

Consciousness, Theatre,
Literature and the Arts 2013

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Edited by

Daniel Meyer-Dinkgräfe

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P U B L I S H I N G

Consciousness, Theatre, Literature and the Arts 2013,
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INTRODUCTION

The book collects essays based on papers presented at the 5th International Conference on Consciousness, Theatre, Literature and the Arts (CTLA), held from June 15-17, 2013, at the University of Lincoln, UK, hosted by the Lincoln School of Performing Arts. The conference was attended by thirty-five delegates from twelve countries across the world—the eighteen essays in this book come from delegates from eight of those countries. The range of essays in the book reflects the range of material presented and discussed at the conference, across the fields or disciplines of philosophy, literature, fine arts, music, dance, performance and theatre.

The keynote presentation from academic and theatre artist **Andy Jordan** opens this collection with his analysis of science in theatre, with special emphasis on his work with eminent scientist Carl Djerassi who has written a number of plays about science all produced by Jordan. **Philip Shepherd** follows with a brief account of the material informing his workshop practice. **Alla Sosnovskaya** considers the impact of costume in plays by Ibsen, and **Susie Hennessy** offers an original take on Beckett from the perspective of philosophy. **Sanjay Kumar** moves into the area of applied theatre, with an account of his company's activities with "platform children", runaway boys aged from seven to fifteen who live on trains and platforms. **Keneth Bamaturaki** discusses the use of Theatre for Development in Uganda.

From theatre the chapters move on to literature. **Pavel Gavrilov** engages with the broad scope of contexts for the depiction of sacred space in literature. **Tamar Mebuke's** angle is similarly wide in her discussion of aspects of intentionality. **Rosy Saikia's** focus is on the creative process in Rainer Maria Rilke's poetry. **Krishna Barua** considers the *deep ecology* dimension of the ecological movement with reference to Indian novelist Raja Rao's *The Serpent and the Rope*, and 2000 Nobel laureate Gao Xingjian's *Soul Mountain*.

The next three chapters cover architecture (**Christopher R. Wood** on how to interpret architectural works of art), film (**Martin Julien** on the use and impact of silence in Abbas Kiarostami's *A Taste of Cherry*), and drawing (**Joe Graham** discusses the concept of seeing in relation to the practices of drawing and phenomenological reduction). In her chapter

based on her keynote lecture at the conference, **Nicole Panizza** explores her encounter, as a professional vocal accompanist and coach, with a range of songs based on poems by Emily Dickinson. In the footnotes to this chapter is a link to a website—the website provides further links to video clips that further illustrate Panizza’s argument. **Pema Clark** provides the text and the context of a live, music-based installation she presented at the conference. **Jekaterina Haritonenko** combines music and literature in her chapter on musicalized fiction in the 21st century. The final two chapters of this book bring us back to performance with their emphasis on dance. **Karla Shacklock** develops further the reflexive narrative about her choreographies begun at the 2011 4th *International Conference on Consciousness, Theatre, Literature and the Arts*¹, and **Jane Carr** considers the ways in which the relationship between dancer, choreographer and audience is best conceptualised as embodied.

Note

¹ Shacklock, Karla. 2012. Going Beyond into the Jar of Consciousness: A Proposal for New Practice. In *Consciousness, Theatre, Literature and the Arts 2011*, ed. Daniel Meyer-Dinkgräfe, 139-152. Newcastle: Cambridge Scholars Publishing.

CHAPTER ONE

SCIENCE-IN-THEATRE: A SIGNIFICANT NEW GENRE?

ANDY JORDAN

“Science is arguably the defining feature of our age; it characterises Western civilization. Science has never been more successful nor its impact on our lives greater, yet the ideas of science are alien to most people’s thoughts”.

(Lewis Wolpert, quoted in Zehelein 2009: 103)

In this chapter I will pose two questions: is Science-in-Theatre indeed a new genre which goes beyond other genres or styles previously in existence and secondly, if so, how important to the theatrical canon is this new type of writing?¹

The chapter will seek to provide an analytical understanding of the different terminologies of “Science Plays” and “Science-in-Theatre”, and the relationship between them. It will demonstrate not merely that Science-in-Theatre is a new genre, but will show how this concept – Science-in-Theatre – has developed beyond the type of text-based theatre (for which the man who devised the term is known) and been taken up by a new, progressive generation of theatre and performance makers as its significance grows. Finally, the chapter will focus on the work of Professor Carl Djerassi, the world-renowned chemical scientist-turned playwright, through a critical examination of his science-in-theatre plays from the last 14 years.

In my discussion I am going to make use of three key terms. They are **science-in-theatre**, a phrase coined by Carl Djerassi in the late 1990s, **Science Plays**, a term used by the two leading science, theatre and performance scholars, Kirsten Shepherd-Barr (in her book *Science on Stage: From Doctor Faustus to Copenhagen*) and Eva-Sabine Zehelein (in her book *Science: Dramatic: Science Plays in America and Great Britain, 1990–2007*), and **Science Performance**, a classification used by

Shepherd-Barr to encompass a type of work frequently called contemporary performance (or just performance, which is most often devised or “made” productions using cross and multi-disciplinary approaches). Of necessity, I shall also, on occasion, refer to other descriptive terms such as science, theatre and performance and science-engaged plays/performance, both being grab-all labels of my own which simply describe the entire area of work.

In the past few decades, science seems to have captured the imagination of all sorts of people, nationally and internationally. Evidence for this can be found in the extraordinary success and popularity of books about science (fiction, graphic novels, and non-fiction), TV drama serials, Hollywood movies, scientists-turned-comedians, rock-stars-turned-scientists, science entertainment and science education, and more and more primetime programmes on television and radio about science, reaching surprising levels of ratings success. Britain has always, of course, been “a science nation” with a “long and glorious scientific heritage” (Ahuja 2013: 16, 19). But science has undoubtedly broadened its appeal beyond the laboratory and academia. The continuing popularisation of science, and the fascination of ordinary people in science and its seemingly inexhaustible ability to transform our world, as a social and cultural phenomenon, is the broader context for the discussion in this chapter. What all this demonstrates is a level of engagement with science and scientists amongst both artists and the community which is about wanting to share and understand both common interests and the kind of potentialities and challenges with which all human beings are confronted².

