 71-91. Paris : Hermann.

Carpenter, K. J. (1986). *The History of Scurvy and Vitamin C*. Cambridge and New York: Cambridge University Press.

Chang, Ku-Ming. (2002). "Fermentation, Phlogiston and Matter Theory: Chemistry and Natural Philosophy in Georg Ernst Stahl's 'Zymotechnia Fundamentalis'."*Early Science and Medicine* 7: 31-64.

Clark, William, Jan Golinski, and Simon Schaffer. (1999). “Introduction.” In *The Sciences in Enlightened Europe*, edited by William Clark , Jan Golinski, and Simon Schaffer, 3-31. Chicago: University of Chicago Press.

Clark-Kennedy, Archibald. (1929). *Stephen Hales, D.D., F. R. S. An Eighteenth Century Biography*. Cambridge: Cambridge University Press.

Clow, Archibald and Nan Clow. (1952). *The Chemical Revolution: A Contribution to Social Technology*. London: The Batchworth Press.

Coley, Noel G. (1982). “Physicians and the Chemical Analysis of Mineral Waters in Eighteenth- Century England.” *Medical History* 26: 123-144.

Cook, Harold J. (1990). “The New Philosophy and Medicine in Seventeenth-Century England.” In *Reappraisals of the Scientific Revolution*., edited by David C. Lindberg and Robert S. Westman, 397-436. Cambridge, UK: Cambridge University Press.

Cook, Harold J. (1994). “Good Advice and Little Medicine: The Professional Authority of Early Modern English Physicians.” *Journal of British Studies* 33: 1-31.

Coulter, Jack and Christopher Lloyd. (1961). *Medicine and the Navy, 1200-1900. Volume III- 1714-1815.* Edinburgh and London: E. & S. Livingstone Ltd.

Cowen, David L. (1957). “The Edinburgh Pharmacopoeia.” *Medical History* 1: 123-139.

Crane, Verner. (1966). “The Club of Honest Whigs.” *The William and Mary Quarterly* 23: 210-233.

Crosland, Maurice. (1987). “The Image of Science as a Threat: Burke versus Priestley and the ‘Philosophic Revolution.’” *The British Journal for the History of Science* 20: 227-307.

Crosland, Maurice. (2000). “Slippery Substances.” In *Instruments and Experimentation in the History of Chemistry*, edited by Frederic L. Holmes and Trevor H. Levere, 79-104. Cambridge, MA: The MIT Press.

Cunningham, Andrew. (1981). “Sydenham versus Newton: The Edinburgh Fever Dispute of the 1690s Between Andrew Brown and Archibald Pitcairne. In *Theories of Fever from Antiquity to the Enlightenment*, edited by W. F. Bynum and V. Nutton, 71-98, *Medical Histor*y, Supplement No. 1, 1981.

Daston, Lorraine and Elizabeth Lunbeck. (2011) “Introduction: Observation Observed.” In *Histories of Scientific Observation*, edited by Daston, Lorraine and Elizabeth Lunbeck , 1-11. University of Chicago Press, Chicago & London: 2011.

Dawbarn, Frances. (1998). “Patronage and Power: The College of Physicians and the Jacobean Court.” *The British Journal for the History of Science*. 31: 1-19.

Dear, Peter. (1985). “Totius in Verba: Rhetoric and Authority in the Early Royal Society.” *Isis* 7: 144-161.

Dingwall, Helen M. (2005). *‘A Famous and Flourishing Society’: The History of the Royal College of Surgeons of Edinburgh, 1505-2005*. Edinburgh: Edinburgh University Press.

Donovan, Arthur L. (1975). *Philosophical Chemistry in the Scottish Enlightenment: The Doctrines and Discourses of William Cullen and Joseph Black*. Edinburgh: Edinburgh University Press.

Eastwood, David. (2002). “Local Government and Local Society.” In *A Companion to Eighteenth-Century Britain*. Edited by H. T. Dickinson. 40-54. Malden, MA: Blackwell Publishers.

Emerson, Roger. (1979). “The Philosophical Society of Edinburgh, 1737-1747.” *The British Journal for the History of Science* 12: 154-191.

———. (2004). “The Founding of the Edinburgh Medical School.” *Journal of the History of Medicine and Allied Sciences* 59: 183-218.

———. (2009). *Essays on David Hume, Medical Men and the Scottish Enlightenment: ‘Industry, Knowledge and Humanity.*’ Farnham, Surry, andBurlington, VT: Ashgate Publishing Ltd.

