

## INTRODUCTION

**THIS EDITED VOLUME** examines toxic airs from the Middle Ages to the recent past on a variety of scales, from lungs to locales and from places to planetary processes. Chapters shed new light on the myriad ways that humans have feared and then made sense of the air they breathe and the climates in which they live. Such understandings have often opened avenues for intervention in the air, improving it for ourselves and sometimes making it more frightening for perceived enemies. The authors examine how cultural assumptions, technologies, and policies were formulated, often in an atmosphere of crisis, and typically aimed at mitigating fears about health, air quality, social tensions, and the global atmosphere.

The history of the air, and its woes, is a topic that falls among many different disciplines. While the composition of the air is ostensibly a problem of chemistry, chemistry itself has changed significantly since the Middle Ages. Even the notion of atmospheric chemistry is relatively recent and it raises the specter of presentism to see any kind of modern chemistry in medieval concerns about breath or in nineteenth-century concerns about climate and disease transmission. On the other hand, environmental history offers some analytical frameworks to analyze pollution, but typically focuses on terrestrial rather than atmospheric concerns. In addition the strong declensionist narrative of environmental historians is too simplistic for the complexities of toxic air, which is often surprisingly remediable. Medical histories of the role of air in human health address some of the concerns here but our scale transcends the body, to involve ecosystems, upper layers of the atmosphere that humans do not inhabit, and ultimately the health of the planet. Lastly, this volume points out that policy matters, and the history of air quality policies has to be seen in a context of available science and technologies, political possibilities, and emotional responses to the air. Humans are, not surprisingly, threatened by compromises to their air, and they have reacted by wielding their full arsenal of understandings on toxic airs.

This volume is at once evocative and visceral. It introduces a new, interdisciplinary set of voices from different specialties. The volume presents a broad series of case studies that, taken together, open up new conversations on a variety of scales of analysis (body, place, planet), while shifting perspec-

tives away from discovery, progress, simple solutions, or gloom and doom. The delicate balance is to introduce the apprehensions, problems, and looming disasters involving the atmosphere while at the same time contextualizing the issues and connecting science, engineering, and medicine with public understandings, policies, and practices. The authors use multiple historical accounts of toxic air as lenses to view the connections between different ways of knowing and acting, focusing on historical actors' efforts to do something about what they perceive to be dangerous in the air they breathe or that threatens them from above.

The authors' intent is to understand many different perceptions of both air and the possibility of action regarding the air. To do so they employ a large array of disciplinary approaches at the intersections of history, philosophy, anthropology, literature, art, science, engineering, and policy. Coverage ranges from an analysis of toxic *pneuma* in the Middle Ages to current, cutting-edge policy concerns involving transboundary and global air pollution, from medical to bureaucratic and technoscientific concerns. In all cases, the chapters inform and are informed by one another as they speak to both specific and universal issues. The essays are empowering, providing new analytic tools and clear visions of the problems on the one hand and providing critiques of efforts to manage them on the other.

The authors intentionally vex technological fixes in hope that higher levels of solutions might emerge. The volume is designed to act as a catalyst increasing the speed of insights by bringing together new materials that previously have been separated by discipline or time period. The authors present a rich and diverse set of cases and introduce new categories that challenge perspectives. Taken together these essays facilitate new ways of imagining and talking about questions of the atmosphere and toxic air. They produce new insights precisely because of their breadth, range, and temporal and topical diversity.

Overarching themes addressed in more than one chapter include "toxic *pneuma*"; private and public guilt; the "pathology of deadly air"; the natural and the artificial; the visible and the invisible; the social organization of science, medicine, and technology; transmission of technical information to the public; technological "fixes"; the many challenges inherent in regulating the atmosphere; anxiety about personal and environmental health; and scale interactions along the axis of body, place, planet.

The volume begins on a personal scale, examining the ways that airs act as conduits between human bodies and contaminants. Chapters here focus on the intimate level of breathing, choking, disease, invisible wounds, and

scars. They introduce the themes of hidden aerial threats, bodily permeability, fear, and vulnerability. Brenda Gardenour Walter takes as her focus the toxic breath of witches as exemplary of the centrality of air in the reciprocal relationship between body and environment, microcosm and macrocosm, in medical theory and theology as received from ancient traditions and modified by scholars in the thirteenth and fourteenth centuries. She examines the ways these seemingly dichotomous traditions inform one another and inform our basic assumptions moving forward. This chapter sets the stage for the rest of the volume, specifically in its claim that the body is not bounded mechanically, chemically, or pneumatically, but indeed is open to fluid and foul atmospheric influences. Her work stands as a corrective to the popular but misguided notion of the deep past as static and unchanging in contrast to the notion that our own times are the only ones changing dynamically at an increasing rate. Further, her work speaks to issues raised by other authors in this volume, including the permeability of the body and its vulnerability to invisible toxic airs released in warfare (Kilshaw) or in nature (Fleming).

Christopher Hamlin examines cholera research in nineteenth-century colonial India by regimental surgeon Reginald Orton and like-minded successors as pioneering but failed attempts to make a complete geographical, atmospheric, and etiological study of the disease. This study illuminates the social organization of medicine and empire and examines epistemological tensions between metropolitan and colonial accounts of disease and between empirical and rational research traditions. It also illuminates the modern quest to establish a synthesis of infectious and environmental factors involving disease. In this way Hamlin's paper informs the work by Kilshaw on Gulf War syndrome and the work of Lee on the Environmental Protection Agency's (EPA) Community Health Environmental Surveillance System (CHESS).