As in wider society, the performing arts are embracing science as never before. Science-engaged theatre and performance has been achieving considerable critical acclaim and popular success, particularly in the past two decades. Plays, opera, music theatre pieces and contemporary performance productions exploring scientific themes have become international sensations, playing in London at renowned theatres of all types, including the National Theatre, Almeida, Royal Court, Barbican, and on the West End stage, and on New York’s Broadway, as well as being turned into feature films and toured extensively round the globe. These include Philip Glass and Robert Wilson’s seminal opera *Einstein on the Beach* (1976/1984/2012, officially part of the Cultural Olympiad in the UK), Philip Glass and Mary Zimmerman’s chamber opera *Galileo Galilei* (2002), Tom Stoppard’s international smash hit *Arcadia* (1993, chaos theory and landscape gardening), Steve Reich and Beryl Korot’s *Three Tales* (2002, technology and Faust), David Auburn’s Broadway and West End mathematics hit *Proof* (2000, made into a Hollywood film), Michael

Frayn's *Copenhagen* (also a Broadway and West End hit, and made into a Hollywood film), Peter Parnell's *QED* (2001, about physicist Richard Feynman), *Dr Atomic* (2005), John Adams and Peter Sellars' opera, *Los Alamos and The Bomb*, Complicite's *A Disappearing Number* (2007 – 2010, toured internationally and beamed into cinemas worldwide), and Danny Boyle and Nick Dear's recent National Theatre production of *Frankenstein* (2012, also beamed into cinemas around the world).

Often hailed as a vanguard cultural development, science-engaged performance nevertheless enjoys rich historical traditions as well as a contemporary diversity of manifestation that defies tidy labelling. Although a comprehensive synoptic and contextual overview of the science-performance phenomenon is lacking, some features, such as cross-disciplinary collaborations between scientists and theatre / performance artists, have generated considerable scholarly and media attention. Given the number of and at times high-volume claims declared about the artistic and cultural significance of the growing science-performance relationship, it is hardly surprising that debate has arisen about the nature and importance of such work.

What is not in dispute is that such plays about science are nothing new. The first known "Science Play" was Aristophanes' comedy *Clouds*, written in Athens in 423BCE. Ironically, for the first known play to tackle the subject, its treatment of science is far from respectful. In fact it satirises what we would now call science and research scientists, describing them as "rank pedants, those pale-faced, barefoot vagabonds in the academy". So since the Greeks there have been plays written by canonical writers about science and scientists, and whilst there are only seven extant plays written between 423BCE and the late 19th century the interest in the subject has proven enduring³.

In 2006, Shepherd-Barr listed 122 science plays, a survey which, for her, did not begin with Aristophanes' comedy but with Marlowe's *Doctor Faustus* in 1604, in which a scientist strikes a bargain with the devil and meets a horrible end because of his lust for knowledge⁴.

Other examples of influential science plays are Jonson's *The Alchemist* (1610), Ibsen's *An Enemy of the People* (1882, revived at the Young Vic in 2012/3, politics trumps science) and Shaw's *The Doctor's Dilemma* (1906, revived at the National Theatre in 2012, about doctorly quackery and bio-chemistry). Subsequently, rapid developments in science and technology led to the production of many more science-engaged plays. By the middle of the 20th century there was a clearly discernible and growing interest in playwriting and theatre-making about science, perhaps encouraged by Brecht's *Life of Galileo* (1939/1945), which gathered pace

during the 1960s and 1970s. The following decade an ever greater number of science plays were produced and the 1990s witnessed yet another increase described by some commentators as an “explosion”, “surge” and a sudden “wave” of science-informed plays and performance (Shepherd-Barr, 2006: 1). Nor has this engagement slowed down. Since the turn of the 21st century, there has been a noticeable burgeoning in the variety, scope, originality and authenticity of science-based plays and performance, a movement which owes a good deal to the work of Carl Djerassi.

Djerassi is Emeritus Professor of Chemistry at Stanford University, where formerly he was also Professor of Human Biology and Feminist Studies. He is best known for the synthesis of the Contraceptive Pill, which triggered the social revolution of the 1960’s (for which he was one of a handful of American scientists to be awarded the National Medal of Science), and for many other important scientific breakthroughs such as developing anti-histamines (he is one of the few American chemists to have been awarded the National Medal of Technology for promoting new approaches to insect control). As Peter Barkham said in *The Guardian* Djerassi is a “remarkably vigorous polymath who fled Nazi Germany for America, and has shaped the modern world his life spans”. (2006). During the past twenty-four years, Djerassi has turned from active involvement in scientific invention to active involvement in the world of fiction and the theatre and, though he is now 89 years old, he remains remarkably energetic, even in the face of cancer, with which he is currently battling: this year alone his third volume of autobiography is published, plus a volume of three of his plays; his lecture schedule takes him around the world and he is currently working on revisions to his next play, *Foreplay*, which will be presented in London in April 2014, after an initial performance at The Lincoln Performing Arts Centre (LPAC).

Prior to the 1960s, plays/performance that in some way or other engaged with science were rarely granted the accolade of being called a “genre”. Between then and the 1990s, the term “Science Plays” was more frequently used, and as a definition it started to be contested, an argument which will be investigated in this chapter. Science Plays, as a term, has in the past also embraced other types of performance such as opera, musical theatre, dance theatre and contemporary performance. Science Plays as a genre therefore embraces all sorts and types of play or performance that in some way touches on science as a subject, theme or adornment.