———. (2012). *An Enlightened Duke: The Life of Archibald Campbell (1682-1761), Earl of Ilay, 3rd Duke of Argyl*. Humming Earth Press: Kilkerran, Scotland.

Feldman, Theodore S. (1990). “Late Enlightenment Meteorology.” In *The Quantifying Spirit in the Eighteenth Century*, edited by Tore Frängsmyr, J. L. Heilbron, and Robin E. Rider, 143-177. Berkely: University of California Press.

French, Roger, (2003). *Medicine before Science: The Rational and Learned Doctor from the Middle Ages to the Enlightenment.* New York: Cambridge University Press.

Gabriel, Richard A. (2013). *Between Flesh and Steel: A History of Military Medicine from the Middle Ages to the War in Afghanistan*. Washington: Potomac Books.

García-Ballester, Luis. (1993, reprinted 2002). “On the Origin of the ‘Six Non-natural Things’ in Galen.” In *Galen and Galenism*. Aldershot, UK: Ashgate Publishing Company.

Gascoigne, John. (1999). “The Royal Society and the Emergence of Science as an Instrument of State Policy.” *The British Journal for the History of Science* 32: 171-184.

Golinski, Jan. (1992). *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1829.* New York: Cambridge University Press.

———. (2007). *British Weather and the Climate of Enlightenment*. Chicago: University of Chicago Press.

Gordon, Charles. (1989). “Sir John Pringle and the Apothecaries.” *Pharmaceutical Historian* 19: 5-12.

Griffiths, Arthur. (1884). *The Chronicles of Newgate.* Volume 1. London: Chapman and Hall.

Guerrini, Anita. (2008). “Mead, Richard (1673–1754).” In *Oxford Dictionary of National Biography*, edited by H. C. G. Matthew and Brian Harrison; online ed., ed. Lawrence Goldman.

Guy, Alan J. (1985*). Oeconomy and Discipline: Officership and Administration in the British Army 1714-63*. Manchester: Manchester University Press.

Hamilton, David. (1963). “Sir John Pringle.” *Journal of the Royal Medical Corps*; 110: 138-47.

Hardy, Anne. (1993). “The medical response to epidemic disease during the long eighteenth century.” In *Epidemic Disease in London*, edited by J.A.I. Champion, 65-70. Centre for Metropolitan History Working Papers Series, No.1.

Hellmuth, Eckhart. (2002). “The British State.” In *A Companion to Eighteenth-Century Britain*, edited by H. T. Dickinson, 19-29. Malden, MA: Blackwell Publishers.

Holmes, Frederic L. (1989). *Eighteenth-Century as an Investigative Enterprise.* Berkeley, Office for the History of Science and Technology, University of California at Berkeley.

Holmes, Frederic L. (2000). "The ‘Revolution in Chemistry and Physics.’ Overthrow of a Reigning Paradigm or Competition between Contemporary Research Programs?" *Isis* 91: 735-753.

Holmes, Geoffrey and Daniel Szechi. (1993). The Age of Oligarchy: Pre-Industrial Britain 1722-1783. New York: Longman.

Hunter, Michael. (1985). *The Royal Society and its Fellows 1660-1700: The Morphology of an Early Scientific Institution.* Chalfont St. Giles: The British Society for the History of Science.

Jameson, Eric. (1961). *The Natural History of Quackery*. London: Michael Joseph.

Janković, Vladimir. (2001). *Reading the Skies: a Cultural History of English Weather, 1650-1820.* Chicago: University of Chicago Press.

Jordanova, Ludmilla. (1999). *The Sense of the Past in Eighteenth-Century Medicine. The Stenton Lecture 1997.* The University of Reading.

Jouanna, Jacques. (2012). *Greek Medicine from Hippocrates to Galen*. Selected Papers, edited by Philip van der Eijk. Translated by Neil Allies. Boston: Brill.

Klein, Ursula. (2003). "Experimental history and Herman Boerhaave's chemistry of plants" *Studies in the History and Philosophy of Biology and Biomedical Sciences* 34: 533-567

Klein, Ursula and Wolfgang Lefèvre. (2007). *Materials in Eighteenth-Century Science: A Historical Ontology*. Cambridge, MA: The MIT Press.

Kopperman, Paul. (2007). "The British Army in North America and the West Indies, 1755-1783: A Medical Perspective," *British Military and Naval Medicine, 1600-1830*, edited by Geoffrey Hudson, 51-86. Amsterdam: Rodopi Press.

Lawrence, Christopher. (1979). "The Nervous System and Society in the Scottish Enlightenment." In *Natural Order: Historical Studies in Scientific Culture.* edited by Barry Barnes and Steven Shapin, 19-40. Beverly Hills: Sage Publications, Inc.

