KIRSTEN E. SHEPHERD-BARR

Introduction

An audience follows a park ranger into the woods looking for wolves … A young Danish prince contemplates a skull in a dug-up grave … A wheelchair-bound blind man spars verbally with the carer who is about to leave him … A woman with a deformed spine is murdered by a fanatical doctor who wants to dissect her corpse … A bald, cancer-ridden woman recites the poetry of Donne as she lies dying … Two pairs of couples in Regency dress dance a waltz as the lights gradually fade …

These moments and images come from memorable plays and performances that, in various ways, engage with scientific ideas. Some of them will be instantly recognizable as 'science plays': Shelagh Stephenson's *An Experiment with an Air Pump*, Tom Stoppard's *Arcadia*, Margaret Edson's *Wit*. Others will be familiar as famous plays, but it might come as a surprise to think about Shakespeare's *Hamlet* or Beckett's *Endgame* as engaging with science. The first example on the list may be unknown to most readers, as it is part of an ongoing series of site-specific performance works about species loss and other impacts of climate change, a relatively new area that theatre is exploring in powerful ways. Most of these examples come from plays written and performed within the past few decades, a period of great activity and interest in putting science on stage. However, that is by no means a recent tendency; theatre and science have a long history of interacting, going back to the ancient Greeks, for example in the playwright Aristophanes' *The Clouds* and (as one of the chapters in this book explores) in Plato's metaphor of the cave. That history has been charted in numerous books and articles defining the field of theatre and science. This book gathers some of the findings that have emerged from this growing discourse and presents new developments and directions of inquiry. Contributions come from many different areas of expertise within the field of theatre and science and demonstrate how far it has expanded since it began to be a 'field'.

And when, exactly, was that? Many of those working in the field would agree that it was Michael Carklin's pioneering conference, 'Theatres of

Science', at the University of Glamorgan (now the University of South Wales) in 2004 that marked out the territory by recognizing that there was more to the engagement of theatre and science than a few scattered plays and articles here and there. Many of the contributors to this volume, including Carklin himself, were at that 2004 conference. *The Cambridge Companion to Theatre and Science* provides a snapshot of the field as it is now, building on seminal works such as Joseph Roach's *The Player's Passion: Studies in the Science of Acting*, Natalie Crohn Schmitt's *Actors and Onlookers: Theatre and Twentieth-Century Scientific Views of Nature*, Allen E. Hye's *The Moral Dilemma of the Scientist in Modern Drama*, William Demastes's *Theatre of Chaos: Beyond Absurdism*, Charles A. Carpenter's *Dramatists and the Bomb: American and British Playwrights Confront the Nuclear Age, 1945–1964*, and Jane R. Goodall's *Performance and Evolution in the Age of Darwin*. In addition, Carl Djerassi's articles and plays proposed a 'science-in-theatre' model that engendered lively discussion, much of it in the journal *Interdisciplinary Science Reviews*, which has regularly featured articles on the relationship between theatre and science. All of this publishing activity coincided with a surge of playwriting and theatre-making on scientific themes, ideas, and figures, accentuated by the excitement and controversy over Michael Frayn's 1998 play *Copenhagen*, which became a watershed moment for theatre and science in raising fundamental questions about what it means when the two domains meet. What responsibility, if any, does the playwright have toward real-life people and actual scientific ideas being depicted? And what defines a successful 'science play'? My book *Science on Stage: From Doctor Faustus to Copenhagen* addressed such questions as it explored the phenomenon of the 'science play', and in the same year (2006) Sue-Ellen Case's *Performing Science and the Virtual* traced the ways in which science has been performed in a variety of modes, from alchemy to the contemporary virtual avatar. These were followed by Eva-Sabine Zehelein's *Science: Dramatic: Science Plays in America and Great Britain, 1990–2007* and Tiffany Watt-Smith's *On Flinching: Theatricality and Scientific Looking from Darwin to Shell Shock*, which was one of the first studies to consider the theatre–science interaction as a two-way street, with scientists often borrowing from performance and incorporating theatrical techniques into their experiments. There has also been greater recognition by historians of science and medicine of the role played by theatre in the cultural dissemination and embeddedness of scientific ideas and medical findings and innovations, for example in Martin Willis's *Staging Science: Scientific Performance on Street, Stage, and Screen* and Bernard Lightman and Bennett Zon's collection *Evolution and Victorian Culture*.