However, Carl Djerassi’s Science-in-Theatre plays are different from the kinds of Science Play that had gone before. His concept of a science-in-theatre play was based on a far narrower, more focussed and precise definition of the Science Play genre, in which “science and scientists are

central and the facts impeccably correct". (Djerassi 2001: 3). Djerassi, as a scientist, was perhaps understandably keen to investigate ways in which the science in a "Science Play" might be both more authentically presented and used as a mechanism with which to engage the audience with scientific and ethical issues that he regards as being of fundamental importance to society and humanity. As a chemist-turned-playwright, Djerassi wants to engage with a wider, non-scientific, non-academic audience. This has been always one of the ambitions for his plays (and, incidentally, also my ambition as the producer-director of his plays). He describes himself as an *agent provocateur*⁵.

It was in the 1980s when Djerassi first became troubled by what he felt was a widening gulf between the sciences and the other cultural worlds of the humanities and social sciences, and that scientists themselves spent preciously little time in attempting to communicate with these other cultures. Many critics then – and still today – opined that theatre and science were fundamentally incompatible and that when the two disciplines came together the result was often bad plays⁶.

This particular debate was of course set alight by C. P. Snow's famous Rede Lecture in 1959, *Two Cultures*, a "conversation" that continues to this day, being brought into repeated focus by plays and performance about science. Indeed, many commentators now argue that recent science plays and performance "defy C. P. Snow's pessimistic forecast of a widening rift between the two cultures and instead encourage each culture to learn about the other..." (Shepherd-Barr 2006: 218) But here, in the 1980s, was a world-renowned scientist still echoing C. P. Snow's observations made in 1959.

So Djerassi decided to do something about illuminating the scientist's culture for a broader audience, and to do it through a quintet of novels. In doing so he also offered a definition of the type of writing he was then engaged in. He said:

And so I call the literary genre in which I work 'science-in-fiction'. It was important to me to differentiate what I do as clearly as possible from *science fiction*. For me, the most important difference is that in science-in-fiction all the science or idiosyncratic behaviour of scientists described in it is plausible... But if one actually wants to use fiction to smuggle scientific facts into the consciousness of a scientifically illiterate public – and I do think that such smuggling is intellectually and societally beneficial – then it is crucial that the facts behind that science be described accurately. Otherwise, how will the scientifically uninformed reader distinguish between what science is presented for entertainment and what is informative? (Djerassi 2001: 165).

After Djerassi began to write his science novels – all still in print always he began to think about playwrighting, and in the mid-1990s set about writing a trilogy of what he called Science-in-Theatre plays. In seeking to define *science-in-theatre* Djerassi said,

By this label I refer to plays in which science or scientists do not just fulfil a metaphoric function....In my plays, what I call the ‘tribal practices’ of scientists constitute the central focus of the drama, as, for instance, in Michael Frayn’s *Copenhagen*. (Djerassi, unpublished).

By inventing the term science-in-theatre, Djerassi was implicitly criticising many plays which claim some kind of spurious scientific credibility but which, as Djerassi said, simply have “*some* scientific content” (Djerassi 2007). Djerassi does, however, acknowledge

There are canonical plays – admittedly few, but important ones, and written by famous playwrights – that *have some scientific themes* (my italics), yet I would not categorise them as “science-in-theatre” but rather as plays with *some* scientific content. Four examples should suffice: Brecht’s *Life of Galileo*, Dürrenmatt’s *The Physicists* and Stoppard’s *Hapgood* and *Arcadia* ...a superb play and an interesting transition between “science-in-theatre” and a play simply containing *some science*. (my italics) (Djerassi 2007),

This underlines Djerassi’s own idea of what a “core” science-in-theatre play should look like.

From when he first began to write and talk about Science-in-Theatre in the 1990s, and until recently, Djerassi has called Science-in-Theatre “a rare genre” because, he argued, there were so few *genuine* science-in-theatre plays. In a recent book preface he said:

Let me start with two questions: Why is there such a paucity of plays dealing with the world of science? And does it matter? My affirmative answer to the second question is based on the fact that I am a playwright who has lived in the world of science for half a century and who feels strongly that on the stage scientists should not be depicted mostly as the proverbial nerds or Frankensteins. Science plays such a crucial role in the world that it is important that the general public understands the idiosyncratic behavior of its practitioners. Illustrating it through plays – in other words through real “case histories” – is an effective way of accomplishing such an aim. (Djerassi, 2012b)

What is interesting is that Djerassi only concentrates on *theatre plays* (as distinct from *performance*), something which may have prevented him

from noticing that his own concept of science-in-theatre has had a profound impact on types of performance other than theatre plays. Moreover, even though Djerassi makes the intentions behind his concept of science-in-theatre clear, there is a sense in which his intentions are irrelevant. In espousing the theory behind science-in-theatre, Djerassi believed he had gone beyond the established boundaries and created – or at least *identified* – a new genre. But his conviction about this is immaterial as it is not in the gift of a playwright to determine whether he/she has created a new genre. It is up to others to do this, people who, in this regard, have power and authority, namely critics and scholars.

Eva-Sabine Zehelein offers a useful summary of Djerassi's description of what Science-in-Theatre play is, and in so doing acknowledges it as a genre (or *sub-genre*):

Djerassi has provided a very useful label, 'science-in-theater', which comprises four constitutive elements: first, accurate description and representation of the scientific idea or theme, second, realistic depiction of the tribal culture of the scientists, third, a plot which is firmly rooted in the scientific topics and/or context, and finally, a didactic element. (Zehelein 2008)

Undeniably, Djerassi has come up with a highly pertinent distinction between what Zehelein and Kirsten Shepherd-Barr both call “Science Plays” (though they disagreed about the definition of this term) with his definition of plays “where the science and scientists are central and the facts impeccably correct” (Djerassi 2002: 3), which he also describes as “pure science-in-theater *where the play could not exist without the science*” (author's italics, Djerassi 2007). Djerassi's claim that there is a type of play that should more precisely be called science-in-theatre is a persuasive one.