———. (1987). "Priestley in Tahiti: The Medical Interests of a Dissenting Chemist." In *Science, Medicine and Dissent: Joseph Priestley (1733-1804),* edited by R.G W Anderson and Christopher Lawrence, 1-10. London: Welcome Trust/ Science Museum.

———. (1996). "Disciplining Disease: Scurvy, the Navy, and Imperial Expansion, 1750-1825." In *Visions of Empire*, edited by David Philip Miller and Peter Hans Reill, 80-106. New York: Cambridge University Press

Leong, Elaine and Sarah Pennell. (2007). "Recipe Collections and the Currency of Medical Knowledge in the Early Modern 'Medical Marketplace" In *Medicine and the Market in England and its Colonies, c. 1450-c. 1850*, ed. Mark S. R. Jenner and Patrick Wallis, 133-152. New York: Palmgrave Macmillan.

Levere, Trevor. (1984). "Dr. Thomas Beddoes (1750-1808): Science and medicine in politics and society." *British Journal for the History of Science* 17. 187-204.

———. (2000). "Measuring Gases and Measuring Goodness." In *Instruments and Experimentation in the History of Chemistry.* edited by F. L. Holmes and T. H. Levere, 105-35. Cambridge, Mass.: MIT Press.

———. and Gerard L'E. Turner. (2002). *Discussing Chemistry and Steam: The Minutes of a Coffee House Philosophical Society 1780-1787*. Oxford and New York: Oxford University Press.

———. (2009) "Dr. Thomas Beddoes: Chemistry, Medicine, and the Perils of Democracy." *Notes and Records of the Royal Society* 63. 215-229.

Lynch, William T. (2001). *Solomon's Child: Method in the Early Royal Society of London*. Stanford: Stanford University Press.

McBride, William M. (1991). "'Normal' Medical Science and British Treatment of Sea Scurvy, 1753-75." *Journal of the History of Medicine and Allied Sciences*. 46: 159-177.

McCallum, Ian R. (1999). *Antimony in Medical History. An Account of the Medical Uses of Antimony and its Compounds since Early Times to the Present*. Edinburgh: The Pentland Press.

McCullough, David. (2005). *1776*. New York: Simon & Schuster.

McKie, Douglas. (1961). "Joseph Priestley and the Copley Medal." *Ambix* 9: 1-23.

Meynell, G. G. (2006). "Lohn Locke and the Preface to Thomas Sydenham's *Observationes Medicae*." *Medical History*. 50,1: 93–110.

Miller, David Philip. (1998.) "The 'Hardwicke Circle': The Whig Supremacy and Its Demise in the 18th-Century Royal Society." *Notes and Records of the Royal Society of London*, Vol. 52, No. 1: 73-91.

Mitchell, Trent A. (1998). "The Politics of Experiment in the Eighteenth Century: The Pursuit of Audience and the Manipulation of Consensus in the Debate over Lightning Rods." *Eighteenth-Century Studies,* 3: 307-331.

Nenadic, Stana. (2010). "Military Men, Businessmen, and the "Business" of Patronage in Eighteenth-Century London." In *Scots in London in the Eighteenth Century,* edited by Stana Nenadic, 229-253. Lewisburg: Buckness University Press.

Newman, William R. and Lawrence M. Principe (2002). *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chemistry*. Chicago: Chicago University Press.

Nicholson, Marjorie Hope. (1976). *Science and Imagination*. Hamden, Connecticut: Archon Books.

Ochs, Kathleen. (1985). "The Royal Society of London's History of Trades Programme: An Early Episode in Applied Science." *Notes and Records of the Royal Society of London,* Vol. 39, 2: 129-158.

Olson, Richard G. (2006). *Science and Religion 1450-1900: From Copernicus to Darwin*. Baltimore: The Johns Hopkins University Press.

Patterson, Louise Diehl. (1953). "The Royal Society's Standard Thermometer, 1663-1709." *Isis* 44, 1: 51-53.

Peterkin, A. and William Johnston. (1968). *Commissioned Officers in the Medical Services of the British Army 1660-1960.* Vol. 1. London: The Wellcome Historical Medical Library.

Phillipson, Nicolas. (1982). "The Scottish Enlightenment." In *The Enlightenment in a National Context*. Edited by Roy Porter and Mikulas Teich, 33-40.

Pomata, Gianna. (2011). "Observation Rising: The Birth of an Epistemic Genre, 1500-1650." In *Histories of Scientific Observation*, edited by Daston, Lorraine and Elizabeth Lunbeck, 45-80. University of Chicago Press, Chicago & London.