As this brief (and by no means complete) summary indicates, interest in creating theatre works that involve scientific ideas, and in discussing, analyzing, and reviewing them, has continued to build steadily over the past several decades. In 2013 and 2014, two special issues of *Interdisciplinary Science Reviews* on theatre and science (co-edited by Bartleet and Shepherd-Barr) took stock of the field and signalled, through their range of contributors, possible future directions it might take. Many of these directions have been borne out now in books, for example Jenni Halpin's *Contemporary Physics Plays*, Anna Harpin's *Performance, Madness, Psychiatry: Isolated Acts*, and Nicola Shaughnessy's *Applying Performance: Live Art, Socially Engaged Theatre and Affective Practice*. There are also in-depth studies of single areas of science or medicine and theatre, such as disease and contagion (Fintan Walsh's *Theatres of Contagion* addresses this area), psychiatry and 'madness' (Christina Wald's *Hysteria, Trauma, and Melancholia: Performative Maladies in Contemporary Anglophone Drama* pioneered this area), evolutionary thought (my book *Theatre and Evolution from Ibsen to Beckett* and Goodall's *Performance and Evolution in the Age of Darwin*), and the diagnostic gaze (Alex Mermikides and Gianna Bouchard's *Performance and the Medical Body*, which explores this topic transhistorically). Mathematics on stage has received expert analysis from Steve Abbott in particular. One can find whole books devoted to single plays, such as Liliane Campos's *The Dialogue of Art and Science in Tom Stoppard's Arcadia*, and dozens of articles in a wide range of journals attest to the range and variety of the field as it currently stands.

In short, there is no end to the hypertextual resources readers can draw on as they read this companion. In addition, there is a wealth of resources in the field of 'literature and science' that have particular relevance to performance and science. Although it has tended to focus on narrative forms like the novel (and in particular the nineteenth-century novel), the field of 'literature and science' is an important close relative to 'theatre and science' and its common ground is touched upon in the final chapter of this book.

The Cambridge Companion to Theatre and Science aims to provide something different from what is already available on this subject both in print and on the Internet. It is also different from many companions and guides to a field, topic, or theme in the way it is designed to be consumed. The book recognizes that habits of reading have changed because of the accessibility of digital resources; as book historian Leah Price points out in *What We Talk about When We Talk about Books* (2019), we now read in hypertext mode, taking every book or article as a starting point and stopping to look things up as we go along, knowledge gloriously proliferating at every turn or detour. If every statement in a book can be thus explored and

probed, how, then, should a book like this one best serve its readers, who have instantaneous access to so much more information than it can provide? The main job is not to duplicate what is already out there. This book therefore is a companion in the truest sense: it guides readers to the key ideas and topics within the growing field of theatre and science and gives a clear picture of what that field is all about, yet leaves readers completely free to develop and pursue their own areas of interest – to look up plays that pique their curiosity as they go along, or performances that they want to know more about, or theatres and theatre companies that are mentioned, or playwrights, scientists, directors, actors, designers, and so on.

Thus, while dozens of individual plays are discussed in the book, it is not a comprehensive guide to 'science plays'. Rather, it is a companion to some of the key developments and ideas within theatre and science: it guides the reader to and through them, using case studies to illustrate points along the way, and it pays attention to performances as well as to texts. This makes it both more interesting and of more lasting value. Without depth of analysis and expert contextualization, the book would just be a list of science plays. Such lists are available elsewhere, as are analyses of individual plays in articles and books, many of which are listed in the Suggested Reading sections that appear at the end of each chapter.