Yet what of the connection between the established Science Play and the new kid on the block? Zehelein argues that Djerassi's science-in-theatre is an offshoot of a larger genre, the Science Play. Zehelein writes about the whole minefield of contested taxonomical attempts to define what Science Plays are, the disputes over the superiority of one dramatic form over another, and what constitutes a “good” Science Play, and concludes by saying “Science Plays seems to be a less confusing brand name for the entire genre”. (Zehelein 2009: 87) Importantly, she then qualifies the use of the phrase “science play” by saying that it is a “A Rainbow-Colored Umbrella Term”. Zehelein believes that most science plays are however a “heterogeneous group where both form and function vary decisively” (2008). It is also useful to note that Zehelein's concept of

the Science Play is based only on modern plays, from 1990 onwards, which distinguishes her analysis from that of Shepherd-Barr, whose study of Science Plays spans the period 1610 – 2006.

It is here vital to note that for Zehelein, Djerassi's Science-in-Theatre is *a type* of Science Play, which sits within the larger Science Play genre. As Zehelein says later, within the umbrella term "science plays", there is a myriad of different types of plays, ranging from science-in-theatre plays where the science is central, to biographical plays about individual scientists, to plays and performance about the impact of science on society, or ethical and moral questions raised by scientific inventions, or in which science features merely thematically or which uses science (often brilliantly) in a purely metaphorical way as, for instance, in Brecht's *Life of Galileo* (1939/ 1945), Churchill's *A Number* (2002) and Stoppard's *Arcadia* (1993).

Zehelein offers her own definition of Science Plays, and in so doing raises related, but problematic, issues:

The single characteristic which binds all Science Plays together is their use of realistic or real science, in clear contrast to science fiction...it is of central importance to stress that Science Plays are text theater and not director's theater. They rely on the spoken word on stage, on dramatic dialogue, and not primarily on the bodily performance in order to convey meaning. (2008).

With this observation, Zehelein implicitly acknowledges the impact of Djerassi's Science-in-Theatre plays.

When it comes to defining the phenomenon of Science Plays, Zehelein clearly prefers traditional dramatic forms, which she implicitly links with Djerassi's writing (her thematic and textual reading of his plays is acute and revealing). It is true that a great many science plays appear, at least at first glance, to be text-based, a feature that Zehelein suggests is in fact a defining characteristic of their being "science plays", and it is undeniably true that there is a substantial body of powerful and influential text-based science plays. However, in my experience many of these text-based plays also seek to synthesise textuality and theatricality, including Frayn's *Copenhagen* (1998) and some of Djerassi's own plays, e.g., *Oxygen* (2001). Zehelein correctly goes on to say,

(in many) science plays...it is the text itself, and not the performance, which reveals the differences between science and / or scientists and their respective (metaphorical) functions (...) plays which take up socio-culturally or socio-politically relevant topics and wish to foster public discourse, revert to classic formats and put the text at center, since these

formats are much more accessible for a theater audience (...) Science plays are, indeed, in many cases a means of communication more than an artistic medium for its own sake... (Zehelein 2009: 80)

This is very true of Djerassi's plays, at least from the perspective of the writer, and is probably part of their appeal to certain audiences. However, from my professional perspective as director-dramaturg in production and performance the play *ought to take on another life*; as Zehelein says, "(the) dramatic text, of course, develops its own dynamics once it is turned into a theatrical production, and both, text and production, are cultural artifacts in their own right" (Zehelein 2009: 81). Significantly, Zehelein made these remarks in 2009, but the historical, intellectual and cultural scope of her book stopped in 2007, since when the growth and creative complexity of both science plays and science performance have increased markedly, to the point where there are far more devised and cross-disciplinary productions dealing with science than there are conventional (text-based) plays being presented, at least in the UK, so perhaps the time has come to re-think our understanding of what a Science Play might be?

Kirsten Shepherd-Barr's contribution to the study of science and theatre is most considerable. Shepherd-Barr's *Science on Stage* (2006), was the first full-length study of science and theatre. In it she also uses the term "Science Plays", saying her book "recognises this dramatic genre, and does so from the perspective of drama and theatre, with an emphasis on performance" (2006: 3). Shepherd-Barr also offers a definition of Science Plays, which connects in some ways with Djerassi and Zehelein's definitions but differs in one crucial respect:

For my purposes, they [the science plays] will be shown to share certain critical features: a casting of the scientist as hero or villain (or sometimes both), a direct engagement with "real" scientific ideas, a complex ethical discussion, and an interdependence of form and content that often relies on performance to convey the science." (2006: 90)

For Djerassi, the last few words of Shepherd-Barr's definition, "an interdependence of form and content that often relies on performance to convey the science", caused consternation because it suggested that "good" Science Plays were reliant on the performative elements for their impact, rather than text. Djerassi interpreted this as an affront to him personally. (However, from my own perspective as director-producer-dramaturg on his plays, I could interpret these matters differently, as my later reflections will demonstrate).

Like Djerassi, Shepherd-Barr uses the terms “core” and “pure” in relation to certain science plays. But for Shepherd-Barr a “core” science play has to merge form and content. This is not considered important by Djerassi in his definition of a “core” or “pure” science-in-theatre play. For her only plays which “literally *enact* the idea that they engage” are “core science plays...” (Shepherd-Barr 2006: 6). She goes on to wonder whether “the new wave of science playwriting in the 1990s and beyond moves toward a formal and structural integration of the science” and said that it “is not the quantity of the science in a science play that matters, but the quality of its integration: the way in which it figures both thematically and theatrically” (2006: 81), an incisive observation, but one to which Djerassi took exception because it seemed, at least in part, to be contradicting his original conception of science-in-theatre (and because it hinted at questions about what constitutes a “good” science play).

Shepherd-Barr went on to suggest that “Plays about science tend to be quintessentially postmodern in their interest...their conscious theatricality keeps the audience aware of the connection between the form of the play and its content...” (2006: 94). She notes that with many science plays, particularly ones that do not depend on text, the liveness, immediacy and shared experience seem to support the marrying of science and theatre. This observation that the combination of postmodernist theatricality or performance approaches, merged with science as a theme or subject, often results in bold or innovative work – as we shall see shortly – is borne out by the growing volume of fascinating cross-disciplinary productions being made, examples of which will shortly be provided.