Is it better to cry than die? Roger Eardley-Pryor provides multiple perspectives on the use of tear gas as a technological fix in the Vietnam era, both in warfare and in crowd control. The paradox of nonlethal chemical agents lies in the fact that their use in combat was prohibited internationally, but their domestic use was widespread and considered humane. Policy changes were not driven purely by rational choices, however, but by the swirl of events and perceptions. Eardley-Pryor's focus on the elusiveness of a technological fix echoes through other chapters—for example, those by Brimblecombe and by Dunn and Johnson on urban air pollution and automotive emissions.

By design, tear gas intervenes between body and place, whereas the collateral damage to the atmosphere of Kuwait triggered the phenomenon known among veterans as Gulf War syndrome. Susie Kilshaw, an anthropologist, explores the fear of exposure to unseen agents and the uncertainty that followed the veterans home. In the aftermath of the war, and in the absence of a confirmed medical diagnosis, theories of causation began to revolve more closely around veterans' corporeal experiences and contested memories. Her work raises the themes of invisibility and subjectivity that resonate throughout the volume.

Air pollution, which is neither invisible nor subjective, also intervenes between body and place. Los Angeles air plays a central role in atmospheric chemist Peter Brimblecombe's account of the development of the photochemistry of smog. He helps us understand how chemists deciphered the complex relationships between emitted pollutants and the atmospheric processes that transform them into LA's infamous smog. He also argues that without an understanding of atmospheric chemistry it is difficult to develop effective policy.

The related chapter by Richard Chase Dunn and Ann Johnson explores the sequence of technological fixes developed prior to 1980 to curtail automotive emissions. This work, conducted in automotive laboratories and in policy arenas, is framed by studies that model and measure air pollution. Engineers incorporated complex chemical understandings of pollution and reframed that knowledge into design parameters, transforming air pollution into a manageable emissions problem. Such work also shaped and was shaped by new regulations governing the automobile.

For many activists, politicians, and intellectuals the establishment of the EPA was a major accomplishment in itself. However, scientists, engineers, and administrators faced several challenges in defining an agenda and delineating the boundaries of research and regulation. The chapter by Jongmin Lee presents the case of CHESS—a comprehensive epidemiological study of the effects of air pollutants in eight communities on the health of children, asthmatics, and the elderly—to show how EPA scientists and engineers dealt with new geographical, bureaucratic, and functional challenges. Lee's study employs the notion of coproduction to explain what the EPA expected from CHESS and why this flagship program fell short of those expectations.

While CHESS spanned the nation, E. Jerry Jessee's essay reaches into the stratosphere to unpack the controversy over atmospheric nuclear weapons testing and fallout. Was the fallout ultimately dissipated in the environ-

ment? Research on the movement of radiation through the atmosphere and biosphere indicated that it was not, nor was it benign. Such work played a critical role in formulating estimates of fallout risks by pointing to the complex and dynamic ways that the environment both modulated and magnified human exposure to fallout.

After the Limited Nuclear Test Ban Treaty of 1963, concerns about transboundary air pollution took center stage. Rachel Rothschild's chapter examines the Organisation for Economic Cooperation and Development (OECD) project to measure sulfur dioxide transfer between European nations during the 1970s; in doing so she explores the interaction of scientific research, international law, and national policies. The OECD project confirmed a significant transfer of acid rain precursors from northwest Europe to Scandinavia, and nearly two decades of ecological studies provided ample evidence of the environmental harms resulting from this pollution.

Also during the early 1970s, perceptions of ozone underwent a profound transformation. Previously regarded primarily as an annoying component of urban pollution, it began to appear as a positive element protecting the earth from harmful radiation, exemplified in new terms like "ozone shield," which often replaced the more neutral "ozone layer." Matthias Dörries details how new awareness of the role of the atmosphere in supporting life on earth brought the atmospheric sciences to the forefront of political and public debates. Some scientists were particularly concerned about the effect of a nuclear war on the ozone layer; others focused on the pollution load from a proposed fleet of supersonic transports. Dörries's chapter traces the evolution of the debate about ozone and its threats.

The current crisis in climate change and the realization that humans are the primary cause of this change has raised questions about ownership and responsibility. Who "owns" the crisis and who is responsible for mitigating and reversing it, if possible? The overwhelming response has been to propose a market solution. Andrea Polli, a conceptual artist, argues that the arts have a role to play. Her essay brings contemporary artists firmly into the conversation as it explores the idea of air for sale, discusses several contemporary art projects, and highlights the evolving role of artists in affecting public participation on climate change.

The personal and the planetary meet in James Rodger Fleming's chapter on carbon dioxide as toxic *pneuma*. He recounts the history of understanding the substance that eventually came to be known as CO<sub>2</sub>, takes us on a Cook's tour of caves and valleys filled with the asphyxiating gas, and brings the story of carbon dioxide as an active agent in climate change up to date.

The authors in this volume have provided their best insights and inspirations on toxic airs over a vast range of spatial and temporal scales. They have also inspired one another. These essays provide both insights and challenges about the role of air and the atmosphere in the history of science and environmental history. We trust this volume will introduce new themes, provide new perspectives, and address new problems (perhaps frontiers?) in the medical, chemical, and environmental history of the atmosphere. We offer *Toxic Airs* as a model of interdisciplinary historical work in a number of genres and on a wide range of scales.