In parallel with the rise of the 'science play' came the development of other ways of engaging with science on stage, notably through devised performance and through theatre as social intervention. The book explores such developments, and also significant new areas such as theatre and the environment, ecology, and animal studies; theatres of mental health; and performance and cognitive science. The place of technology and invention within the study of theatre and science also comes under scrutiny, with case studies from different periods and cultures. The medical sciences are represented in two chapters dealing with contagion and disease as powerful theatrical starting points. An overarching theme is metaphor, explored in several chapters for its explanatory power, yet also robustly interrogated in terms of its cultural role as the dominant mode of telling scientific stories. Observation and experiment unite the scientific method with the theatrical, and their convergence as well as their significant divergences are explored here, with a strong link to diagnosis. Theatre as laboratory emerges as the abiding common ground of the book as it ponders how science and performance interact.

The book is structured in pairs and triads of chapters that consider a particular aspect of theatre and science in different ways. This structure allows the reader to get a sense of the discourse on the given theme or topic, its history, debates, and key areas of investigation, as well as some of its representative plays and productions. Brief synopses of each chapter follow

below. One of the book's strengths and innovations is its treatment of period and its balance of earlier and later material. In terms of period coverage, the book is not overwhelmingly focused on the twentieth and twenty-first centuries like many discussions of theatre and science but touches on key moments, plays, and performances across the centuries, from the Greeks through to the medieval and Renaissance theatres, from the eighteenth century to the present. In addition, individual chapters are often transhistorical rather than confined to a specific temporal span. While the emphasis tends to be on Western theatre, there is broad cultural coverage within that framework as well as geographical spread beyond the Anglophone world.

The first three chapters of the book introduce key concepts central to both theatre and science: objectivity, experiment, and metaphor. Dan Rebellato's 'Objectivity and Observation' starts by tracing the development of objectivity in both science and theatre through classical and early modern theatre, in which it was a fairly unimportant epistemic virtue, into the late eighteenth century where objectivity begins to emerge through the idealizations of 'Truth-to-Nature' in biology and in literary and theatrical Romanticism. He shows that although some conceptions of scientific objectivity and observation treat these as virtuous by the extent to which they rise above personal or historical bias, the practice and theory of both objectivity and observation have changed through history. Drawing on the work of Lorraine Daston and others, the chapter goes on to show that the emergence of modern ('mechanical') objectivity, and a new relationship with observation, mark both nineteenth-century science and Naturalist theatre. Making the comparison explains some of the antitheatrical claims of Naturalist authors and the contradictions of Naturalist practice. As nineteenth-century 'objectivity' is superseded, so the theatrical figuration of science gravitates towards areas of ambiguity, chaos, and indeterminacy. In Chapter 2, 'Staging Consciousness: Metaphor as Thought Experiment in McBurney's *Beware of Pity*', Jane R. Goodall begins by observing that the repertoire of science plays is dominated by works in which scientific issues are the subject of the drama, rather than a mode of exploration, in symbiotic relationship with those of the theatre itself. This kind of symbiosis can occur only if the collaborative process is set up at the outset, so that the script evolves in concert with all aspects of staging and enactment – a method pioneered by Theatre de Complicité, under the direction of its founder Simon McBurney. Taking as a case study McBurney's stage adaptation of Stefan Zweig's novel *Beware of Pity*, the chapter explores the question of how consciousness might be staged, rather than talked about. Central to the experiment is the process of working with metaphor, both as literary conceit and as an approach to theatrical realization. In Chapter 3, 'The Experimental/Experiential