Shepherd-Barr turns her attention to the science-engaged performance work that started to arrive on the scene from the mid to late 1990s, which she describes as “alternative science plays” (2006: 199) and “science-performance” (2006: 217). Shepherd-Barr discusses the way in which these types of science play skip “the translation of the ideas altogether” and go “straight to an unmediated use of science on stage. This can be achieved only by radically challenging the conventional way of doing theatre” (2006: 205), another astute observation. Shepherd-Barr goes on to discuss the way in which the director’s role in this type of theatre / performance becomes more central than in mainstream theatre, representing a shift away from author to director, text to performance, a comment directly refuted by Zehelein. What Shepherd-Barr is alluding to is a different type of collaborative work, one where the emphasis is on the ensemble and the conceptual, a type of performance where the director is more often regarded as another “author”, for example, as with Simon McBurney and Complicite’s devised performance, *A Disappearing Number*.

Djerassi approved of Zehelein's definition of science plays. It corresponded closely to his own conception of science-in-theatre. However, he expressed a number of concerns regarding Shepherd-Barr's analysis of science plays, namely that she linked postmodernist performance to the genre, and in so doing over-emphasised its significance, that her definition was too loose and did not emphasise the plausible and accurate scientific content enough, and that she made too much of how many science plays have been written.

Djerassi, whilst acknowledging that Science Plays have been written since Jacobean times, pointed out that according to Shepherd-Barr's own list there were just seven written between 1604 and 1906. In developing her argument about the significance of how many science plays have been written, Shepherd-Barr goes on to say (rightly) that since the premiere of Frayn's *Copenhagen* in 1998 there was a sudden increase in the amount of science plays written, a total of 62 plays / performances, but Djerassi challenges the significance of this numerological approach by stating that many of these plays were neither "performed nor published, and the majority of the rest were workshop readings or single minor venue staging's" (Djerassi 2012, viii) and therefore of limited value and importance. Djerassi goes on to suggest that many of the plays on Shepherd-Barr's list are barely what one might even call a science play, and questions whether there was really an "explosion" (to use Shepherd-Barr's word) of science plays by asking whether it was "just a momentary puff or an event with lasting consequences?" (Djerassi 2007).

In essence, in 2006, Djerassi was criticising Shepherd-Barr for exaggerating the significance of the growth of science-engaged plays and performance. However, Shepherd-Barr got it right: she was correct to pay serious attention to the developments in science-inspired performance happening in Europe and the UK as this type of work has produced what could be described as a proliferation of performance that corresponds closely – or even *exactly* – to Djerassi's own definition of science-in-theatre, a factor that Djerassi hadn't either noticed or paid any attention to. Furthermore, rapid developments in the past seven years have shown that the "event" was far more than "a momentary puff", and has indeed grown into a genuine artistic / cultural movement which has – somewhat ironically – adopted Djerassi's own science-in-theatre approaches.

What for Djerassi was once a "new" and "rare" genre (due to the fact there were so few "serious" science-in-theatre plays) has now evolved dramatically to the point where science-in-theatre is not at all rare, in fact it is at the heart of most of the science-engaged theatre / performance work currently being produced. Fascinatingly, what has happened is that

Djerassi's idea of science-in-theatre has come together with the theatrical and performance developments Shepherd-Barr identified in 2006 so as to create a new synthesis. In this regard, science-in-theatre has proven itself of genuine and perhaps even visionary significance, as the message at the centre of Djerassi's concept of what science-in-theatre could be has informed and guided (perhaps unwittingly) a body of innovative theatre and performance which has indeed made a significant contribution to the theatrical canon.

It should also be noted that Djerassi's plays have themselves gained substantial international acclaim and recognition, having been translated into 20 languages and published and performed all over the world, broadcast on radio across Europe and North America, presented Off-Broadway in New York, and in National Theatres, touring productions and at University Theatres around the globe. Djerassi's next play, *Foreplay*, uniquely, has been published in three languages before it has even been produced in a theatre.

Yet even before Djerassi defined and articulated his idea of what Science-in-Theatre was, Science-in-Theatre plays already existed. For the benefit of the reader, there follows a brief, but vital list of critically acclaimed *core* science-in-theatre plays, and performance work, starting with a very early science-in-theatre play, and a masterpiece of its kind, Heinar Kipphardt's powerful *In The Matter of J. Robert Oppenheimer* (1964, a verbatim play based on the secret hearings against Oppenheimer in 1954). Hugh Whitemore's deeply touching *Breaking the Code* (about Alan Turing and Enigma) made a huge impact in 1986, starring Sir Derek Jacobi. At the start of the 1990s, both Maureen Hunter's Canadian play *Transit of Venus* (1992, about historical astronomy) and Frenchman Jean-Norman Fenwick's *Palmes de M. Shutz* (1992, about the Curies) attracted great international success. Produced in 20 countries, the play ran for many years in Paris and was made into a very successful French film. Then, in the mid-1990s, at the National Theatre, Stephen Poliakoff's *Blinded by the Sun* (1996, "cold fusion", media, science as popular culture and modern scientific research) and Michael Frayn's *Copenhagen* (1998, quantum mechanics, the uncertainty principle, Heisenberg and Bohr) came along, both of which are now regarded as being amongst the highpoints of the science-in-theatre genre. Simon McBurney and Complicite's *Mnemonic* (1999, memory, connection and evolution) and *A Disappearing Number* (2002 – 2005, inspired by the collaboration during the 1910s between two of the most remarkable pure mathematicians of the 20th century, Srinivasa Ramanujan, a poor Brahmin from South India, and the Cambridge University don G.H. Hardy) are both extraordinary examples of science-

in-theatre and science performance, and showed what the creative possibilities were with science-engaged performance.