Porter, Dorothy and Roy Porter. (1989). *Patient's Progress: Doctors and Doctoring in Eighteenth-Century England*. Stanford: Stanford University Press.

Porter, Dorothy. (1999). *Health, Civilization, and the State: A story of public health from ancient to modern times.* Routledge: London and New York

Porter, Roy. (1982). "The Enlightenment in England." In *The Enlightenment in a National Context*., edited by Roy Porter and Mikulas Teich, 1-18.

———. (1985). "Lay Medical Knowledge in the Eighteenth Century: The Evidence of *Gentleman's Magazine*." *Medical History* 29: 142-143. Cambridge, UK. Cambridge University Press.

———. (1990). *English Society in the Eighteenth Century. Revised Edition*. London: Penguin Books.

———. (1999). *The Greatest Benefit to Mankind: A Medical History of Humanity from Antiquity to the Present*. London: Fontana Press.

———. (2001). *Bodies Politic: Disease, Death, and Doctors in Britain, 1650-1900*. Cornell University Press.

Powers, John C. (2012). *Inventing Chemistry: Herman Boerhaave and the Reform of the Chemical Arts*. Chicago: The University of Chicago Press

Riley, James C. (1987). .*The Eighteenth-Century Campaign to Avoid Disease*. New York: St. Martin's.

Rogal, Samuel J. (1992). *Medicine in Great Britain from the Restoration to the nineteenth century, 1660-1800: An Annotated Bibliography*. Westport, CT: Greenwood Press.

Rusnock, Andrea. (1999). "Biopolitics: Political Arithmetic in the Enlightenment" In *The Sciences in Enlightened Europe*, edited by William Clark, Jan Golinski, and Simon Schaffer, 49-68. Chicago: The University of Chicago Press.

———. (2002a). "Hippocrates, Bacon, and Medical Meteorology at the Royal Society, 1700-1752." In *Reinventing Hippocrates,* edited by David Cantor, 136-153. Burlington, VT: Ashgate Publishing Limited.

———. (2002b). *Vital Accounts: Quantifying Health and Population in Eighteenth-Century England and France*. Cambridge: Cambridge University Press, 2002).

Schaffer, Simon. (1983). "Natural Philosophy and Public Spectacle in the Eighteenth Century." *History of Science*, 21: 1-43.

———. (1987). "Priestley and the Politics of Spirit." In *Science, Medicine and Dissent: Joseph Priestley (1733-1804),* edited by R.G W Anderson and Christopher Lawrence, 39-53. London: Welcome Trust/ Science Museum.

———. (1990). "Measuring Virtue: Eudiometry, Enlightenment and Pneumatic Medicine." In *The Medical Enlightenment of the Eighteenth Century*, edited by Cunningham A. and French R, 281-318. New York: Cambridge University Press, 1990.

Schama, Simon. (2001). *A History of Britain: The Wars of the British, 1603-1776.* Volume II. New York: Hyperion.

Scott, E. L. (1970). "The Macbridean Doctrine of Air." *Ambix* 17: 43-57.

Selwyn, Sydney. (1966). "Sir John Pringle: Hospital Reformer, Moral Philosopher and Pioneer of Antiseptics." *Medical history* 10 (3): 266–274.

Shackelford, Jole. (2002). "The Chemical Hippocrates: Paracelsian and Hippocratic Theory in Petrus Severinus' Medical Philosophy." In *Reinventing Hippocrates,* edited by David Cantor, 59-88. Burlington, US: Ashgate.

Shapin, Steven. (1984). "Pump and Circumstance: Robert Boyle's Literary Technology" *Social Studies of Science* 14, 4: 481-520.

———. (1994). *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago: The University of Chicago Press.

———. (2006). "Chapter 6: The Man of Science." In *The Cambridge History of Science: Volume 3: Early Modern Science*, edited by Lorraine Daston and Katherine Park. Cambridge, Uk: Cambridge University Press.

Sher, Richard. (2006). *The Enlightenment & The Book: Scottish Authors & Their Publishers in Eighteenth-Century Britain, Ireland, & America.* Chicago: University of Chicago Press.

Singer, Dorothea. (1949). "Sir John Pringle and his circle.—Part I. Life." *Annals of Science 6*: 127-180.

———. (1950). "Sir John Pringle and his circle. Part II. Public health." *Annals of Science* 6: 229-247.

———. (1950). "Sir John Pringle and his circle.—Part III. Copley discourses." *Annals of Science* 6: 248-261.