Stage: Extreme States of Being of and Knowing in the Theatre', Carina Bartleet charts the intersections between theatre and science and explores how experience and experiment are interlinked in each domain. Looking at three key scientific ideas and theatrical moments, the chapter draws out contextual aspects of the science that reflect the scientific concerns of their moments. Exploring first a play from the early years of the recent resurgence in the interest in theatre and science, the chapter investigates how the biological and medical sciences with their obvious link to genetic testing and human experience are represented, and moves on to consider how science, gender, and life become crystal clear in early twenty-first-century theatre. It concludes by looking at how theatre is shaped by the experience of climate change and its science in the 2010s through two very different plays, one a staged lecture and the other a production whose deliberate excess results in an expansive 'Epic' theatrical form that appears to take precedence over the science.

Two chapters on environmental issues in relation to performance come next. In Chapter 4, 'A Cave, a Skull, and a Little Piece of Grit: Theatre in the Anthropocene', Carl Lavery argues for a new way of thinking about what an ecologically oriented dialogue between theatre and science might give rise to. He does so by reading three canonical western texts – Plato's Cave, Shakespeare's *Hamlet,* and Beckett's *Endgame* – as instances of geology. The aim is to show how Western theatre is not simply a privileged space for human society to reflect on itself, as is often claimed, but a nonhuman medium, a decidedly mineralized practice – the very thing that so troubled Plato and that has caused Western philosophy to remain so suspicious of the stage. Reading Western theatre as geology, moreover, permits a theory of eco-performance criticism appropriate to/for the Anthropocene. Whereas accepted models of eco-theatre tend to run into dangerous contradiction, practically and theoretically, by divorcing themselves from theatre's larger ecology and history, this chapter discloses, by contrast, the extent to which the theatrical medium is always *already* ecological by dint of its occluded mineralogy. In Chapter 5, 'The Play at the End of the World: Deke Weaver's *Unreliable Bestiary* and the Theatre of Extinction', Una Chaudhuri and Joshua Williams situate the American artist Deke Weaver's long-term project *The Unreliable Bestiary* within the ecological politics of the Anthropocene. Weaver aims to create a performance for every letter of the English alphabet, with each letter representing an endangered species or threatened habitat. The performances he has made to date – Monkey (2009), Elephant (2010), Wolf (2013), Bear (2016–17), and Tiger (2019) – address the looming threat of the sixth great extinction by pairing the most fantastic flights of the animalized imagination with the most astonishing facts

discovered by animal science. Reactivating and reconfiguring the medieval bestiary in this way allows Weaver to braid together an epistemology derived from the 'squishy science' of performance with an affect he calls 'plain old wonder', producing a new theatrical grammar for being in and with extinction and a new ethical framework for encountering our remaining animal others.

The book then turns to medical science and practice with a triad of chapters on, respectively, the medicalized body in performance, the concept of contagion on stage, and the staging of mental health conditions and their diagnosis. In Chapter 6, 'Bodies of Knowledge: Theatre and Medical Science', Stanton B. Garner, Jr., discusses how, as scientific medicine gained ascendancy in the nineteenth and twentieth centuries, theatre became an important site for the examination of scientific medicine's aspirations, achievements, limitations, and dangers. Early twentieth-century plays celebrated the pioneers of modern disease research and their accomplishments, while later twentieth- and early twenty-first century plays display a growing critique of scientific medicine and its conception of the body as an object of medical knowledge. David Feldshuh's *Miss Evers' Boys* considers the human and ethical stakes of the infamous Tuskegee syphilis study, and Susan-Lori Parks's *Venus* addresses the historical objectification of anomalous bodies. Margaret Edson's *Wit*, given extensive discussion here, explores the conflict between scientism and subjectivity in the context of the modern research hospital. The medium of theatre is central to these dramatic critiques; medical science may formulate the human body as an object of knowledge, but theatre's bodies look back in the midst of their display. Next, in Chapter 7, 'Pathogenic Performativity: Urban Contagion and Fascist Affect', Fintan Walsh looks at two recent performances, Arinzé Kene's *Misty* (2018) and Neil Bartlett's *The Plague* (2017), which depict cities under siege. Contagions, figurative and literal, spread among residents, destroying lives and tearing the fabric of the urban environment. In both productions the city is at war with itself, via the circulation of disease that passes between infrastructure and people. Focusing on these plays and their productions, this chapter explores how ideas of contagion are deployed to capture a sense of intangible danger spreading throughout the city, especially London, and how this formulation finds impetus in contemporary discourse that mobilizes the risk of economic, cultural, and political contagion as part of a divisive rhetoric. The chapter also considers how we might understand these forms of representation and discourse in light of the prevalence of 'pathogenic performativity', in which the language and phantasmagoria of contagion are deployed as tactics of governance, with theatre enabling its exposure or perpetuation. Finally, in Chapter 8, 'Theatres of Mental