This particular taxonomic list concludes with two very recent and excellent additions to the science-in-theatre category. Lucy Prebble's *The Effect* (National Theatre, 2012, created with the help of psychiatrist and neurologist Dr Gareth Smith, and about sanity, neurology and the limits of medicine) and Katie Mitchell and Stephen Emmott's *Ten Billion* (2013, Royal Court Theatre) both put science-based performance high up the agenda of two of the world's most prestigious theatres (Emmott is Microsoft Professor of computational research at Oxford, and *Ten Billion* was a "dramatised lecture" based on Emmott's book of the same name). Finally, mention should also be made of some of Djerassi's own plays, *An Immaculate Misconception* (1998), *Oxygen* (2001), *Calculus* (2004) and *Insufficiency* (2012), which constitute his tetralogy of science-in-theatre plays which, as a body of work, has had considerable international success.

Whilst there is little doubt that Science-in-Theatre is a new genre, what is its significance? When Carl Djerassi started his experiments in 1986 with Science-in-Fiction by writing a series of novels, and then in 1997 beginning work on a trilogy of plays which he subsequently defined as Science-in-Theatre, conventional plays accounted for most science and theatre work. However, since the turn of the 21st century, there has been a very definite surge in both the quantity and quality of companies and practitioners producing different types of science-engaged work, contemporary science-performance, much (or almost all) of which falls into the category of science-in-theatre, something Djerassi could never have predicted. The fact his definition of a certain type of science play has now been adopted by a type of performance in which text is but one creative component is fascinating. Over and beyond this fact the science-in-fiction genre has already produced some plays / performances which are generally recognised as masterpieces, this is the chief reason why science-in-theatre is a significant new genre, as it has given birth to an altogether different kind of performance about science⁷.

Further proof of how much science-engaged work has been and is continuing to be produced in both theatre and performance on scientific subjects and themes can be demonstrated by examining this year's Edinburgh Fringe Festival programme (2013) where there were over 30 new productions (theatre, performance, dance) about science-related topics.

It is clear that, in particular, "experimental" or "cutting edge" companies and performance practitioners are highly active in devising and

creating science-in-theatre. These companies have brought or are bringing science and performance together in inventive and original ways by experimenting with cross-disciplinary and non-naturalistic approaches, collaborations with scientists, and matching theme to form. Contemporary performance is a domain of creativity in which, because of the inter- and cross-disciplinary nature of the work, boundaries can be pushed and artistic breakthroughs made. For instance, in this area of work, text is but one element in a composition (if it is there at all), and it is often not the most important element. Form, content and theme, structure and ideas, are often more open-ended and fluid, not tied to the sometimes rigid stylistic structures imposed by linearity, scenes and acts, beginnings, middles and ends, rising and falling action and exposition to resolution, to which “conventional”, “traditional” or “mainstream” theatre plays often adhere⁸.

There is another key science-in-theatre trend that needs to be explored in more detail, namely that many companies and practitioners are working *with scientists* in an experimental (and often ground-breaking) fashion. These collaborations are of great significance to the way the language and aspirations of the Science-in-Theatre genre are developing. Scientists, such as Djerassi, collaborating with practitioners / artists is becoming a defining characteristic of the Science-in-Theatre genre, and an inevitable consequence of it. Moreover, scientists are now beginning to articulate what they get from such collaborations with artists, by enabling, in a hands-on way, their ideas and science to be built into works of art (in this instance, plays and performance), and by speaking about the experience in panels, lectures and in writing. But the meaning behind these types of collaborations needs to be analysed and assessed much more, as they go beyond faddishness or novelty, particularly from the scientist’s perspective. It is perhaps easier to say what the artist gets from working with a scientist by way of information, status and credibility. There is no doubt –from the vantage point of the artist – that collaborating with scientists in making theatre and performance can make all the difference in terms of scientific veracity and accuracy. Such collaboration can often allow the artist unique access to the scientist’s way of seeing things, and vice-versa.

Since Djerassi, a chemical scientist-turned-playwright, started to write plays, and to work on a regular basis (in 1998) with a theatre practitioner (myself), more and more similar collaborations have taken place, reaching the point where it could be argued that a majority of science-engaged theatre / performance productions involves collaboration with scientists. Indeed, my own 14-year collaboration with Djerassi is a good example of a theatre practitioner and a scientist working together to produce a

(research-orientated) and on-going body of work. Whilst it is impossible to say our collaboration was *the first* between a scientist and theatre-maker it was undoubtedly one of the earliest and, as such, helped lead the way for others, another very important aspect to Djerassi's particular contribution to the influential body of work that is science-in-theatre.

By way of further illustration, a few examples of scientist-artist collaborations are called for. In the recent past, Peter Brook famously worked with long-time collaborator Marie-Helene Estienne on their "theatrical research" project based on the work of neuroscientist Dr Oliver Sacks, *The Man Who Mistook His Wife For His Hat* (2002), and director Katie Mitchell and playwright Caryl Churchill worked with neuropsychologist Mark Lythgoe (from the Institute of Child Health) on a "Theatre as Experiment" project in 2004 called *Perceptions and Realities: The Science of Theatre*, presented at The London International Festival of Theatre. Whilst this wasn't the first time working scientists had collaborated with theatre-makers, these two projects in the early noughties did help set the tone and point the way forward.

There are many interesting and forward-facing examples of current or recent scientist-theatre artist collaborations, including Clod Ensemble and Suzy Wilson's long-running and unique *Performing Medicine* programme (where artists work with doctors); neuropsychologist Dr Paul Broks and Mick Gordon's collaborations *On Ego* and *On Emotion*; Melanie Wilson and Fuel Theatre's latest project about memory, *Autobiographer* (2012), produced with mental health clinician and psychologist Professor Sube Bannerjee; Professor Graham Foster, Professor of Hepatology, who is collaborating with Fuel Theatre and composer Richard Thomas on a series of podcasts, *Body Pods* (2013), exploring different parts of the body; and Dr Ann Van de Velde, a clinical haematologist who worked with director Dr Alex Mermikides and composer Milton Mermikides to create the multimedia performance *Bloodlines* (2013), performed at the Science Museum's Dana Centre.