Smith, A. H. (1919). “A Historical Enquiry into the Efficiency of Lime Juice for the Prevention and Cure of Scurvy.” *Journal of the Royal Army Medical Corps*, 32, 93-116, 188-208.

Smith, Hannah (2005). “The Court in England, 1714-1760: A Declining Political Institution?” *History* 90: 23-41.

Sonntag, Otto, ed. (1999). *John Pringle’s Correspondence with Albrecht von Haller*. Basel: Schwabe & Co. AG.

Stewart, Larry. (1986a). “Public Lectures and Private Patronage in Newtonian England.” *Isis* 21, 1: 47-58.

———. (1986b). “The Selling of Newton: Science and Technology in Early Eighteenth-Century England.” *Journal of British Studies* 25: 178-192.

———. (1992). *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, 1660-1750*. Cambridge: Cambridge University Press.

———. (2009). “Measure for Measure: Projectors and the Manufacture of Enlightenment, 1770-1820.” In *The Age of Projects*, edited by Maximillian E. Novak, 370-389. Toronto: University of Toronto Press.

Stewart, M. A. (1985). “Berkeley and the Rankenian Club.” *Hermathena* 139: 25-45.

———. (1990). “The Origin of the Scottish Greek Chairs.” In *‘Owls to Athens’ Essays on Classical Subjects, Presented to Sir Kenneth Dover,* edited by E. M. Craik, 391-400. Oxford: Clarendon Press.

Szreter, Simon. (1988). “The Importance of Social Intervention in Britain’s Mortality Decline c. 1850-1914: a Re-interpretation of the Role of Public Health.” *The Society for the Social History of Medicine*. 1: 1-38.

Timperleym, Loretta. (1976). *A Directory of Landownership in Scotland c. 1770*. Edinburgh: Econoprint Ltd.

Tomory, Leslie. (2010). “William Brownrigg’s Papers on Fire Damps.” *Notes and Records of the Royal Society.*

Underwood, E. Ashworth. (1977). *Boerhaave’s Men: at Leyden and After*. Edinburgh: Edinburgh University Press.

Van Tiggelen, Brigitte. (2011). “Chapitre 5. Entre anonymat et traduction : la carrière d’une femme en sciences.” In *Madame d’Arconville : Femme de lettres et de sciences au siècle des Lumières,* edited by Patrice Bret and Brigitte Van Tiggelen, 93-107. Paris : Hermann.

Watt, Sir James. (1979). “Medical Aspects and Consequences of Cook’s Voyages.” In *Captain James Cook and His Times,* edited by Robin Fisher and Hugh Johnston, 129-157. Vancouver: Douglas & McIntyre.

Wear, Andrew. (1992). “Making Sense of Health and the Environment in Early Modern England.” In *Medicine in Society: Historical Essays*, edited by Andrew Wear, 119-147. Cambridge: Cambridge University Press.

Weld, Charles. (1975 [1848]). *A History of the Royal Society.* New York: Arno Press.

Werrett, Simon. (2000). “Healing the Nation’s Wounds: Royal Ritual and Experimental Philosophy in Restoration England.” *History of Science,* 38: 377-399.

Wess, Jane. (2005). “George III, scientific societies, and the changing nature of scientific collecting.” In J. Marsden. *The Wisdom of George the Third: Papers from a Symposium at The Queen’s Gallery, Buckingham Palace,* June 2004. 313-331. London: Royal Collection publications Ltd.

Williams, Glyndwyr. (1998). “The Endeavour Voyage: A Coincidence of Motives.” In M. Lincoln (Ed.) *Science and Exploration in the Pacific*. 3-18. Suffolk: Boydell & Brewer Ltd.

Wilson, Philip K. (2004). “Stephens, Joanna (*d.* 1774).”In *Oxford Dictionary of National Biography*, edited by H. C. G. Matthew and Brian Harrison; online ed., ed. Lawrence Goldman.

Wood, Paul. (2006). “Candide in Catalonia: The Culture of Science in the Scottish Universities, 1690-1805.” In *Universities and Science in the Early Modern Period*, edited by Mordechai Feingold and Victor Navarro-Brotons. Dordrecht: The Netherlands.

Wright-St. Clair, Rex E. (1964). *Doctors Monro: A Medical Saga*. The Wellcome Historical Library: London.

Yamamoto, Koji. (2012). “Reformation and the Distrust of the Projector in the Hartlib Circle.” *The Historical Journal*, 55: 375-397.

Zuckerman, A. (1977). ‘Scurvy and Ventilation of Ships in the Royal Navy: Samuel Sutton’s Contribution’, *Eighteenth-Century Studies*, 10: 222-34.