Health', Jon Venn analyzes the legacy and influence of the diagnostic gaze in contemporary British theatre, examining how theatre can offer a site to negotiate the complex dynamic between psychiatric institutions and the experiences of patients. Contemporary psychiatry has overseen a vast expansion in the categorization of mental illness. Mental disorders can be identified and ascribed to individual patients in an act of diagnosis that signals mental illness as a 'performative malady'. Alongside reflecting shifts in the etiology of mental disorder (increasingly focused upon a biomedical model), the speech-act of diagnosis has implications for the legal status and care of the patient. Analyzing works such as Joe Penhall's *Some Voices* and Lucy Prebble's *The Effect*, this chapter suggests how theatre can offer a reimagination of diagnosis by situating and troubling the role of the psychiatric user.

The next two chapters recognize the extraordinary diversity and range of types of performances that engage with science and challenge the dominance of the mainstream 'science play'. In Chapter 9, 'Devised Theatre and the Performance of Science', Mike Vanden Heuvel notes that as science has become more interdisciplinary and recognized as a form of contingent knowledge circulated across cultural fields, devising has emerged as a suitable method for creating performances with scientific content and themes. By virtue of its multivocality (involving a number of authors), its multimodal forms of storytelling and address (through language, dance, physicalization, digital media, installation and site-specific environments, and the like), and its presentational modes, devised performance can often render scientific ideas performative, capturing not just what they 'are' but what they 'do' and how they disseminate in the public understanding. Across scientific fields that are increasingly interrelated, devised performance provides new ways to move beyond merely conveying scientific ideas, choosing instead to invite spectators actively to map domains of knowledge and construct ideas that are constantly in transit. One of the most significant areas of interaction between theatre and science is in the application of specific social problems, and in Chapter 10, 'Theatre and Science as Social Intervention', Michael Carklin covers a broad range of practices, from science public engagement events to collaborations between artists and scientists, theatre for young people, drama education initiatives, and global activism projects. He examines several case studies: first, examples of exhibitions, lectures, and demonstrations focusing on Michael Faraday and the Royal Institution Christmas Lectures, and also on public autopsy demonstrations; second, arts–science collaborations, known as 'sci-art', with reference particularly to the work of Y Touring; and third, theatre and activism in relation to climate change, as exemplified by the Climate Change Theatre Action project. His discussion is

framed within his own experience as a practitioner working at the boundaries of theatre and science.