Such is the attraction of science and performance. There are companies who actually *specialise* in combining science and performance, another growing trend. It is hard to think of many discrete non-humanities disciplines to which theatre companies dedicate all their efforts. These companies and the work they do is *by definition* science-in-theatre, i.e., they incorporate "realistic" science at the heart of the performance, they are (often) the result of intense consultation and active collaboration with scientists, they explore various facets of "serious" science, and they frequently contain a didactic or pedagogical dimension to the work performed.

These companies include Curious Directive, whose recent productions have explored cognitive neuroscience, light, architecture, genetics, motion and bio-politics. Their show *Return to the Silence* (2011) was based on the works of Oliver Sacks, and the company have collaborated with a number of scientists for their latest season of work *Litmus/Culture* (2013) including Chris Burgess (Neuroscience), Simon Watt (Evolutionary Biology), Henry Ferguson-Gow (Myrmecology), Prof. Martin Hendry (Astronomy), Dr. Kevin Moffat (Genetics), Dr. Robert Howell (Physics) and many more. Curious Directive state that they are “testing the Third Culture that Curious Directive operates within: the liminal space between art and science”. (Curious Directive Theatre Company, 2013. “Litmus / Culture”. Accessed September 12, 2013 <http://www.curiousdirective.com/present>).

Other such companies who regularly produce science-engaged work include Third Angel – *A Perfect Circle* and *Technology* (2009), and *Hurrysickness* (2004); Portable Palace, originally from Russia but now based in the UK, who have collaborated with scientists around the world and create sensory immersion environments that merge physics, chemistry and computer science with uncanny philosophical practices; and Unlimited Theatre, who produce many science-based shows for adult and family audiences, including their recent *The Ethics of Progress* (2012, about quantum physics, working with Professor Vlatko Vedral, Oxford University) and *The Noise* (2012, about sound and memory, working with Dr Denis McKeown and Professor Tim Griffiths)⁹.

Earlier in the chapter I asked the question “why does Djerassi write science-in-theatre plays?”, and described his didactic / pedagogical desire to engage the public’s attention to the scientific ideas in his plays. But his reasoning went deeper still. Djerassi here describes one of the key *thematic* purposes behind the writing of his science-in-theatre plays:

Science in my opinion has no ethical dimension. Ethics start with individual scientists. The story of the Contraceptive Pill, the first medical treatment for healthy people, shows that the chain of responsibility is a long one. Basic science is one thing, technology another, even if the division between them is not always clear. At what stage along the line from theoretical idea, to experimental research, to clinical application, does the moral buck stop? (Tyler 1999)

This profoundly important question is at the heart of most of Djerassi’s plays.

Djerassi and I frequently discussed how best to use theatre plays as a platform for disseminating discussion about scientific issues, and whether

we could succeed in this endeavour. In a lecture about science-in-theatre at the Royal Institution in London in 2000, Djerassi made a very revealing statement when he said that he had come to the Royal Institution “not to talk about bringing theatre to science, but rather science to the theatre; [and] to answer the question, is “science-in-theatre” a viable genre, or is the phrase itself a contradiction in terms?” (Djerassi 2001: 249). Incidentally, I saw *my* job as bringing *theatre* to *science*.

Another question which fascinated Djerassi was: “Can Science-in-Theatre, as a new form of dramatic synthesis, fulfil an effective pedagogical function on stage, or are pedagogy and drama antithetical?” (taken from “Science on Stage: A note from Carl Djerassi” in the theatre programme for *Oxygen*, London, Riverside Studios, 2001). This is a query Djerassi and I have tried to explore and answer in each of the plays and their productions. For many people, the jury is probably still out on this question. However, it was clear this issue was hugely significant, for it was central both to Djerassi’s plays themselves *and* to who Djerassi was/is as a writer. There was no ignoring it; the balance simply had to be got right in each play between pedagogy / didacticism and the “other things”: story, characters and their relationships, dramatic conflict, and the way the plays were staged. Interestingly, Djerassi’s initial response to his question was that science “is inherently dramatic, at least in the opinion of scientists because it deals with the new and unexpected. But does it follow that scientists are dramatic personae, or that science can become the stuff of drama?” (programme note by Carl Djerassi, performance programme for *Oxygen*, Riverside Studios, London, 2001), a question which has been satisfactorily answered not only in Djerassi’s own body of work but also the current theatre / performance that Djerassi’s science-in-theatre has influenced so very much.

In thinking about how to treat the didacticism in the plays – something that Eva-Sabine Zehelein and Kirsten Shepherd-Barr have both identified as being a characteristic of many (if not *all*) Science-in-Theatre plays – it was clear that Djerassi needed to accentuate other qualities in the writing, particularly the matter of engaging storytelling, which was at the heart of much of the dramaturgical work we focussed on as compelling storytelling is one obvious way in which plays that have a didactic and pedagogical purpose can be made more palatable to a non-specialist audience¹⁰.

Many scientists and artists talk about there being a deep connection between what might at face value seem to be wholly different processes, science and art, and Djerassi also drew an interesting parallel between the scientific process and the collaboration involved in playmaking when he said, (F. 14): “...when you finish a play to your satisfaction, the process

has only started. The director, dramaturg, and actors participate. Suddenly it becomes a process of collaboration – and, to that extent, a replication of the scientific process” (Devins 2001)¹¹. Director Michael Blakemore in discussing his production of Michael Frayn’s *Copenhagen*, took the idea a stage further, “Putting on a play itself is a sort of scientific experiment... This is not a naturalistic play. We’re not trying to pretend that what we’re seeing is *real*. The audience must listen to the arguments, empathize with the character’s emotions, and create the reality for themselves” (Shepherd-Barr 2006: 104). This process is exactly what I myself aspired to in the directing and producing of Djerassi’s plays.