Performance and cognition, another key development in the field of theatre and science, is explored in the next pair of chapters. In Chapter 11, 'Acting and Science', Rhonda Blair surveys intersections between views of acting and paradigms of science, and addresses views of the human. The chapter begins with a brief historical overview, starting with Plato and Aristotle and proceeding to early twentieth-century scientists such as Pavlov and Freud. The focus is on late twentieth- and early twenty-first-century cognitive sciences and neuroscience, which provide the actor with concrete, material information about how body and brain work. This helps to eliminate misapprehensions about how different aspects of the self operate and offers insight into imagination, intellect, emotion, memory, and language, among other aspects of our experience. The discussion addresses the fact of actors as complex processes, inextricably connected to each other and their environments, and how the actor might utilize the findings of science. In Chapter 12, 'Staging Cognition: How Performance Shows Us How We Think', Amy Cook shows how theatre operates as a kind of cognitive prosthetic, helping us stage and imagine what we are not yet able to see around us or within us. Committed to embodied and extended theories of cognition, the chapter examines the relationship between the stories told onstage across the centuries and the shifting conceptions of the self and the other. Through a kind of wormhole between *King Lear*, the pageant wagon of the medieval period, and the off-off-Broadway theatre of today, the chapter connects the theatrical innovations around personation, or the taking-on of a character, in these different periods to argue that the theatrical conventions that set up the relationship between character and actor display a changing notion of the self. This shifting of theatrical conventions generates discomfort at first, as spectators learn to consume stories in a new way; and the discomfort unveils what we need to learn next.

The role of technology has received relatively little attention by scholars of theatre and science, who have tended to privilege scientific ideas and subject matter (as well as scientists themselves), following a pattern established by the broader field of 'literature and science'. The oversight is surprising, given the many and varied ways, both contemporary and historical, in which theatre and technology are intertwined, especially the central role technology has played in shaping playwriting norms and audience responses alike. Another way of putting this is that technology usually comes first; thus, electricity gave us modern playwriting, and Ibsen, Chekhov, O'Neill, Glaspell, and everyone else who followed are unimaginable without it. The final pair of chapters in this book explores technology and theatre through

transhistorical examples of scenography. In Chapter 13, 'Clouds and Meteors: Recreating Wonder on the Early Modern Stage', Frédérique Aït-Touati traces the *theatrum mundi* (theatre as world) metaphor back to its technical and philosophical roots. By comparing iconographic sources from scientific texts with scenographic ones, the chapter follows the evolution of the notions of machine and wonder in the seventeenth century and argues that the material culture of theatre played an important role in the development of Cartesian physics and the new cosmology, and in particular in the mechanization of the world picture. The chapter focuses on the relationship between Fontenelle, Descartes, and the engineer and architect Giacomo Torelli, whose scenography gained him the name of 'the great sorcerer'. Paradoxically, it is by taking up Torelli's design, combined with Descartes's new definition of meteors, that Fontenelle manages to define a new type of 'wonder', scientific and no longer magical. In Chapter 14, '"The Stage Hand's Lament": Scenography, Technology, and Off-Stage Labour', I explore advances in stage technology from the nineteenth and twentieth centuries that profoundly shaped and influenced both theatrical performance and playwriting, particularly in the domain of stage lighting. Opening with the mid-twentieth-century example of Josef Svoboda, the chapter then goes back to the invention of limelight and its behind-the-scenes manipulation, which leads into a consideration of other kinds of technologically oriented off-stage labour. The discussion then turns to theatrical patents of the late nineteenth century, building on recent scholarship on backstage labour with a view to considering how scientific, technological, and theatrical work merge and often share this status of invisibility. The conclusion proposes a model for approaching and teaching theatre history based on a greater recognition of the role of technology, especially in our understanding of 'science on stage'.

There are some stimulating debates inherent in the way the chapters speak to each other, debates that I hope readers will pursue further. For example, Cook's 'swarm logic' and Goodall's 'force-field' are directly at odds, at least at first glance – and both raise profound questions about how humans will survive in the future. Walsh's focus on two plays that rely on spoken description rather than theatrical depiction sits in direct contrast to Goodall's selection of plays that do the opposite and show rather than tell. Blair's account of the history of cognition complements Garner's history of medicine in intriguing ways that, together, give startling insights into the evolution of our understanding of how the mind and body work. Aït-Touati and I come to very different conclusions about the relationship between stage technology and wonder. To some extent, both of these final chapters are concerned with science and technology in the service of wonder, and with