The comparison between the two forms of “creative” process, artistic and scientific, is important, partly because it could help to explain why so many scientists and artists are drawn to cross-disciplinary collaboration, even in the face of the supposed chasm between the two cultures. Could it be that the actual intellectual and emotional processes that both scientists and artists go through to reach their goals are not so different after all? I have observed that scientists use as much “creativity” in the pursuit of their aims as the artists do in theirs, so I suspect there is less of a chasm between the two cultures than there perhaps was. And even though – to paraphrase Djerassi – on the face of it, science is about concrete experiment and the arts are about applying the imagination, I suspect that what motivates people to do any creative work is more alike than we care to admit. Roald Hoffmann, co-writer of *Oxygen*, and author of several non-fiction books dealing with science, literature and the arts appositely commented: “Science can provide creative and spiritual satisfaction, much like art, music and literature, and people are interested when the emotions aroused by these disparate elements are combined” (Bennett 2001). I have been delighted to see an ever-increasing number of interdisciplinary collaborations between scientists and artists, where practitioners of both disciplines are seeking out areas of common interest, and enquiring into ways in which the human spirit in all its majesty can be better and more deeply explored through scientific and artistic contemplation, discovery and experimentation.

Moreover, Science-in-Theatre is at the vanguard of this movement. At the start of this chapter Lewis Wolpert was quoted about the impact of science on people’s lives, saying that scientific ideas “are alien to most people’s thoughts.” (quoted in Zehelein 2009: 103), something Djerassi has also spoken about in the past. Djerassi, as a scientist, wanted Science-in-Theatre to help change this situation, something which seems to be happening, both in wider society and in theatre and performance¹².

In discussing the practice of science as also being a creative act, Suzanne Lynch said of Djerassi and Hoffmann's *Oxygen*,

the play also suggests ways in which the domains of humanities and science can overlap....It marks a bold attempt on the part of science to take its place in the world of the humanities – and to exploit the potential of theatre to bring scientific knowledge to a wider audience. In this sense, *Oxygen* is an important stage in the move towards a more inclusive form of education and pays testimony to the power of theatre to open up the possibility of an interdisciplinary way of viewing the world (Lynch 2001).

In saying this, Lynch is acknowledging the potential contribution of Science-in-Theatre, by virtue of the way it can reach beyond the theatre itself.

All of Djerassi's plays address themselves to this laudable aim, something that will now be explored by investigating some of his science-in-theatre plays, in terms of style, function and theme. In doing this, it can also be shown how and why the plays sometimes deviate from his own science-in-theatre definition. Djerassi felt that his scientific knowledge would make the science in his plays more realistic and accurate, which was important to him. It is interesting to note, however, that after having written his first three science-in-theatre plays, he began to experiment with non-science plays, to see whether he could successfully write one. Once Djerassi had written his first non-science play, *Three on a Couch* (an earlier version known as *Ego* was performed at the Edinburgh Festival Fringe), he then produced two plays, *Phallacy* and *Taboos*, about science and scientists, but which do not wholly correspond to the dictates of his own science-in-theatre definition. These two plays examine science and art (*Phallacy*) and science and society (*Taboos*) and, even though there is serious science in both plays, it is not at the heart of the plays. Djerassi described the writing of these plays as an act of "compromise" because he purposefully reduced the amount and complexity of science in them. These plays are both what one might therefore call Science Plays rather than science-in-theatre¹³.

As the start of an on-going artistic collaboration and research project into the presentation of science in theatre performance, Djerassi and I worked together, at different times and with different casts, on his first play *An Immaculate Misconception*, the first script in what became a trilogy of science-in-theatre plays.

An Immaculate Misconception takes place in the explosive arena of reproductive technology, and includes IVF procedures such as ICSI (intra-cytoplasmic sperm injection), which the play explored in some detail.

Who better to write it than the man who is said to have ushered in the sexual revolution of the 1960s? His work was so revolutionary, and his achievements so enormous, that he was the only *living* person to be included in The Sunday Times List, in 2000, of *The Top Thirty Men of the Millennium*, a list which included Dante, Chaucer, Da Vinci, Shakespeare, Marx, Napoleon, Darwin, Freud, Einstein and Lenin (and in which Isaac Newton, incidentally, topped the list). For me, this achievement is amongst his most impressive.

The play's story is about a thirty-seven-year old research scientist, Dr Melanie Laidlaw, whose biological clock is ticking: she wants a child. But the man she loves is already married. As a high-flying reproductive scientist, she needs a womb to try her new cure for male infertility. The solution to all her problems seems simple – test the invention on herself. So Melanie “steals” the sperm of her married lover and successfully inseminates herself using a revolutionary IVF technique, ICSI. Her controversial pregnancy (whose child is it, anyway?), gives rise to fundamental questions about parenthood. The play is in fact the story of twin births, the first being the birth of Melanie's son and the second the birth of the real-life scientific medical process known as ICSI. Dr Laidlaw's invention is not science fiction, it is science fact; intra-cytoplasmic sperm injection is a form of test tube fertilisation where a single sperm is injected directly into an egg, a process which, since 1993, has already helped create over 350,000 babies.

Genetics, cloning and assisted reproduction have created a brave new world where sex is no longer a vital part of reproduction. The ethical issues surrounding ART (assisted reproductive technology) and explored in the play – genetic engineering, eugenics, and designer babies – profoundly affect us all. The play shows us what happens when technology which is powerful beyond the means of control (“scientists playing God?”) is put into human hands. As Djerassi's first play, *An Immaculate Misconception* conforms entirely to his definition of science-in-theatre in that the “science and scientists are central and the facts impeccably correct” (Djerassi). The play is about the tribal world of the scientist, it is about real science, it seeks to both educate and entertain its audience, and it examines the impact of current scientific developments on society. We even see footage of an actual ICSI procedure taking place.

In 1998 when *An Immaculate Misconception* was first performed, the questions it posed were central to the play's purpose, and they re-surfaced in 2006 in Djerassi's play, *Taboos*, namely the very topical matter of assisted reproduction (ART), to which Djerassi gave a funny and unexpected twist.